# On the effects of the financialization of private utilities: lessons from the UK water sector

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# On the effects of the financialization of private utilities: lessons from the UK water sector*

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**Abstract**

This paper analyzes the quantitative impact of the growing role of non-traditional financial actors, in particular institutional investors, in the financing structure and consumer pricing of regulated private utilities. The focus is on the water sector in England and Wales, where the effect of the firms' corporate financing strategies on key outcome variables may have been underestimated. The analysis is based on a *staggered difference-in-differences* estimation of the impacts of the evolution of the ownership of the assets, namely an increased participation of institutional investors, on leveraging and water pricing decisions. It shows a statistically significant positive impact on leverage levels and average consumer prices.

**Keywords**: Regulation, corporate finance, water and sewerage, public utilities.

**JEL classification**: C23, C51, G32, G38, L50, L51, L95, L97.

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# 1 Introduction

Since the end of the 1980s, many governments around the world have privatized in some form their public utilities. For water and sanitation utilities, the governments of 80 out of 177 developed and developing economies have entered some form of private participation in the sector. They have also reformed its regulation, which in several cases has included the creation of regulatory agencies separated from the ministries traditionally in charge (e.g., Bertoméu-Sánchez et al. (2018)). In many countries, regulation was also designed to diversify the financing sources of the sectors and link more explicitly the average regulated prices with the cost of financing these sectors, while providing strong incentives to the private owners of these utilities to cut costs. The British government was the leader of these reforms in many ways, reforms that have been studied in the literature (Saal and Parker (2001), for instance, study how successful the privatization of the sector and its new regulation were in terms of price performance and productivity).

While the reforms were long seen as a success in policy circles, they have often been criticized for a number of reasons by consumer associations, in particular because of their impact on prices (e.g., see Decker (2014) or Guthrie (2006)). Increasingly, some of the stakeholders have expressed concerns with many of the consequences of the evolution of the financing strategies adopted by some of the utilities, and have blamed regulators for underestimating these effects (Bertoméu-Sánchez and Estache, 2019). In the UK, particularly, since the mid-2010s, the water regulator, Ofwat, has been criticized for allowing the water companies to simultaneously distribute huge dividends, and significantly increase their leverage levels and managerial wages, while under-investing and over-pricing. The combination of these observations suggests that firms may have been borrowing to finance high dividends and wages rather than investments in improved service levels and quality, and in cost-cutting efforts. It also suggests that the regulator may have underestimated the importance of monitoring the corporate financing strategies of the firms it is regulating (Helm, 2018).

This regulatory failure is linked to the underestimation of the potential impact of the increased "financialization" of the sector. In practice, this refers to the "increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operations of the economy and its governing institutions" (Epstein, 2002). The main concern associated with the consequences for the final consumers of the efforts by owners to extract value from illiquid assets - i.e., physical infrastructures - through creative financing techniques is that these assets become more liquid than they should to be able to maintain service level and quality at reasonable prices to consumers.

We focus on the English and Welsh experience because six of the ten regional water and

sewerage companies (WaSCs) created through the 1989 privatization, are now owned by private equity - investment and infrastructure funds - and these actors have much shorter-term concerns than the social dimensions of the water and sewerage sector. Most of these new actors are keen to maximize the short-term rents they could extract from their investment without much concern for the longer-term social effects of their financing decisions, while consumers are more interested in affordable prices and service quantity and quality. As suggested by Helm (2018) and multiple opinion pieces in the Financial Times (e.g., Ford and Plimmer (2018) or FinancialTimes (2017)), the regulator seemed to have a hard time finding the proper balance between these two perspectives.

This paper offers a first quantitative assessment of the impact of the increased financialization of a sector. So far, all discussions have been qualitative. This paper, instead, tracks econometrically the consequences of the evolution of the degree of financialization of the sector. In particular, it establishes a causal effect of financialization of private utilities on two key outcome variables central to regulatory debates: the leverage levels of regulated utilities and the average consumer prices.

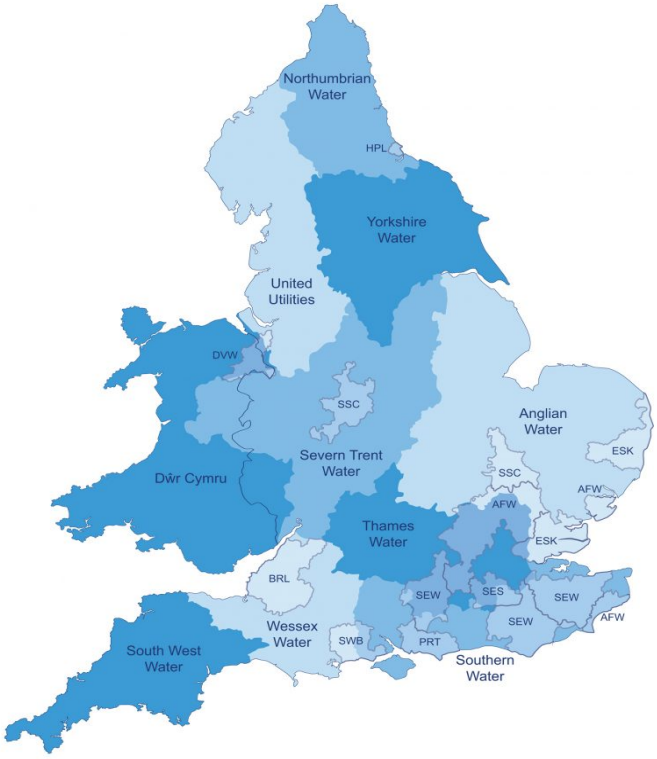
In terms of the identification strategy allowing to derive causal relationships, as the year of financialization differs between the concerned companies, we use a *staggered difference-in-differences* (*staggered DiD*) approach, which allows for varying treatment periods, to estimate the impact of financialization. We also account for a number of relevant control variables usually included in regulatory discussions.The main conclusions are as follows: first, we show that the financialization of WaSCs has a positive impact on the companies' leverage level. It increases the leverage level by an average 10.3 to 12.8 percentage points, depending on the model specification. Second, the paper shows that the evolution of ownership in the sector towards a more financialized structure also leads to an average 32.1 to 38.4 GBP increase in average consumer prices. To give an illustrative example of the implications of such a result, suppose we have a WaSC that initially has a 50% leverage level and a 350 GBP average consumer price. The buy-out of the WaSC by private equity implies that, on average and for the companies in our sample - i.e., English and Welsh WaSCs -, its leverage level and average consumer price will increase to $60\% - 63\%$ and $380 - 390$ GBP respectively.

The rest of the paper is organized as follows. Section 2 describes the England and Wales context in detail and presents the stylized facts of the sector related to the WaSCs' leverage level and consumer prices. Section 3 reviews the main related literature and highlights the research question of the paper. Sections 4 and 5 explain the theoretical framework and the empirical methodology respectively. Finally, section 6 reports the results and section 7 concludes and discusses the policy implications of the findings.

## 2 Context and stylized facts

The water and sewerage sector in England and Wales was privatized in 1989 as a result of the public sector's difficulties to meet with investment needs, leaving political ideology aside. In the process, the 10 previously publicly owned regional water authorities were privatized through the transfer of all staff and assets into limited companies, the Water and Sewerage Companies (WaSCs). The 10 WaSCs were initially set-up as public limited companies, thus publicly traded and listed on the UK Stock Exchanges. In addition, a number of smaller "Water-Only-Companies" (WOCs) were created, many of which - there are currently 12 left - have been progressively acquired by the WaSCs. The map presented in figure 1 shows the WaSCs and WOCs and the area in which they operate in 2019.

Figure 1: WaSCs and WOCs in England and Wales




Source: Ofwat

Along with the creation of the private companies and due to the non-competitive nature of the set-up, as the 10 WaSCs operated each in a different region, therefore enjoying an increased level of monopoly power, the privatization process was accompanied with the introduction of three different regulatory entities. First, an environmental regulator, the Environment Agency in England and the Natural Resources of Wales.[1] Second, a service

[1]Their mission is to "regulate major industry and waste, treatment of contaminated land, water quality

quality regulator, the Drinking Water Inspectorate,[2] and third, an economic regulator, the Office of Water Authority (Ofwat).[3]

Ofwat's mission is to "protect consumer's interest by promoting effective competition, secure that water companies carry out their statutory functions and meeting with the necessary financing, secure that supply licensees carry out their functions, and secure the long-term resilience of water companies' water supply". To put it differently, the agency's mission is to insure that consumers can access water and sewerage services while WaSCs have incentives to produce the good and service. To do so, price reviews (PRs) occur every five years. Prior to the price reviews, the WaSCs send the forecasts of the costs and revenues they will need to be able to provide with water and sewerage in an efficient manner. Ofwat then sets the consumer prices for the following five years so as to allow companies to earn a profit and consumers a surplus. The agency bases its regulatory model on an incentive-based mechanism: the price-cap approach, where the price $P$ in period $t$ is given by

$$P_t = P_{t-1}(1 + RPI \pm K) \tag{1}$$

where $P_t$ is the price in period $t$, $P_{t-1}$ is the price in the previous year $t-1$ of the five-year control period, $RPI$ is the economy-wide rate of inflation allowing price to move according to inflation, and $K$ is the K-factor $K = Q - X$, where $X$ reflects the efficiency increases expected from WaSCs during the five-year control period, and $Q$ reflects the output changes that companies are expected to deliver during that period.

After 30 years of privatization experience, the financing capability of the sector has considerably increased, and access to water and sewerage services is universal. According to UNICEF, 100% of the population now uses piped drinking water. However, experts have highlighted the under-investment made by companies in both maintenance and construction of new infrastructure. The public opinion has pointed-out that such under-investment has increased the consumer vulnerability problem in recent years, and has not allowed to deal properly with environmental issues. In addition, tariffs, leverage and dividend levels have rocketed (e.g., see Armitage (2012), Helm (2018) or Yearwood (2018)).

This mix of organizational and outcome facts and their evolution makes this case of study particularly useful to assess the impact of financialization in a regulated industry. Indeed, since the beginning of the privatization process in 1989, six of the companies have been de-listed, three remain listed - Severn Trent, South West Water, and United Utilities -, and

resources, fisheries, inland river, estuary and harbor navigation, conservation and ecology" - `www.gov.uk/government/organisations/environment-agency`

[2]Its mission is to "insure that water companies supply safe drinking water that is acceptable to consumers and meets standards set down in the law - `www.dwi.gov.uk`

[3]Though there exists an environmental regulator, it is the economic regulator, Ofwat, who is in charge of setting the targets for leakage reductions every year - `www.ofwat.gov.uk`

one has become a not-for-profit company - Dwr Cymru -. The de-listed companies are now owned by infrastructure funds or financial companies (Bayliss, 2014):

- **Owned by infrastructure funds**: Northumbrian Water (2011)[4] and Wessex Water (2002). These two companies are now part of international infrastructure conglomerates,[5] both of which are based in Asia.

- **Owned by financial companies**: Anglian Water (2006), Southern Water (2007), Thames Water (2006), and Yorkshire Water (2008). These companies are owned by special purpose vehicles (SPVs) designed by financial investors. In England and Wales, the owners of these SPVs are mostly investment fund managers and pensions funds.

We analyze the relevance of these differing ownership structures among the ten WaSCs, which are regulated by the same entity. To do so, we focus on leverage levels and consumer prices, which have been described as excessive at numerous points in times and by different sources (see section 3). Excessive leverage is an extremely relevant issue as it could lead to unsustainable debt levels, potentially increasing the company's risk of financial distress. As Spiegel and Spulber (1994) conclude, this is what would lead to higher consumer prices since the regulator, which oversees the activity of a company providing with a basic need good and service, increases the regulated price in order to reduce such a risk of financial distress. Analyzing the determinants of leverage levels, particularly in the context of regulated private utilities, seems thus rather important, as leverage levels have positive effects on consumer prices.

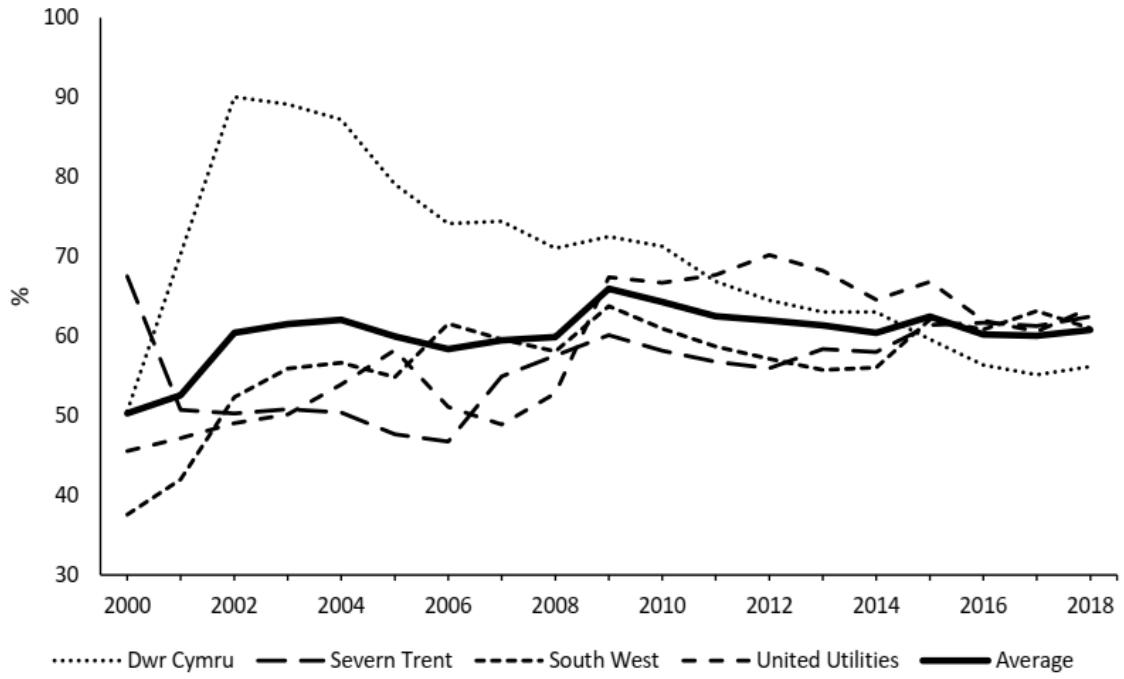
In order to describe the contrast between differing ownership structures, figures 2 and 3 show the evolution of the listed and not-for-profit WaSCs' leverage levels respectively[6] between 2000 and 2018. The main message is that both figures show increasing trends, but there are a few subtleties worth highlighting. First, in terms of listed companies - i.e., figure 2 -, the leverage level of Dwr Cymru, the not-for-profit Welsh WaSC, followed a clear decreasing trend from 2002 and on, year during which the company became not-for-profit. Likewise, it is the only WaSC than started decreasing its dividend levels until completely stopping distributing them in 2006. On the other hand, listed companies increased their leverage levels at the end of the 2000s, therefore coinciding with the beginning of the financial and economic crisis, but were relatively stable from 2010 and on. The average leverage level of

[4] Year of de-listing of the companies.

[5] Northumbrian Water is owned by CK Infrastructure holdings, while Wessex Water is owned by YTL Corporation.

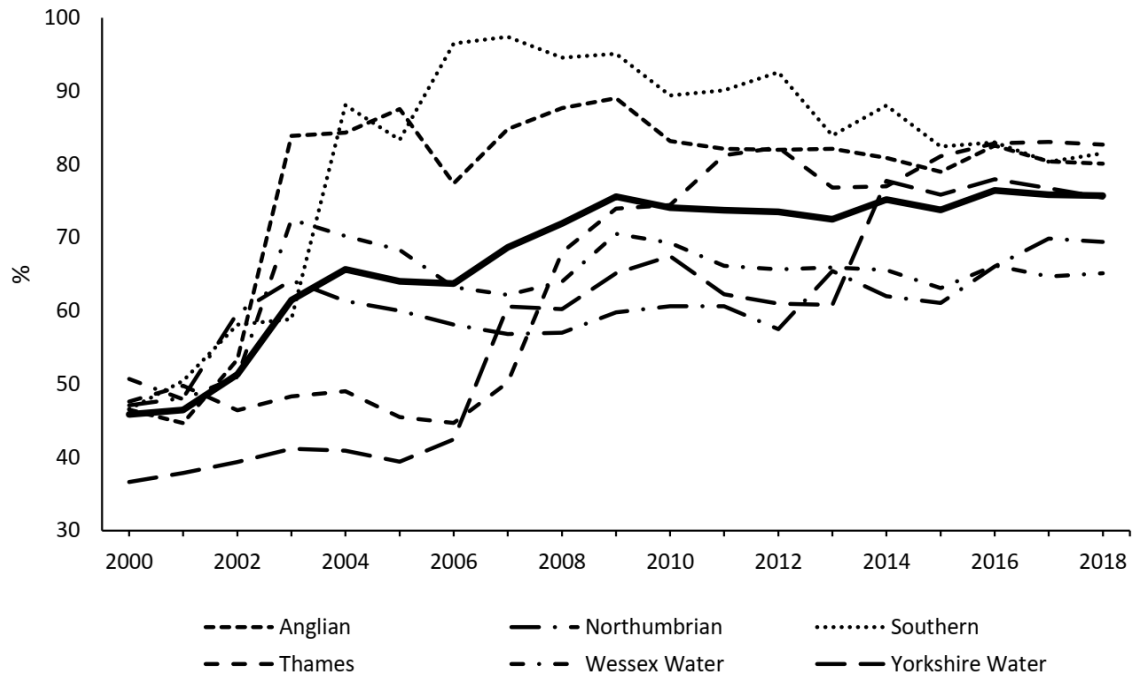
[6] In this case, leverage levels are computed using Ofwat's formula: $leverage = \frac{NetDebt}{AverageRCV}$ where $AverageRCV$ is the average Regulatory Capital Value, which is a key component in setting price limits. It represents the value of the capital base of each company, on which Ofwat determines the needed return.

Figure 2: **Leverage level of listed and not-for profit companies - 2000-2018**




Source: Ofwat and companies' annual reports

Figure 3: **Leverage level of de-listed companies - 2000-2018**




Source: Ofwat and companies' annual reports

listed and not-for-profit WaSCs - solid line in figure 2 - increased by 10 percentage points between 2000 and 2018.

The difference between de-listed - i.e., figure 3 -, and listed and not-for-profit companies is remarkable. The starting leverage level of the former is at around 50% for most companies, similar to listed and not-for-profit WaSCs at the beggining of the period of study. The figure then shows a clear and steeper increasing trend for most companies considerably earlier than the beginning of the crisis. The levels then stabilized, at higher ranges than for listed and not-for-profit companies, for most of the 2010s. It seems important to highlight than some of the de-listed WaSCs - e.g., Southern Water and Wessex Water - got relatively close to 100%. Finally, the average leverage level for de-listed companies increased by 30 percentage points between 2000 and 2018, i.e., an increase that has been around 20 percentage points higher than for listed and not-for-profit companies.

Turning to prices, figures 4 and 5 show the evolution, on a company-by-company basis, of average water and sewerage consumer prices[7] for listed and not-for-profit, and de-listed companies respectively. In this case, there is no striking difference between both sets of WaSCs as was the case in terms of leverage. All the company prices follow a similar trend, though there is a slight difference in levels. The average consumer price for WaSCs that remain listed begins at 470 GBP in 2000 and ends at a slightly inferior level, namely 432 GBP in 2018. In terms of de-listed companies, the starting average price is at around 418 GBP and the final average price is 410 GBP. Therefore, there is no difference between the two sets of companies, and the differences inside the sets were such at the beginning of the period of study and were maintained throughout.

There is a clear difference in terms of leverage levels between companies that entered the financialization process through a private equity buy-out and those that did not. Furthermore, Figure 6 shows the leverage level of each company separately with the year of de-listing for the concerned WaSCs. However, these stylized facts do not allow to derive causal conclusions. The following section reviews the literature related to the subject with the goal of identifying possible drivers of such difference, and the consequences of high leverage levels for regulated utilities.

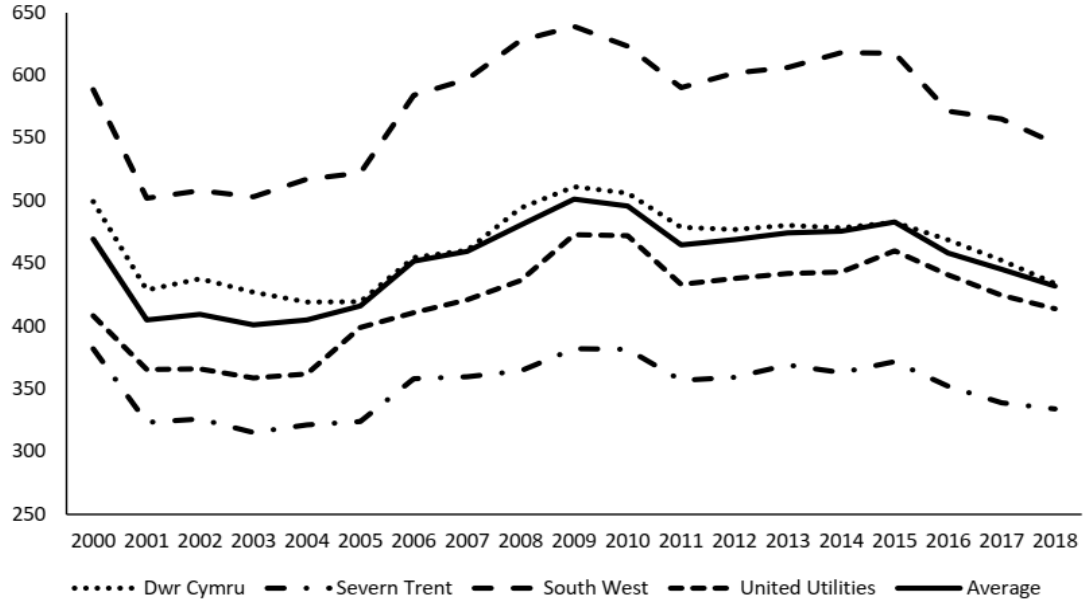
## 3 Research question and contribution

Traditional regulatory theory has looked very little into the private utilities' financing strategies. There is a clear gap in the literature that we aim to fill in this paper related to whether

[7] Prices have been converted to constant 2018 prices to eliminate any effect of inflation.

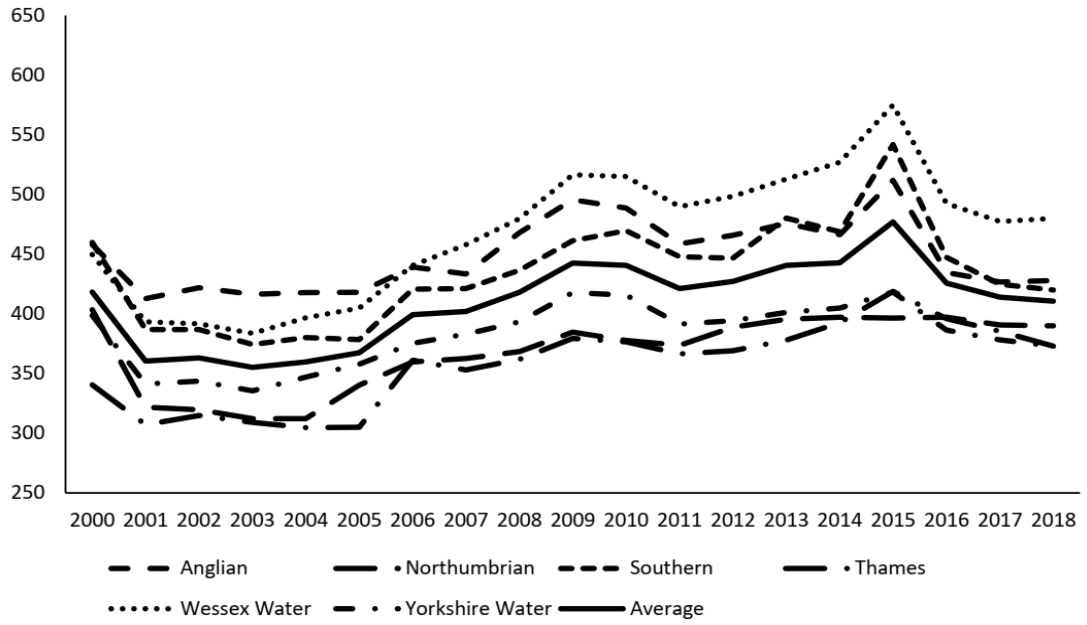
Figure 4:

Annual average water and sewerage consumer prices (GBP) of listed and not-for profit companies - 2000-2018



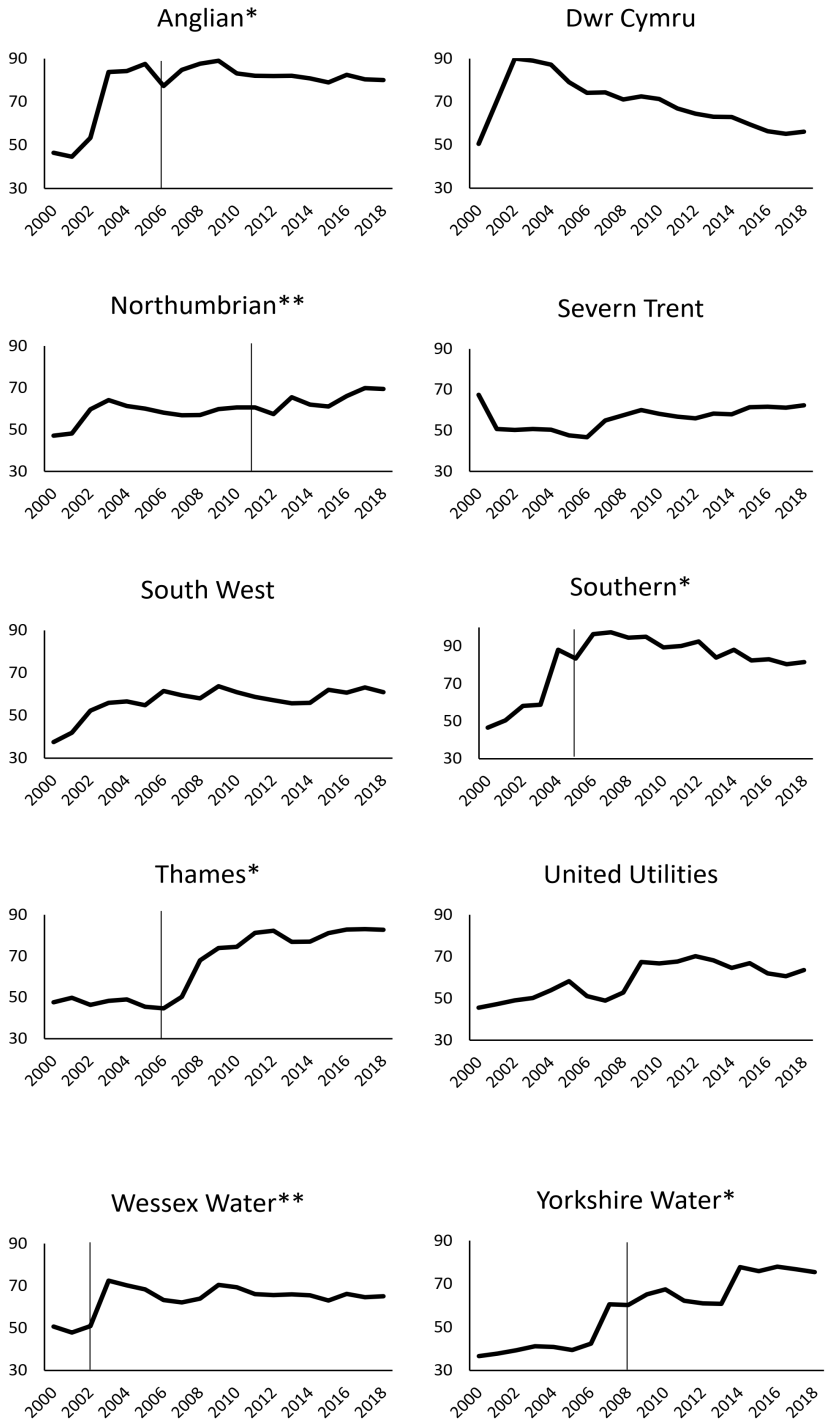

Source: Ofwat and companies' annual reports

Figure 5: **Annual average water and sewerage consumer prices (GBP) of de-listed companies - 2000-2018**




Source: Ofwat and companies' annual reports

Figure 6: **Leverage level (%) by WaSC - 2000-2018**




Source: Ofwat and companies' annual reports;

Vertical line represents year of de-listing for concerned the WaSCs;

* and ** represent WaSCs owned by investment and infrastructure funds respectively.

the ownership structure and the financing strategy of regulated private utilities are key sources of regulatory failures. Our research question is as follows:

> *Is the financialization of the water and sewerage sector in England and Wales behind the observed market failures, namely high leverage levels and consumer prices?*

Answering this question contributes to different fields of the literature: first (i), it adds to the leverage and corporate structure determinants of the empirical financial literature; second (ii), in terms of research in regulation, it highlights different dimensions of regulated private utilities that should be overseen more closely by the regulators, and identifies the causes behind leverage and price increases, which complements the literature - both theoretical and empirical - on the drivers and effects of high leverage levels. Finally, third (iii), it brings a quantitative approach to the determinants of market failures in the water and sewerage sector in England and Wales. The remaining of this section highlights the main findings in these different fields that are more closely related to the subject of study of this paper, with the goal of building on the existing results and using the insights to complement our analysis.

In terms of the financial literature, existing research has looked into the drivers of corporate financing structures of unregulated firms. To begin with, the stylized facts described above can be easily related to the classic financial literature. For instance, England and Wales' WaSCs have shown a clear preference for debt, rather than equity, in the past two decades, contradicting the Modigliani-Miller theorem (Modigliani and Miller, 1958) or the pecking order theory (see Myers (1984) and Myers and Majluf (1984)). What the experts in the sector underline is that internal funds are used, to a large extent, to pay for dividends. So much so that WaSCs have reached $> 1$ dividend payout ratios - thus paying higher-than-profit dividends and demanding debt as an additional financing source.

Regarding the more recent financial literature, the main insights from the drivers of leverage levels of unregulated firms perspective are the following: first, Titman and Wessels (1988), Rajan and Zingales (1995) or, more recently, Frank and Goyal (2009) and Öztekin (2015) identify tangible assets, which characterize utilities companies in general, as a key driver of debt financing in OECD economies. Second, Graham and Harvey (2001) conclude that firms issue debt to increase their financial flexibility and improve their credit rating, while Fama and French (2002) and Öztekin (2015) point out that firms with higher profits and investment levels are less levered. One of the criticisms pointed towards the English and Welsh water sector is, however, that high leverage levels are accompanied by under-investment in maintenance and new infrastructure. Third, Benito et al. (2003) find evidence of such association between leverage levels and new infrastructure, but in the opposite direction in terms of maintenance. Finally, Miao (2005) shows that high growth industries have lower

leverage levels, while Frank and Goyal (2009) conclude that leverage is negatively associated to profit and dividend pay-outs, which contrasts with our case study.

The economic theory of regulation has looked very little into the relation between corporate financing strategies and regulation of private utilities. Broadly speaking, the traditional literature sustains regulation of private utilities based on efficiency control of monopoly power or externality rationales. Namely, regulation is needed where the market fails, and there are three main reasons why markets may be failing: (i) imperfect competition, (ii) imperfect access to information, and (iii) technological characteristics of production. From this point of view, the literature has widely studied how to improve regulation of firms in situations in which the regulator cannot observe the level of effort chosen by the regulated firm to reduce costs (Laffont and Tirole, 1986), or where the firm has better information in terms of demand (e.g., (Riordan, 1984) or (Lewis and Sappington, 1988)), but there is a lack of research concerning the drivers of corporate financing structures and its consequences in the context of regulated private utilities. The corporate financing structure has actually not been considered as a possible source of failure in regulated markets, but rather as a distortionary mechanism, as explained below.

The little available evidence on the interaction between regulation and capital structure links the financing of regulated firms with prices and investment, though not always finding causality. First, in terms of empirical findings, the starting point in this sense is Correa da Silva et al. (2006), who conclude that, until the beginning of the 2000s, debt had been replacing equity as the main financing source of investment needs of utilities and transport services in developing countries. More recently, Bortolotti et al. (2011) and Cambini and Rondi (2011) find that, in the context of regulated utilities, high leverage levels are associated with higher regulated prices. Second, concerning theoretical research, Spiegel (1994), Spiegel and Spulber (1994) and De Fraja and Stones (2004) analyze the relationship between debt and regulated prices from a theoretical perspective, finding that regulated firms choose equity and debt strategically to impact the regulated price. The mechanism is as follows: the regulator sets the regulated price at a level such as to avoid risk of financial distress due to high levels of debt; aware of this, the regulated firm chooses its corporate financing structure strategically with higher debt levels than optimal to force the regulator to increase the regulated price further. Therefore, if financialization has a positive effect on leverage levels, we can assume that financialization can have an effect, at least indirectly through leverage levels, on consumer prices.

Finally, in terms of the available evidence specifically related to water and sewerage sector in England and Wales, the public opinion has paid increasing attention to the sector due to the growing dividends, CEO wages, and leverage levels, coupled with huge water leakages not being properly dealt with or consumer prices that could be higher than they should.

There is relatively little evidence on the subject and the related existing literature focuses mainly on dividends and is mostly qualitative. Armitage (2012), for instance, concludes that the traditional theories of dividend policy - i.e., agency-cost, signalling, pecking-order, life-cycle of debt and tax -, do not explain the observed high dividend pay-outs. Rather, they would be the result of a strong demand for dividends from investors and the desire of companies to satisfy such demand. In this sense, Helm (2018) concludes that it sums up to the investors' confidence in the companies' management. Indeed, the companies' managers have two options: (i) cut dividends and increase investments, which given the investors' lack of confidence in their ability to invest profitably could result in a tightened financing; or (ii), manage the companies to meet with the dividend demand and keep investors interested in the sector. Therefore, the companies' managers find themselves in a "dividend trap", which has strong repercussions on the other key stakeholders of the sector, especially consumers, as this trap seems to be partly behind the increase in regulated prices, and therefore behind the increase in consumer vulnerability. Furthermore, such high dividends are identified as the main drivers of leverage levels ((Helm, 2018) and (Yearwood, 2018)). Lastly, the qualitative literature has also pointed to financialization as the main driver of social and environmental failures ((Bayliss, 2014). Indeed, as Loftus et al. (2019) highlight, "the activities of WaSCs overseen by Ofwat represent a low share of the companies' overall function; they rely on the securitization of guaranteed revenue streams that can be sold on as financial commodities within a range of bundled investment packages".

# 4 Theoretical framework

This short section briefly presents the theoretical framework on which our hypotheses are based, both of which will then be tested empirically in the subsequent sections.

Our theoretical framework builds on Spiegel (1994) and Spiegel and Spulber (1994), both of which are part of a four-paper series developed in the 1990s in which Spiegel - and Spulber in two of the four - focuses on the strategic interaction between the capital structure of regulated firms, their investment decisions, and the price-setting process by the regulator. The strategic interaction is modeled as a three-stage game with three different players, the regulated firm, which must take the investment decision, investors, who must finance such an investment, and the regulator, who sets the regulated price.

The main conclusion derived from both analyses is that the regulated firm chooses its debt and equity levels strategically to impact the regulated price. Spiegel (1994) concludes that the game equilibrium is characterized by an optimal level of debt contracted by the regulated firm and that, considering such a debt level and the fact that the firm produces a basic need

public good, the regulator sets the price at a high enough level so as to avoid risk of financial distress. Spiegel and Spulber (1994), on the other hand, follows up on the close relation between the chosen debt level and the regulated price, and concludes that in equilibrium the firm chooses a higher debt level than optimal to induce the regulator to increase the regulated price further.[8]

Considering these findings, we make different assumptions to derive the two testable hypotheses.

- A1: Financialization of a WaSC implies that their main objective is to extract rents through their productive activity;

- A2: To extract rents to a larger extent, WaSCs aim to increase prices further without cost-cutting efforts to ultimately increase their profits;

- A3: Aware that the regulator wishes to avoid risk of financial distress, the WaSCs choose debt, over equity, as the main financing source, anticipating that it will force the former to increase the price further;

- A4: As the debt level increases, the regulator increases the regulated consumer price further.

As a result, the companies manage to increase their profits without any cost-reductions, solely through the choice of debt over equity. Furthermore, choosing debt over equity as the main financing source of their activity increases their leverage level. This mechanism allows us to make two testable hypotheses. The first is related to the link between financialization and the leverage level. The financialization process positively impacts the companies' leverage levels. As explained above, aware that the regulator wishes to minimize the risk of financial distress of a company that provides the population with a basic need good and service, the companies increase their leverage level to force the regulator to increase the regulated price further.

- *The leverage effect*: The de-listing or financialization of regulated companies increases their leverage levels;

Considering the above explanation, the financialization process has a positive effect on the regulated prices.

- *The price effect*: The de-listing or financialization of regulated companies increases

[8] Appendix 1 describes the set-up of Spiegel and Spulber's model and the first order conditions that allow them to derive the conclusions that are pertinent to this paper

the average consumer price through the leverage level increases;

Considering the stylized facts described in the previous section, we expect to find larger evidence for the leverage effect than for the price effect as the average consumer price of all WaSCs followed a similar trend. However, the price effect could present itself indirectly through the increases in leverage levels. We test these hypotheses empirically in the following sections.

# 5 Empirical strategy and data

In this section we first describe the empirical strategy used in this paper to derive causal relations between the variables, and we then describe the data used in the process.

## 5.1 Identification

Th main objective of this paper is to identify the causal effect of the financialization of water companies in England and Wales on two of their key outcome variables, namely their leverage levels and the average consumer price. As described above, the sector was fully privatized in 1989, with the creation of the ten regional WaSCs, and since then, six of the companies have been de-listed through the respective buy-outs by infrastructure and investment funds. We therefore exploit this variability in the ownership structure -i.e., listed vs. de-listed - to identify the causal effect studied in the paper.

As explained in section 2, two companies were bought by infrastructure funds, Northumbrian Water in 2011 and Wessex Water in 2002, and four were bought by investment funds: Anglian Water in 2006, Southern Water in 2007, Thames Water in 2006, and Yorkshire Water in 2008. Among the rest, three remain publicly listed and one, Dwr Cymru, became not-for-profit in 2002. These discontinuities seem useful to assess the causal impact of financialization on the outcome variables through a *difference-in-differences (DiD)* approach. Such an approach uses a natural experiment set-up to mimic an experimental design. By using observed data, we estimate the differential effect of a *treatement* on a*treatment* group and a *control* group. The de-listing of companies, representing their financialization, is identified to be the *treatment*. The *treated* units are therefore the six companies that have been de-listed since 2000.[9] The *control* units, on the other hand, are the WaSCs that have remained with the same ownership structure since privatization, namely publicly traded

[9]Though the year of privatization of the sector is 1989, data availability restrains the period of study to 2000 to 2018.

and listed on UK stock exchanges.

However, the standard *DiD* approach cannot be used in this case as the *treatment* takes place at different periods for the different companies, in other words, the *treatment period* differs from WaSC to WaSC. We therefore use a *staggered difference-in-differences (staggered DiD)* approach, which allows for such a variability in the periods of *treatment*.

Since we aim to identify the causal impact of financialization on two outcome variables, leverage levels and average consumer prices, we develop two different *staggered DiD* models, one for each variable. We rely on both models in order to use the natural variation resulting from the different timing of the de-listing of companies to compare the average leverage levels and average consumer prices of listed and de-listed companies before and after the de-listing. We therefore set up the two models as follows:

$$L_{it} = \alpha_i + \delta Treatment_i + \lambda_t Year_t + \beta(Treatment_i \times Time_{it}) + \gamma X_{it} + \epsilon_{it} \tag{2}$$

$$P_{it} = \alpha_i + \delta Treatment_i + \lambda_t Year_t + \beta(Treatment_i \times Time_{it}) + \gamma X_{it} + \epsilon_{it} \tag{3}$$

where $L_{it}$ and $P_{it}$ are the dependent variables - i.e., the leverage level and average consumer price, in models 1 and 2 respectively -, of company $i$ at year $t$; $i = \{1, ..., 10\}$ and $t = \{2000, ..., 2018\}$ represent each company and each year of study respectively; $Treatment$ is a dummy = 1 if a company is de-listed at any point throughout the period of study; $Year$ is a year dummy inherent for the *staggered DiD* approach so as to control for year fixed effects; $Time$ is a company-specific *treatment* variable that = 0 in the years before *treatment* and = 1 in the years of *treatment*; $\beta$ is the *staggered difference-in-differences* estimator measuring the causal effect of financialization on the dependent variables; and $X_{it}$ is a vector of company and year-specific control variables that include factors that are likely to affect both the leverage level and the average consumer price of companies, among which we include financial and socio-economic variables.

The main difference with a standard *DiD* model lies in the $Time$ variable. While in a standard *DiD* estimation this variable is the same for all units and equals 0 prior to the *treatment* period and 1 from the *treatment* period and on, in a *staggered DiD* approach, as stated above, the $Time$ variable is unit-specific and equals 0 in every period for the *control* units, while for the *treated* units, the variable equals 0 in periods before the *treatment* and 1 otherwise.

The impact of interest is identified by the parameter $\beta$, associated to the interaction term between the dummy that indicates whether a company is treated or not throughout the period of study, and the dummy indicating the years in which the *treatment* takes place, $Treatment$ and $Time$ respectively. For the first model, this parameter quantifies the differ-

ence in percentage points of leverage levels related to the financialization of a company. In the same way, for the second model, it measures the difference in GBP in average consumer prices related to such a financialization process.

In addition, the errors are clustered at the company level since companies operate each in a distinct region and there are therefore sources of variation coming from differences across companies. This is particularly useful in the case of the study of the impact of financialization on average consumer prices, as the test performed showed evidence of heteroskedasticity, which is accounted for by clustering the errors.

To sum up, the objective of this paper is to analyze the causal impact of financialization on two key outcome variables, leverage level, and average consumer prices, while recognizing the possible feedback effect between them. Indeed, the existing theoretical literature has established a positive effect of the leverage level of regulated utilities through the choice of debt over equity on the regulated consumer prices. This feedback effect should therefore be taken into account in the discussion of the results.

#### 5.1.1 Common trends assumption

Standard and generalized - among which staggered - *difference-in-differences* approaches rely on the assumption that the evolution of outcomes - i.e., leverage levels and average consumer prices in this case - of the *treatment* and *control* groups follows a similar trend. In settings with more than two *pre-treatment* periods, such as this one, this assumption can be partially validated graphically by plotting the period evolution of group - *treatment* vs. *control* - means and checking whether the lines are parallel. It is then graphically simple to observe deviations from the common trends and to spot whether such deviations in the *treatment* group happened at the time that the *treatment* was applied. This, methodology is not easily applicable, however, to our context, in which the *treatment* period varies between *treated* units.

We present, however, such graphical evidence in appendix A.1, containing two figures representing the evolution of the group averages of leverage levels and average consumer prices, respectively. First, in terms of leverage levels, what is compelling about those figures is that deviations of the common trend - not deviations from the initial trend - happen in the periods of *treatment*, and such deviations are longer when *treatment* periods are followed by one another - i.e., 2006, 2007 and 2008 -. Second, in terms of average price levels, both groups show an almost equal trend and it is harder to spot *treatment*-related deviations - or any deviation at all -, except for the last *treatment*, where the average consumer price of the *treatment* group starts increasing to reach a similar average level as that of the *control*

group.

## 5.2 Data

The majority of the data used in this analysis has been collected from the regulator's website and from the companies regulatory accounts as presented on their annual accounts reports. The data collected from such sources includes financial information from 2000 to 2018 for each one of the companies. The financial variables used in the analysis are the following: current cost operating profit, total new fixed asset formation, infrastructure renewals expenditure, average water bill, average sewerage bill, dividends reported, average regulatory capital value, and net debt. We then compute to additional financial variables as follows:

- We compute capital expenditure ($CAPEX$) as the sum of total new fixed asset formation and infrastructure renewals expenditure;
- We compute the leverage level of each company as $Leverage = \frac{NetDebt}{AverageRCV}$;
- We compute the average consumer price of water and sewerage prices as the sum of the average water and sewerage bills.

The company-specific financial data has been converted to constant 2018 prices using consumer price inflation RPI data downloaded form the Office for National Statistics[10] to eliminate any biasing effect from inflation.

We then collected company-specific regional socio-economic data from both Eurostat[11] and the Office for National Statistics. These data include population, unemployment rate and income per capita. Unfortunately, these are proxies of the real information related to the population served by the companies, as for some WaSCs, part of they region in which they operate is also served by one or more WOCs, though in most cases these are considerably small. Likewise, one of the regions in England and Wales, the South West, is dividend into two sub-regions each of which is served by either South West Water or Wessex Water respectively. Since the annual reports do not provide with the needed information, we have considered them to have the same rate of unemployment and income per capita, and we have dividend the population according to the proportion of current cost profits of each company with respect to their sum.

[10] Office for National Statistics - `www.ons.gov.uk`
[11] Eurostat - `http://ec.europa.eu/eurostat`

# 6 Results

This section presents and describes the main results of this analysis. The first part is devoted to the model analyzing the impact of financialization on the leverage level of companies, whereas the second part studies the impact of financialization on the average consumer price.

## 6.1 Impact of financialization on leverage levels

Table 1 reports the results of the *staggered DiD* model in which leverage level is the dependent variable, estimating eight different specifications, varying in terms of financial and socio-economic covariates. As it is standard, we estimate all the specifications of the model by OLS. Furthermore, the tests performed - Breusch-Pagan - showed no evidence of heteroskedasticity. As explained above, the standard errors are however robust by clustering at the company level.

Before discussing the main results, note that the $Treatment$ variable is non-significant in every specification. As a reminder, such a variable equals 0 in every period if the concerned company remains listed throughout the analysis, and equals 1 in every period if the company is de-listed at some point. The interpretation of this variable is therefore not useful in terms of the causal impact of financialization on our outcome variables. It is, however, necessary to be able to construct the *staggered DiD* estimator, as the latter is the coefficient of the interaction between $Treatment$ and $Time$.

Specification 1 of the model reports the *staggered DiD* results, omitting any effect of financial or socio-economic controls. Our interest is to identify the causal impact of financialization on the leverage level of companies, which is quantified by the *DiD estimator* presented on the table and is the coefficient of the interaction term between the *treatment* dummy, which = 1 if the company is treated - i.e., bought out by private equity at any point in the period of study -, and the *time* dummy, which = 1 for a treated company in the periods in which the owner of the company is private equity. As expected, our first hypothesis, the *leverage effect* is confirmed, as according to specification 1 of the model, the financialization of a water and sewerage company in England and Wales has a positive impact on its leverage level of 12.725 percentage points.

Furthermore, the positive impact of financialization on leverage levels is maintained at every specification of the model, with 5% significance levels in all of them except for specification 6, where he significance level is at 10%. We can therefore conclude that financialization

Table 1: Dependent Variable: Leverage Level

| **Variable** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** |
|---|---|---|---|---|---|---|---|---|
| Treatment | -0.837 | -0.905 | -0.913 | -0.802 | 0.824 | -0.354 | | |
| | (6.70) | (6.52) | (6.50) | (6.93) | (7.66) | (7.47) | | |
| DiD Estimator | 12.725** | 12.334** | 12.316** | 12.476** | 10.273* | 10.766* | 12.816** | 10.821** |
| | (4.74) | (5.10) | (5.20) | (4.76) | (5.45) | (5.53) | (4.53) | (4.53) |
| *Financial controls* | | | | | | | | |
| Current Cost Op. Profit | | -0.019 | -0.019 | | | -0.016 | | 0.006 |
| | | (0.02) | (0.01) | | | (0.02) | | (0.02) |
| CAPEX | | 0.009 | 0.009 | | | | | -0.006 |
| | | (0.01) | (0.01) | | | | | (0.01) |
| Dividends | | | 0.001 | | | | | 0.003 |
| | | | (0.01) | | | | | (0.01) |
| *Socio-economic controls* | | | | | | | | |
| Unemployment | | | | | -2.395 | -1.712 | | -0.082 |
| | | | | | (1.52) | (1.65) | | (1.42) |
| Population | | | | 0.001 | 0.001 | -0.001 | | 0.000* |
| | | | | (0.001) | (0.001) | (0.001) | | (0.001) |
| Income per capita | | | | | -0.000 | | | -0.001 |
| | | | | | (0.00) | | | (0.001) |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Company Fixed Effects | No | No | No | No | No | No | Yes | Yes |
| N | 190 | 190 | 190 | 190 | 180 | 190 | 190 | 180 |
| Adj.$R^2$ | 0.391 | 0.405 | 0.405 | 0.403 | 0.436 | 0.460 | 0.488 | 0.551 |

Robust standard errors in parentheses clustered by company
*, **, *** denote significance at the 10 percent, 5 percent and 1 percent levels respectively

of WaSCs, or their de-listing through a buy-out by private equity, has a positive causal impact on their leverage level, increasing it by an average 10.27 to 12.82, depending on the model specification. The effect is maintained when introducing company fixed effects - specifications 7, and 8 -, and the different specifications show that the model explains between 40% and 55% of the variation in the data, which considering the context, is a relatively high goodness-of-fit, as leverage levels are considerably difficult to predict.

In terms of the financial controls, the evidence presented in table 1 seems to contradict part of the existing literature, as there is no significant association between leverage levels and investment or dividends, which have been identified in the literature as important drivers of the former, especially in England and Wales. There is no significance either in the negative association between leverage levels and current cost operating profit. From a theoretical point of view this negative relation makes sense as the higher is the current cost operating profit, the higher are internal funds available to finance any expenditure - such as CAPEX or dividends - and therefore, the lower is the need to access external funds - debt or equity - to finance such expenditures. The effect is, however, relatively small non-significant.

Finally, concerning socio-economic controls, there is a significant positive, almost nil, link between the population served and the leverage level of the company serving. Concerning the rest of controls, they show no significance in the different specifications of the model.

Therefore, the DID estimator is significant and positive, ranging from 10.27 to 12.82 percentage points, in every specification of the model, whether we include company fixed-effects or not, and whether we control for company-specific financial or socio-economic variables.

### 6.2 Impact of financialization on average consumer prices

Table 2 presents with the results of the *staggered DiD* model in which the average consumer price is the dependent variable, estimating eight different specifications, varying in terms of financial and socio-economic covariates, as in the previous subsection. We estimate all the specifications of the model by OLS and using robust standard errors clustered at the company level. All the specifications show a relatively significant goodness-of-fit, with an $R^2$ ranging from 0.286 to 0.641.

Specification 1 of the model reports the results without any other control, i.e., the causal impact of financialization on the average consumer price, which is the relation of interest in this subsection and is measured with the DiD estimator. Our second hypothesis, namely the *price effect* of financialization, seems to be also confirmed; indeed, according to specification 1, the financialization of the water and sewerage sector in England and Wales has a positive

Table 2: Dependent Variable: Average Consumer Price

| **Variable** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
|---|---|---|---|---|---|---|---|
| Treatment | -63.655 | -75.17* | -63.503 | -74.385 | -57.984 | -64.557 | -68.557 |
| | (46.85) | (39.95) | (45.80) | (40.56) | (50.69) | (39.13) | (37.95) |
| DiD Estimator | 32.069* | 39.025** | 34.030* | 28.128 | 35.044* | 38.379* | 23.33 |
| | (17.28) | (16.85) | (18.28) | (17.32) | (17.17) | (21.43) | (21.19) |
| *Financial controls* | | | | | | | |
| Leverage | | | | 0.859 | | | 1.297* |
| | | | | (0.58) | | | (0.68) |
| CAPEX | | -0.132** | | -0.132** | | | -0.060 |
| | | (0.05) | | (0.05) | | | (0.04) |
| Dividends | | | -0.053 | -0.002 | | | 0.01 |
| | | | (0.05) | (0.03) | | | (0.02) |
| *Socio-economic controls* | | | | | | | |
| Population | | | | | | -0.000 * | -0.000 |
| | | | | | | (0.001) | (0.001) |
| Income per capita | | | | | -0.001 | | |
| | | | | | (0.00) | | |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Company Fixed Effects | No | No | No | No | No | No | No |
| N | 190 | 190 | 190 | 190 | 180 | 190 | 190 |
| $R^2$ | 0.286 | 0.531 | 0.307 | 0.547 | 0.315 | 0.570 | 0.641 |

Robust standard errors in parentheses clustered by company
*, **, *** denote significance at the 10 percent, 5 percent and 1 percent levels respectively

impact on the average consumer price of companies of 32.07 GBP.

This positive impact of financialization is observed in all of the specifications of the model, though at lower significance levels - 5% in one specification and 1% in the other four -. The causal impact of financialization becomes non-significant in the specifications of the model in which we control for all the financial variables. This is an interesting result that could be pointing towards an indirect effect of financialization on average consumer prices through other financial variables such as the leverage level. The leverage level actually shows a positive significant effect on average consumer prices of about 1.30 GBP. This actually reconciles with Spiegel's theoretical literature in which he argues that high leverage levels force the regulator to increase the regulated price in order to avoid financial distress of a company providing with a basic need good or service. We can therefore conclude that, financialization of the water sector in England and Wales has had a positive impact on the average consumer price, increasing it by an average 22.98 GBP to 36.72 GBP, depending on the model specification. Such an impact is both direct and indirect through other financial variables, such as the leverage level, which shows a positive and significant effect on the average consumer price in one of the specifications of the model.

On the other hand, the *treatment* dummy is non-significant in this model either - except for one specification, at the 10% level. This non-significance implies that companies are not treated depending on their average consumer price prior to the treatment and that therefore treatment is indeed random. In other words, it pushes aside any risk of endogeneity in treatment.

In terms of financial controls, aside from the leverage level whose effect is significant and positive in on of the specifications in which it is included, the results only show significance in the negative effect of CAPEX, but this significance does not hold when controlling for socio-economic factors. Nevertheless, this negative link is quite interesting as it implies that when investment increases, the average consumer price decrease. This is a particular interesting result in the actual context of under-investment in utilities sectors.

Finally, in terms of socio-economic controls, the results show evidence of a significant negative, correlation of average consumer prices with the population served.

### 6.3 Robustness

Besides the introduction of the different financial and socio-economic controls presented in the previous subsections that positively test the strength of the *difference-in-differences* estimator, we perform an additional robustness check.

We introduce a treatment lead in the model - i.e., we assume that the *treatment* occurs a year later than it actually did. Intuitively speaking, this is a interesting robustness check as the effect of a buy-out by private equity on our outcome variables could begin later than when the buy-out takes place. The results, in terms of significance, are very similar for both outcome variables. In terms of coefficients, the positive impact of financialization on leverage levels ranges from 9.94 to 12.70 percentage points, though slightly less significant, while the impact on average consumer prices ranges from 24.431 GBP to 38.257 GBP. In other words, when considering a treatment lead, the average impact on leverage levels seems to be slightly smaller - around half a percentage point - and less significant, which inreases the robustness of our results concerning the impact of financialisation in the year that it actually took place. On the other hand, the impact on the average consumer price is around 2 GBP higher. A possible explanation could be related to the transmission mechanism of the impact of financialization on the average consumer price through the leverage level. Indeed, as explained in the theoretical framework, when the leverage level increases, the regulator sets a higher regulated price in order to avoid risk of financial default. Our results show that financialization has had a positive impact on the leverage level of de-listed WaSCs; the regulator needs to observe such a leverage level before setting the new regulated price, which should be adapted to the new leverage at least a period later. Therefore, the results point towards an impact on prices higher than that presented in the previous subsection.

# 7 Concluding remarks

The main objective of this paper is to study the causal impact of the financialization of private utilities on their outcome variables, by focusing on the water and sewerage sector in England and Wales. We aim at assessing the causal effect of the private equity buy-outs of WaSCs on two key variables, leverage levels and average consumer prices. We analyze this relation through a *staggered difference-in-differences* approach in which the *treatment* - which for *treated* companies takes place at different years in the period of study - is the buy-out of WaSCs by private equity - more precisely, by infrastructure and investment funds.

It is convenient to keep in mind, though, that the results hold for our specific sample, namely water and sewerage companies in England and Wales, and for our specific period of study, spanning from 2000 to 2018. Further research on the subject should attempt to derive more general conclusions form a theoretical perspective, or to apply the methodology in other sectors in which similar trends are observed. Likewise, the links between financialization and other variables such as dividends should be studied more in-depth.

The hypotheses derived from our theoretical framework are confirmed by the empirical results: first (i) the *leverage effect* of financialization is robustly confirmed. Indeed, our different specifications of the model in which the leverage level is the dependent variable, show that the financialization of WaSCs has had a positive impact on the leverage level of companies, increasing it by an average 10.3 to 12.8 percentage points, depending on the model specification. Second (ii), the different specifications of the model in which the average consumer price is the dependent variable is the average consumer price confirms our *price effect* hypothesis, both directly and indirectly: financialization of the water sector in England and Wales has had a positive impact on the average consumer price, increasing it by an average 32.1 GBP to 38.4 GBP, depending on the model specification.

Reminding the illustrative example given in the introduction, suppose there is a WaSC that initially has a 50% leverage level and a 350 GBP average consumer price. The buy-out of the WaSC by private equity implies that, on average and for the companies in our sample - i.e., English and Welsh WaSCs -, its leverage level and average consumer price will increase to $60\% - 63\%$ and $380 - 390$ GBP respectively.

These results have very important policy implications in two different manners. First (i), while there may be grounds for privatization of public utilities due to the economic efficiency gains related to such processes, we show that financialization is a more sensitive undertaking. Hence, it should be followed more carefully by the regulators as we present evidence of negative - from a social welfare perspective - effects on key outcome variables. Indeed, bought-out water companies providing with a first need good and service are more leveraged, increasing their risk of financial distress, and charge higher consumer prices. Thus, should companies that provide with a basic need good or service even be allowed to be financialized? Further research on a more general level, on other sectors or countries and for different levels of development, for instance, should shed light on a proper answer to this question. Second (ii), traditional regulatory theory has looked very little into the corporate financing strategy or the ownership structure of private utilities. In this paper, we present evidence that both the ownership structure and their financing strategy should be watched more carefully by the regulator, as they have important effects on outcome variables that ultimately impact the welfare of the population they are supposed to serve.

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# A Appendix

## A.1 The Spiegel-Spulber (1994) model

Consider a three-stage sequential game. In the first stage, the regulated monopoly chooses the level of investment and its financing structure, i.e., debt vs. equity. In the second stage, the firm's securities market value is determined in the capital market. In the third stage, the regulator sets the consumer price by maximizing a welfare function that is the weighted sum of consumer's surplus and firm's profits. Finally, the regulated monopoly produces its output and the market clears.

The regulated monopoly produces quantity $q$ at price $p$, and the demand it faces is given by $q = Q(p)$ such that $Q'(p) < 0, Q''(p) < 0$. Its cost function is $C(q, z, k)$, where $k$ is the chosen level of investment and $z$ is an efficiency parameter. The cost function is twice differentiable in $q$, $z$ and $k$, and such that marginal costs are positive and nondecreasing, investment reduces total and marginal costs, and the reduction in total costs is at a decreasing rate. Likewise, some investment is always profitable. The revenues of the monopoly are given by

$$R(p, z, k) \equiv pQ(p) - C(Q(p), z, k)$$

The assumptions above ensure that $R_{pp}(p, z, k) \geq 0$. The efficiency parameter $z$ is a random variable distributed over the unit interval, of positive density function $f(z)$ and cumulative distribution function $F(z)$. Total and marginal costs are assumed to be decreasing in $z$.

Let $D$ denote the face value of the firm's debt, and $E$ and $B$ the market value of new equity and bonds respectively. Since bonds and equity must cover for new investments, the monopoly s budget constraint is given by $k = E + B$.[12] There is a critical value of the efficiency parameter $z$ above which the monopoly is able to pay its debt:

$$z^* \equiv min\{z \geq 0 : R(p, z, k) \geq D\}$$

When $z\ geqz^*$, the monopoly is solvent. When $z < z^*$, the firm declares bankruptcy and bondholders are the only residual claimants. Therefore, $F(z^*)$ represents the probability of bankruptcy. Bankruptcy costs are represented by $H(D - R(p, z, k))$, twice differentiable, increasing and convex. Therefore, if $z^{**}$ denotes the critical value of the efficiency parameter below which the firm is liquidated, expected bankruptcy costs are given by

$$T(p, D, k) = \int_0^{z^{**}} R(p, z, k)dF(z) + \int_{z^{**}}^{z^*} H(D - R(p, z, k))dF(z)$$

[12]There may be no excess of financing as generally regulatory commissions do not allow firms to raise external funds in excess of the costs

Finally, the expected profits are equal to the difference between expected revenues and bankruptcy costs

$$\Pi(p, D, k) \equiv \int_0^1 R(p, z, k)dF(z) - T(p, D, k)$$

The authors use subgame perfect equilibrium, they describe the strategies and solve the game backward. In the third stage of the game, the regulator chooses an optimal regulated price that maximizes the welfare function

$$W(p, kD) = CS(p) + b\Pi(p, k, D)$$

where $CS(p)$ is the consumers' surplus, and $b$ is a welfare weight such that $0 < b < 1$. The optimal pricing strategy is $p^*(k, D)$.

In the second stage, investors earn an expected rate of return that is equal to the risk-free rate of return, as in equilibrium the capital market correctly anticipates what the regulator will do in the third stage.

In the first stage of the game, the firm chooses its investment, $k$, equity participation of outsiders, $\alpha$, and face value of its bonds $D$. The firm's objective is to maximize the expected payoff of its original shareholders

$$V(k, \alpha, D, p) = (1 - \alpha) \int_{z^*}^1 [R(p, z, k) - D]dF(z)$$

As such, the firm chooses $(k^*, \alpha^*, D^*)$ in equilibrium to maximize $V(k, \alpha, D, p^*(k, D))$, subject to $k = E^*(k, \alpha, D) + B^*(k, \alpha, D)$. The strategies $(k^*, \alpha^*, D^*, E^*(k, \alpha, D), p^*(k, D))$ represent the subgame perfect equilibrium of the game.

In equilibrium, the authors show that the optimal strategy of the regulated monopoly is given by the following first order conditions

$$\begin{aligned}\Pi_p(P^*, k^*, D^*)\frac{\partial P^*}{\partial k} &= \int_0^1 C_k(Q(P^*), z, k^*)dF(z) \\ &+ \int_0^{z^*} h(D^* - R^*(z, k^*, D^*))C_k(Q(P^*), z, k^*)dF(z) + (1 + i) \quad (4)\end{aligned}$$

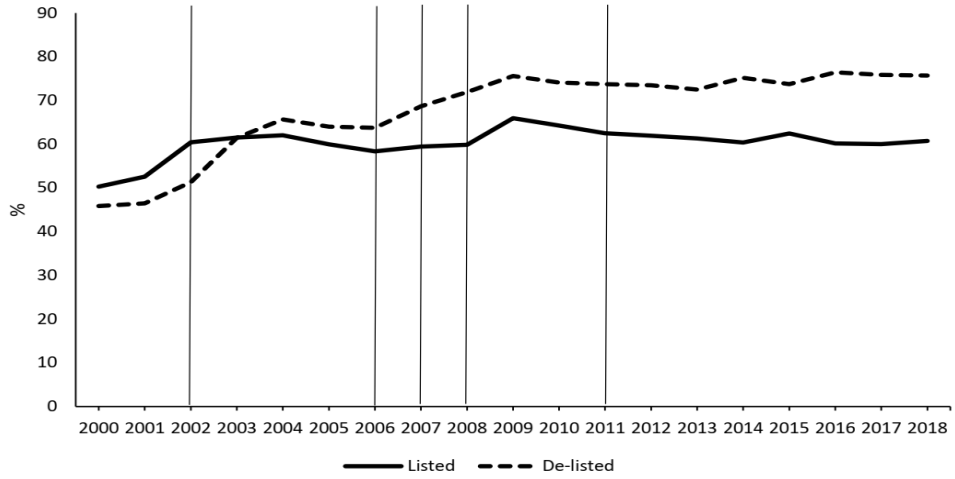
$$\Pi_p(P^*, k^*, D^*)\frac{\partial P^*}{\partial D} = \int_0^{Z^*} h(D^* - R^*(z, k^*, D^*))dF(z) \quad (5)$$

where $P^* = p^*(k^*, D^*)$. Equation (5) shows that the monopoly firm benefits from issuing debt through an increase in the regulated price. Therefore, by issuing debt, the monopoly

firm induces the regulator to increase the price.

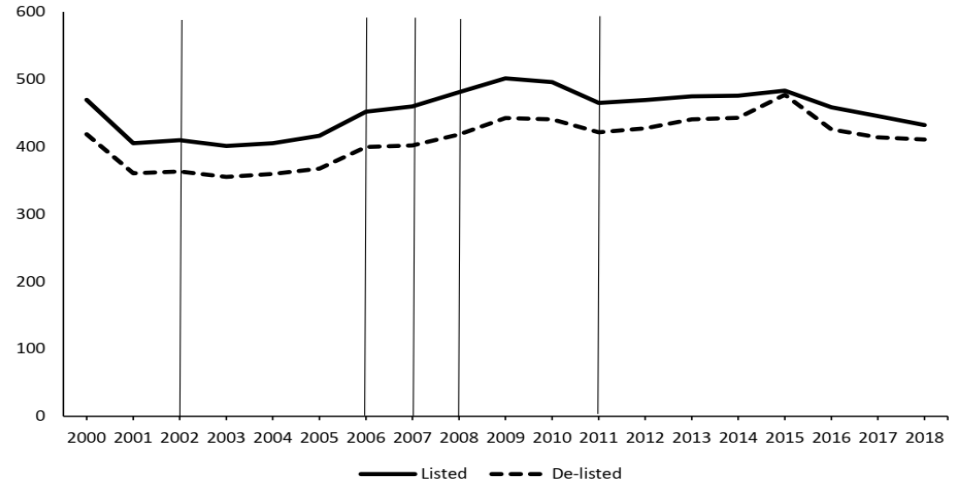
## A.2 Parallel trends assumption

Figure 7: Annual average water and sewerage leverage levels - Listed vs. de-listed WaSCs - 2000-2018




Source: Ofwat and companies' annual reports

Figure 8: Annual average water and sewerage consumer prices - Listed vs. de-listed WaSCs - 2000-2018




Source: Ofwat and companies' annual reports

## A.3 Treatment lead

Table 3: Dependent Variable: Leverage Level

| **Variable** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** | **(8)** |
|---|---|---|---|---|---|---|---|---|
| Treatment | -0.110 | -0.218 | -0.218 | -0.086 | 1.563 | 0.342 | | |
| | (6.84) | (6.58) | (6.56) | (7.06) | (7.74) | (7.48) | | |
| DiD Estimator | 12.628** | 12.272** | 12.271** | 12.379** | 9.940 | 10.515* | 12.699** | 10.257** |
| | (4.94) | (5.21) | (5.36) | (4.94) | (5.76) | (5.80) | (4.73) | (4.37) |
| *Financial controls* | | | | | | | | |
| Current Cost Op. Profit | | -0.019 | -0.019 | | | -0.016 | | 0.006 |
| | | (0.02) | (0.02) | | | (0.02) | | (0.02) |
| CAPEX | | 0.009 | 0.009 | | | | | -0.005 |
| | | (0.01) | (0.01) | | | | | (0.01) |
| Dividends | | | 0.000 | | | | | 0.002 |
| | | | (0.02) | | | | | (0.01) |
| *Socio-economic controls* | | | | | | | | |
| Unemployment | | | | | -2.323 | -1.619 | | 0.848 |
| | | | | | (1.56) | (1.67) | | (2.31) |
| Population | | | | 0.001 | 0.001 | 0.001 | | 0.000* |
| | | | | (0.001) | (0.001) | (0.001) | | (0.00) |
| Income per capita | | | | | -0.000 | | | -0.001 |
| | | | | | (0.00) | | | (0.00) |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Company Fixed Effects | No | No | No | No | No | No | Yes | Yes |
| N | 190 | 190 | 190 | 190 | 180 | 190 | 190 | 180 |
| $R^2$ | 0.393 | 0.467 | 0.408 | 0.405 | 0.434 | 0.459 | 0.491 | 0.547 |

Robust standard errors in parentheses clustered by company

*, **, *** denote significance at the 10 percent, 5 percent and 1 percent levels respectively

Table 4: Dependent Variable: Average Consumer Price

| **Variable** | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
|---|---|---|---|---|---|---|---|
| Treatment | -62.992 | -73.382 | -63.072 | -73.230* | -56.908 | -63.585 | -68.024* |
| | (46.94) | (39.68) | (45.69) | (39.82) | (50.86) | (38.10) | (36.75) |
| DiD Estimator | 33.788* | 39.495** | 36.359* | 28.925* | 36.541* | 40.143* | 24.792 |
| | (17.47) | (16.73) | (18.04) | (16.54) | (17.08) | (21.00) | (20.01) |
| *Financial controls* | | | | | | | |
| Leverage | | | | 0.845 | | | 1.279* |
| | | | | (0.58) | | | (0.69) |
| CAPEX | | -0.132** | | -0.131** | | | -0.060 |
| | | (0.05) | | (0.05) | | | (0.04) |
| Dividends | | | -0.054 | -0.003 | | | 0.009 |
| | | | (0.06) | (0.03) | | | (0.72) |
| *Socio-economic controls* | | | | | | | |
| Population | | | | | | -0.000* | -0.000 |
| | | | | | | (0.00) | (0.00) |
| Income per capita | | | | | -0.001 | | |
| | | | | | (0.00) | | |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Company Fixed Effects | No | No | No | No | No | No | No |
| Comp. Time Trends | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 190 | 190 | 190 | 190 | 180 | 190 | 190 |
| $R^2$ | 0.289 | 0.532 | 0.311 | 0.548 | 0.318 | 0.573 | 0.642 |

Robust standard errors in parentheses clustered by company
*, **, *** denote significance at the 10 percent, 5 percent and 1 percent levels respectively