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Energy market deregulation: A new perspective on dividend smoothing

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ABSTRACT

This paper investigates how U.S. electricity and gas utility firms adapted their dividend policies in response to deregulation of the energy sector, with a focus on understanding the internal financial mechanisms that support or constrain dividend smoothing. Using Lintner's (1956) speed of adjustment model and a variance decomposition framework, we provide new evidence that deregulation significantly reduced dividend smoothing among utility firms, unlike their counterparts in the broader energy sector or non-energy industries. Specifically, we find that after deregulation, utility firms relied more heavily on debt financing and curtailed investment when faced with an income shock but also reflected that shock in the dividends more than before deregulation. Our empirical analysis draws on firm-level data from 1969 to 2021 and compares behaviour before and after deregulation across multiple firm categories, including a matched sample of non-utility firms. We show that deregulation made it harder for firms to maintaining the same level of dividend smoothing. These findings give insights on the importance of regulatory context in corporate finance research, and how market liberalization can impact not only competition and pricing for the affected sectors, but also the strategies firms use to balance investor expectations and operational needs.

1. Introduction

Beginning in the 1980s, the deregulation of the energy sector has reshaped the utilities markets globally. This movement began with the liberalization of electricity markets in the United Kingdom and spread across Europe, Asia, and Latin America, changing drastically how firms in this industry operate. In this study, we take the U.S. experience as a starting point that offers valuable lessons for other countries navigating similar shifts in market organization and regulatory frameworks. In the U.S., this sector which had been stable regulated at state level and was composed of monopolies was transformed into competitive markets, which led to an increase in earnings volatility and prompted firms to reconsider traditional financial policies. While prior research documents that utilities reduced dividend payouts after deregulation (Gao, 2012), an important question remains: how did these firms manage to maintain

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dividend stability in the face of income shocks? We investigate the firms' ability to smooth their payouts and the specific financial mechanisms, namely adjustments in debt and investment, that deregulated utility firms employ to maintain stable dividend payments despite increased cash flow uncertainty. The pressure to smooth dividends is particularly important in market-based, shareholder-centric economies like the U.S. and UK, where investor expectations for steady income are high. The financial trade-offs firms make in this environment may differ from those in bank-based economies (e.g., Germany, Japan) where capital structure and governance relationships are different. Studying the U.S. case, therefore, provides a clear view of how firms behave under strong market pressure for dividend stability.

One aspect that remains insufficiently explored is how deregulation influences firms' dividend policies. The relationship between dividend payout and firm valuation remains controversial (Balli et al., 2022). Dividend policy has long been a topic of interest in corporate finance. While Miller and Modigliani (1961) suggests that payout decisions are largely irrelevant in a perfect market, the reality is far more complex. In practice, dividends play several important roles. More recent studies have shown that the dividends can act as signals to investors about a firm's future profits (Bhattacharya, 1979), serve as tools to limit managerial discretion and reduce agency problems (Easterbrook, 1984), or simply reflect efforts to meet shareholder preferences for regular income (Baker et al., 2001). Similarly, recent study by Brockman et al. (2022) finds that firms that smooth their dividends tend to be valued higher, particularly in countries with weaker shareholder protections. Dividend smoothing serves as a bonding mechanism, helping managers build credibility and reduce agency costs. These functions are especially pronounced in the energy utility sector, where both regulatory oversight and investor expectations have traditionally supported a steady and generous approach to dividend payments.

Indeed, regulated utility firms are often characterized by high and predictable dividend yields. This is typically attributed to the steady cash flows afforded by rate-setting mechanisms and the regulatory scrutiny that promotes financial transparency and risk aversion (Frankfurter et al., 2003; Moyer et al., 1992). However, deregulation that happened in the late 1990 s can upend these assumptions. After the deregulation one would expect that revenue volatility increases, investment horizons shift, and firms must reevaluate how they allocate capital. Existing evidence suggests that deregulated firms not only reduce payout ratios but also adjust their dividends more frequently than their regulated peers (Gao, 2012). Indeed, consistent with the literature, the average dividend per share paid by electricity and utility companies decreases following deregulation, as shown in Fig. 1. Both previous studies and Fig. 1 suggest that some electricity and utility companies may have reduced their dividend payouts in order to prioritize other operational or investment needs.

Still, most of the literature has focused on observable outcomes like payout levels rather than underlying mechanism that allow firms to maintain dividend stability under income volatility pressure. We attempt to address this gap in literature head-on. While earlier work has established that deregulation alters payout behavior, there is little insight into the financial levers firms pull in response to earnings shocks. How do firms react to income shocks? Do they borrow more? Cut back on capital investment? Tap into reserves? While existing studies have documented shifts in dividend levels and payout timing, few have explored the internal financial adjustments, particularly around debt issuance and investment decisions that firms use to smooth dividends. That is the central contribution of this paper. Exploring these mechanisms has implications beyond theory. Dividend smoothing, the practice of maintaining steady payouts regardless of short-term earnings fluctuations remains common, especially in capital-intensive sectors like energy. In a regulated environment, smoothing is relatively straightforward: firms benefit from stable revenues and often have the regulatory leeway to recover costs. In contrast, deregulated firms must make difficult choices whether to scale back investment, take on more debt, or risk cutting dividends. Understanding how firms navigate these trade-offs sheds light on broader questions about financial strategy and resilience in liberalized markets. Recent research shows that payout smoothing decisions depend heavily on the environment that firms operate in. For instance, when competition is more intense, companies tend to smooth earnings less (Shu & Peng, 2024). Greater financial flexibility, on the other hand, allows firms to sustain smoothing through borrowing (Fliers, 2019). Moreover, institutional and tax settings influence whether firms prefer dividends or share buybacks (Geiler & Renneboog, 2015). Taken together, these studies suggest that deregulation might not only weaken payout smoothing by increasing competition but also push firms to rely more on debt as a smoothing tool.

We analyze a large panel of U.S. publicly traded firms for more than 50 years, to test how firms in different sectors, more specifically utilities that have been historically regulated, adjust payout policies after deregulation. We use two methods to understand the effects of deregulation on firms' financial policies: Speed of adjustment (SOA) approach and a variance decomposition approach. We show

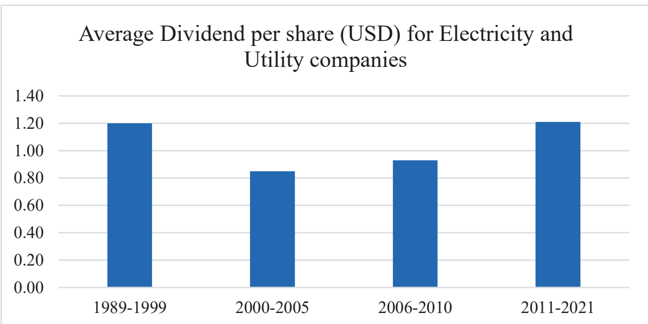

Fig. 1. Average dividend per share (USD) for Electricity and Utility companies.

that utility firms are not able to adjust their payouts at the same level of the firms in other sectors, showing an unintended consequence of the deregulation. These findings show hidden financial costs of deregulation and its impact on corporate resilience.

Our study makes four distinct contributions to the literature. First, we offer new empirical evidence on how dividend smoothing behavior evolves after deregulation, with a particular focus on the role of debt financing and investment flexibility in the face of income shocks. Second, we examine these dynamics across three groups (1) electricity and gas utilities, (2) the broader energy sector, and (3) all other publicly traded firms. By comparing these three groups we are able to isolate what is specific to deregulated firms versus general market behaviour. Third, we contribute to the literature at the intersection of corporate finance and regulatory economics by showing how changes in market structure can influence firm-level financial policy in ways that are not immediately visible in payout ratios alone. Finally, as the deregulation is a global phenomenon, our analysis of the U.S. experience provides and important framework for the international finance literature, offering insights into adaptations and hidden costs that firms would have to face in all other markets during similar transitions. While our empirical analysis focuses on the U.S. firms, the insights contribute to a more general understanding of how liberalization affects corporate financial behavior globally. The dynamics we identify apply to deregulation efforts in Europe, Asia, and Latin America, where utilities and other infrastructure firms are also adapting to more market-oriented systems.

In short, this paper adds depth to our understanding of how utility firms adapt their financial strategies in response to deregulation. Rather than simply reducing dividends, firms appear to use a mix of tools such as increased borrowing and delayed investment to preserve payout stability. These findings underscore the need to consider regulatory context when analyzing corporate behavior and suggest that both policymakers and investors should be attuned to the hidden costs and adaptations that deregulation can impose on the industry and the firms.

The rest of this paper is organized as follows. Section 2 gives a background on the deregulation reform and reviews the literature. Section 3 describes the dataset and presents summary statistics. Section 4 outlines the empirical framework and discusses the results. Section 5 concludes.

2. Literature review and background

2.1. Energy sector deregulation

Electric and gas utility companies given their role in the market have held a unique role in the economy across the world, including the United States. These firms have usually operated as vertically integrated monopolies (Joskow, 2000). They have managed everything from electricity generation to transmission and distribution within certain given geographic boundaries for most of the 20th century. Regulatory oversight had a great input in determining pricing, investment decisions, and service obligations. This system was designed to ensure reliability and fair pricing for consumers who were getting utility services, but at the same time it also imposed significant constraints on the operational and financial flexibility of utility firms. This practice created a relatively stable environment, as financial and operational planning could be done with a long-term view, given that risks were minimal and market dynamics were controlled.

This model began to change in the mid-1990 s. Driven by growing frustration with inefficiencies and broader economic reforms, the energy sector began to follow the path of other industries such as airlines, telecommunications, transportation, and financial services. These industries had either already moved or were moving at the same time toward deregulation. The goal of this trend toward deregulation was to introduce more competition, reduce the role of government in setting prices, and allow market forces to determine the equilibrium in the market. It all started with the Federal Energy Regulatory Commission (FERC) Order 888 issues in 1996. According to this order, utility companies were required to open up their transmission lines to outside providers in order to break up the monopolies that existed in each service area. The proponents wanted to encourage competition, improve efficiency, and allow for more innovation across the sector (Joskow, 2008). Several U.S. states took steps to restructure their electricity markets, unbundling generation from transmission and distribution, and opening both wholesale and retail markets to new entrants (MacKay & Mercadal, 2022).

As a result, the dominance of vertically integrated utilities began to decrease leading to a fall from near-universal market coverage to about 30 % of the market (Heiman & Solomon, 2004; Ryan, 2021). These policy changes not only enabled new entrants to compete in industry but also helped stimulate innovation so that small firms could employ new technologies to compete with larger counterparts, eventually driving growth in industry. (Ovtchinnikov, 2016; Necoechea-Porras et al., 2021). Generation of electricity was separated from transmission and distribution, and utility firms suddenly found themselves operating in competitive markets where revenues were less predictable and future earnings far more uncertain. Some companies adapted well to this new reality by streamlining operations, boosting performance, and seeing improvements in market valuation (Sueyoshi & Goto, 2011; Kishimoto et al., 2017). However, there were other firms that faced significant challenges. Many studies have documented the growing pains that came with the shift. Issues like underinvestment, aggressive cost-cutting, and increased price volatility became common across the industry (Delmas & Tokat, 2005; Woo et al., 2006). Mergers which are often seen as a way to boost efficiency and scale have not always produced the desired outcomes either. As Becker-Blease et al. (2008) note, realizing performance gains after a merger can be difficult, especially when companies struggle to reallocate resources or achieve meaningful cost savings. And while deregulation has improved efficiency in some areas of the market, the results have not been uniformly positive. On the retail side, Borenstein and Bushnell (2015) argue that the promises of deregulation have fallen short, especially when it comes to delivering real value to everyday consumers.

Given this trend that was extended even beyond United States, expectations around deregulation were high. Proponents of deregulation were optimistic that opening up the market would drive greater efficiency, encourage innovation, and ultimately bring down costs for consumers. Countries like the UK, Norway, and Sweden, along with a number of U.S. states, saw meaningful benefits from these reforms, including expanded consumer choice and pricing that responded more directly to market dynamics. (Newbery, 2002; Amundsen & Bergman, 2003). On the other hand, the deregulation has also exposed the market to new levels of volatility. Inadequate investment in infrastructure, pricing spikes, and even cases of market manipulation such as the California energy crisis highlighted the risks of a system without centralized control (Woo et al., 2006; Borenstein & Bushnell, 2015).

These mixed results have led to deeper inquiry into how deregulation affects firm behavior, especially with respect to corporate governance and financial decision-making. As utility firms adjusted to this new competitive environment, they had to revisit not only their operational models but also their financial strategies including their approaches to capital investment, borrowing, and dividend policy. These strategic recalibrations offer a useful lens through which to study how firms respond financially to regulatory disruption.

2.2. Dividend smoothing literature

Dividend smoothing policy has always been an important topic of discussion in corporate finance. Why companies work so hard to keep dividend payments steady, even when earnings are volatile, has intrigued finance scholars for decades. One of the earliest and most influential explanations comes from Lintner's (1956) seminal work, where he found that managers generally avoid cutting dividends because they worry it will send a negative signal to investors. As a result, changes in dividends tend to be gradual and carefully measured.

Later theories have built on this foundation with added layers. Agency theory, for instance, argues that paying dividends reduces the free cash flow at management's disposal, helping to align interests between shareholders and executives (Easterbrook, 1984; Jensen, 1986). Signaling theory takes a different tack, suggesting that dividend changes convey private information about a firm's future prospects. Since cutting or sharply increasing dividends could send unintended messages, firms often prefer to smooth payments over time (Bhattacharya, 1979; Miller & Rock, 1985). Then there's lifecycle theory, which brings a firm's stage of growth into the picture. Mature companies with fewer opportunities for reinvestment are more likely to maintain consistent dividends, while younger, fast-growing firms typically retain earnings to fund expansion (DeAngelo et al., 2006; Grullon & Michaely, 2002).

Investor preferences also have a significant influence on how companies approach dividend policy. Shareholders who rely on regular income, especially those investing through tax-advantaged accounts often favor firms with a track record of consistent dividend payments. This creates what's known as a "clientele effect," where companies feel additional pressure to maintain stable payouts in order to meet the expectations of their investor base (Miller & Modigliani, 1961). Accordingly, dividend smoothing is not simply a sign of financial caution, but it often reflects a deliberate strategy, balancing what the market wants with what the company needs internally and where it is trying to go strategically.

Researchers have explored how this behavior varies across different types of firms and conditions. Leary and Michaely (2011) show that smoothing practices can differ widely, even among firms in the same industry. Guttman et al. (2010) find that companies dealing with higher earnings uncertainty or more severe information asymmetry tend to smooth dividends more potentially to reassure investors and maintain credibility. Chasiotis et al. (2024) shows that markets put a premium on dividends for firms and countries that face substantial substantial agency issues. Recent evidence by Dong, Zhang, and Huang (2024) shows that dual-class firms smooth dividends less than single-class firms, especially when they have high free cash flows, low growth opportunities, or are in mature stages. Financial constraints can further amplify this tendency. In environments where external capital is costly or hard to access, smoothing becomes a way to manage internal cash flow and project financial health (La Porta et al., 2000; Adjaoud & Ben-Amar, 2010). Managerial social capital is shown to mitigate information asymmetry and financial constraints, thereby resulting in increased dividend payouts, especially for firms anticipating high cash retention costs (Cumming et al., 2024) Younger firms and those with limited tangible assets, who can appear riskier to lenders, also lean more heavily on smoothing, as highlighted by Bates et al. (2009), Javakhadze et al. (2014) and Balli et al.(2025) argue that in these cases, dividend smoothing is not just habitual but a rational adaptation to the realities of imperfect capital markets.

While evidence on dividend smoothing and the literature on its underlying motivations is extensive, its relationship to major structural changes such as industry deregulation has not received as much attention. Traditionally, regulated utility companies were known for their high and stable dividend payouts (Hansen, Kumar, & Shome, 1994). This made sense as given the predictable earnings, limited need for reinvestment, and an investor base that expected steady returns, the model worked well (Moyer et al., 1992; Frankfurter et al., 2003). However, deregulation starting from the Federal Energy Regulatory Commission (FERC) Order 888 in 1996 shook up those assumptions completely.

As earnings became more volatile under increasing uncertainty and financial pressure, utility firms were often pushed to rethink whether sticking to the same dividend strategy was still financially responsible. Deregulation introduces more than just financial volatility as it also raises new questions about how firms recover investments, set prices, and retain customers. Some companies, particularly those with strong market positions or operational advantages, may continue smoothing dividends in the same way that they did before. But for others, especially those facing heightened competition, the need to adapt can lead to more significant changes in financial strategy. A study by Shu and Peng (2024) provides evidence from Chinese firms, showing that those operating in more competitive industries tend to smooth their dividends less, highlighting how competitive pressures can prompt firms to adjust their dividend strategies.

Recent research shows that many utilities have responded by changing their approach. Gao (2012) shows that firms often respond to changing economic conditions by decreasing their target dividend payout ratios and adjusting the dividends to reflect in earnings. This reflects a broader change in how managers view the dividend policy as a financial tool to add flexibility to the firm rather than focus on stability and signaling. This flexibility would allow for the extra liquidity to be used during uncertainty, or to be reinvested into the firm. This behavior provides support to the dynamic trade-off theory. In a more volatile environment, the trade-offs increase. Firms must carefully balance the desire to reward shareholders with the need to hold onto capital for strategic investments or to safeguard against unexpected shocks. Therefore, this study takes a closer look at dividend smoothing dynamics by examining how electric and gas utility firms in the United States adjusted their dividend policies in the wake of deregulation. Given the trade-off theory and the increased uncertainty brought by deregulation, we hypothesize that utility firms smooth dividends less following deregulation.

Furthermore, what we are really trying to understand is how these firms responded when their income became less certain. Did they borrow more, or did they cut back on investments to keep dividends on track? It should be noted that dividend policy does not function in isolation, and it is closely tied to other major financial decisions, particularly around debt and investment. A growing body of research highlights how firms tend to manage these elements together, rather than separately. Research studies by Kaplan and Zingales (1995), Lambrecht and Myers (2012), Hoang and Hoxha (2016), and Balli et al. (2022) shed light on the tough choices companies often face when juggling dividends, debt, and investment—especially as financial conditions change over time. For example, when earnings face a temporary shock, a firm might opt to borrow more to maintain dividend payouts, or it might scale back on investment to conserve cash liquidity. This kind of financial decision-making becomes even more crucial for utility companies after deregulation.

The utility sector is characterized by significant capital intensity, with substantial investment in infrastructure required. Deregulation further heightened this investment requirement, as competition forces firms to expand infrastructure and maintain efficient platforms to support changes in supply and demand for services (Joskow, 2008). The literature notes that a common channel to mitigate income shocks and support dividend smoothing is through reducing or delaying investment. However, with deregulation, increased competition constrains this flexibility, as utilities must maintain high levels of infrastructure investment to support robust competitive wholesale and retail markets. Consequently, we hypothesize that income smoothing through the investment channel declines following energy deregulation. Nevertheless, regarding the debt channel, we hypothesize that it remains a primary mechanism for managing income shocks and, in turn, sustaining dividend smoothing. This reliance on debt as a smoothing tool is consistent with prior findings that a significant portion of payouts is financed through debt (Balli et al., 2022).

Generally, these gas and electricity utility firms often operate under tighter financial constraints while also adapting to fast-paced technological changes, evolving regulatory demands, and changing investor expectations. In such a dynamic environment, dividend policy is not just a financial decision, it is a key part of a broader strategy to balance competing pressures and priorities.

3. Data and descriptive statistics

We collect data on net income, dividend payout, debt, and investment at firm level from Compustat for the period between 1969–2021. We restrict our study only to US firms. There are over 22.000 firms in Compustat in total, with over 5.000 firms considered as Energy-related firms that produce energy directly or indirectly (as suppliers for the materials for energy production). We create a category of Energy-related firms as Energy producers and suppliers according to the Standard Industrial Classification (SIC). SIC classifies this category as Electric and Gas Services, and Electric and Gas Production and Distribution (SIC codes 491,492, and 493).[1] Overall, after focusing on these SIC codes, we have 569 firms in the sample and dropped the number to 467 firms after requiring consistent dividend payments. In addition, we also have 467 firms on a matched sample that matched with the electricity and gas firms.

We employ several transformed variables in our estimations. Net Income denotes the annual change in a firm's net income at time *t*, while Payout represents the firm's net payout position at time *t*, defined as the sum of cash dividends and share repurchases net of equity issuance. The Debt variable captures the annual change in each firm's total debt. Summary statistics for these variables are reported in the table below. It is important to emphasize that all variables are expressed in first differences and as expected, have no unit root.

We present the descriptive statistics for the main variables employed in our study in Table 1. The logarithmic transformation and first difference of the data helps us perform the variance decomposition methodology used in our study. At the first glance, we note that the mean and standard deviation of our variables are consistent with previous studies (Balli et al., 2022; Balli et al., 2020), indicating evidence that our sample is representative and reliable. The skewness and kurtosis calculations reveal that our variables have negligible outliers.

Tables 2a-2c show the correlation matrix of our main variables of interest (i.e., debt, investment, net income, and dividend payout) that we employ in this study for different subgroups. At first glance, we observe that for the overall sample excluding energy firms (Table 2c), the correlation between dividend payouts and net income is close to zero. This is consistent with the dividend smoothing strategies of firms. However, for energy-related firms (Table 2a) and electricity and gas providers (Table 2b), the correlation between dividend payouts and net income is around 10 % and 21 %, respectively, indicating the differences in firms' dividend smoothing strategies. Deregulation in the energy markets may require electricity and gas providers to make additional investments, potentially leading them to reduce dividend payments. This provides a rationale for examining how deregulation affects dividend smoothing.

[1] See the SIC numbers of Energy-related firms.SIC 13 includes firms in the Oil & Gas Extraction sector.SIC 29 includes firms in Petroleum Refining & Related sector.SIC 46 includes firms operating in Pipelines (excluding Natural gas).SIC 491 includes firms operating in the Electric Services sector. SIC 492 includes firms operating in the Gas Production & Distribution sector.SIC 493 includes firms operating Combination Electric & Gas, and other Utility firms.

Table 1
Summary statistics.

	Mean	Median	Kurtosis	Skewness	Standard deviation
Energy-related Firms					
Δ Net Income	0.12	0.12	−0.05	1.45	0.89
Δ Payout	0.08	0.07	−0.18	3.42	1.16
Δ Debt	0.08	0.04	0.85	12.22	0.94
Electricity & Gas Service					
Δ Net Income	0.07	0.07	−0.29	12.23	0.52
Δ Payout	0.05	0.06	−0.23	1.79	0.46
Δ Debt	0.10	0.03	0.84	1.34	0.52
Overall Sample					
Δ Net Income	0.10	0.09	−0.29	10.23	0.34
Δ Payout	0.08	0.07	1.34	20.14	0.41
Δ Debt	0.14	0.11	−0.43	1.56	1.01

Notes: Δ Net Income denotes the annual change in a firm's net income at time t. Δ Payout represents the firm's net payout position at time t, defined as the sum of cash dividends and share repurchases net of equity issuance. Δ Debt captures the annual change in each firm's total debt.

Table 2a
Pairwise correlation between main variables (energy-related firms).

Correlation	Δ Debt	Δ Net Income	Δ Payout
Δ Debt	1.00		
Δ Net Income	−0.05	1.00	
Δ Payout	0.02	0.10	1.00

Table 2b
Pairwise correlation between main variables (electricity and gas service).

Correlation	Δ Debt	Δ Net Income	Δ Payout
Δ Debt	1.00		
Δ Net Income	−0.08	1.00	
Δ Payout	0.01	0.21	1.00

Table 2c
Pairwise correlation between main variables (rest of the firms).

Correlation	Δ Debt	Δ Net Income	Δ Payout
Δ Debt	1.00		
Δ Net Income	0.01	1.00	
Δ Payout	0.02	0.02	1.00

Notes: Δ Net Income denotes the annual change in a firm's net income at time *t*. Δ Payout represents the firm's net payout position at time *t*, defined as the sum of cash dividends and share repurchases net of equity issuance. Δ Debt captures the annual change in each firm's total debt.

4. Empirical analyses

First, we start our analysis by estimating dividend smoothing using the famous Lintner (1956)'s speed of adjustment (SOA) model. Next, we estimate the amount of dividend smoothing and channels of dividend smoothing by adopting a variance decomposition model.

4.1. Dividend smoothing

Lintner (1956) shows that firms try to smooth their dividend payouts by making periodic adjustments to their dividends. The amount of dividend smoothing is measured by estimating a SOA coefficient following Lintner (1956)'s SOA model, as in Equation (1).

$$\Delta D_{i,t} = \alpha_{fe} + \beta_1 D_{i,t-1} + \beta_2 E_{i,t} + \beta_3 X_{it} + e_{i,t} \quad (1)$$

where $\Delta D_{i,t}$ stands for the annual change in dividends of firm i at year t. $D_{i,t-1}$ is the dividend (payout) of firm i at year $t-1$. $E_{i,t}$ represents the net income of firm i at year t. α_{fe} corresponds the time fixed effect, whereas X_{it} includes time variant firm specific factors including profit margin, liquidity and solvency ratios, macroeconomic factors including GDP growth and inflation.[2] The speed of adjustment (SOA) coefficient is calculated by estimating β_1 from Equation (1).

In this framework, Lintner (1956) proposes that the SOA captures the variation in dividend payments in response to the changes in net income. As part of our initial examination, we simply use the same framework and compute the SOA (β_1) for each firm before and after deregulation. Theoretically, dividend smoothing is inversely related to the SOA coefficient and can be quantified as $-\beta_1$. Accordingly, a smaller SOA coefficient means more stable dividend payments. Meanwhile, a higher SOA coefficient stands for faster adjustments of the dividends, meaning less stable dividend payments.

Given that deregulation is not a one-time decision, the timing of deregulation is considered a tricky point as there is no specific starting date. We have tested different cut-off dates for deregulation for the SOA calculations. We used each year from 1995 to 2000 as a cut-off year. As a result, our results do not change substantially.[3] Accordingly, we divide our full sample into two sub-samples, including 1969–1999 and 2000–2021 to measure the impact of energy deregulation on firms' dividend smoothing. We provide the results of our estimations for four different categories: (i) electricity and gas firms, (ii) energy firms, (iii) the rest of the US firms, and (iv) the matched sample for the electricity and gas firms.

Table 3a presents the estimation results for Equation (1). Starting with electricity and gas firms (see Column (1)), we find a significant increase in the SOA (β_1) by 10 %, from 29 % (in the period 1969–1999) to 39 % after 2000. Such increase in SOA implies a substantial decrease in dividend smoothing. The *t*-test and Wilcoxon/Mann-Whitney tests are employed to test the equality of the means, which indicate a statistically significant difference in mean at a 1 % significance level. The significant increase in the speed of adjustment of dividends suggests that electric and gas firms might have engaged in dividend smoothing before deregulation, but the amount of dividend smoothing is found to significantly decrease after deregulation. From Column (2) of Table 3a, we also find an increase in the SOA from 30 % to 32 % for energy firms. However, when we test for the difference in mean between two subperiods (1969–1999 versus 2000–2021), we find that this increase is not statistically significant.

It is considered that after deregulation, energy firms have new opportunities which increase their competition but, at the same time, required them to make extra investments to further states. Previous studies indicate that electricity prices which are mostly stable have experienced limited downturns (Nakajima & Hamori, 2010; Razeghi et al., 2017). Even when there is an increase in electricity prices, the extra revenue might be used for generating technological advances. In the cases of natural gas price fluctuations, more investments will be in energy production. Therefore, it is not expected that utility (electricity and gas) firms in the US would witness increased dividend smoothing after deregulation.

In order to compare our results and check their validity, we also perform similar estimations for a subsample of the rest of the US listed public firms. As can be seen in Column (3) of Table 3a, we notice that the SOA decreased from 43 % to 34 % for the rest of the US listed firms. Additionally, we establish a matched sample of non-utility provider firms that have similar characteristics with electricity and gas firms, such as firm size, net income, firm age, and dividend payout ratios. Similar to the finding for the rest of the US listed firms, we note that the SOA coefficient of the matched sample firms experiences a significant decrease of 8 %, from 39 % to 31 % (see Column (4)). On these both groups (i.e., the rest of the US listed firms and matched sample firms), the *t*-test and Wilcoxon/Mann-Whitney tests suggest that the decreases in the SOA coefficients (after versus before deregulation) are statistically significant, indicating the improvements in dividend smoothing for both the rest of the US firms and the matched sample firms.

Table 3b presents a sub-analysis examining the speed of adjustment in Electricity and Gas Utility firms (treatment group) compared to matched control firms. Deregulation policies within states predominantly commenced after 1999; accordingly, the period following 1999 is designated as the post-treatment phase, while the period preceding 1999 is considered the pre-treatment phase. At this juncture, a Difference-in-Differences (DiD) analytical framework is appropriate, whereby the difference in the speed of adjustment coefficients between the treatment and control groups, before and after deregulation, constitutes the DiD estimate. The results reported in Table 3b reveal an estimated coefficient of 18 %, which is statistically significant. This finding robustly suggests that deregulation has a pronounced effect on the speed of adjustment. Furthermore, the evidence implies that firms within the Electricity and Gas Utility sectors with substantial initial capital investments exhibit reduced flexibility in payout smoothing.

4.2. Decomposition of dividend smoothing channels

4.2.1. Variance decomposition analysis

Based on our findings from Section 4.1 that dividend smoothing decreases in case of electricity and gas firms but not for the other groups of firms, we want to look further for the reasons behind this difference and analyse the channels which firms use to smooth their income shocks. Based on the firm-level intertemporal budget constraint proposed by Lambrecht and Myers (2012), Hoang and Hoxha (2016) find that firms are able to smooth their dividend payouts and that negative income shocks are buffered by the debt channel, where firms increase their borrowing or reduce their investments.

[2] Firm-specific control variables, including earnings per share, profit margin, liquidity (current assets), and solvency ratios (debt-to-asset and debt-to-equity), as well as macroeconomic variables such as inflation and GDP growth, are all stationary.

[3] We reported the estimation results, which only use the year 2000 as a cut-off year for deregulation, for the sake of brevity.

Table 3a
SOA coefficients for different subperiods and subsamples.

Periods	(1) Average SOA (Electricity and Gas Utility firms)	(2) Average SOA (All energy firms)	(3) Average SOA (Rest of the US listed firms)	(4) Average SOA (Matched Sample)
1969–1999	29 % (1 %)	30 % (4 %)	43 % (2 %)	39 % (2 %)
2000–2021	39 % (1 %)	32 % (3 %)	34 % (3 %)	31 % (3 %)
Δ SOA	10 %*** (1 %)	2 % (2 %)	−9%*** (2 %)	−8%*** (1 %)

Notes: This table contains the average SOA for different subsamples for the periods 1969–1999 and 2000–2021. We capture periods before and after the energy deregulation. The averages are all in percentages. Standard deviation of the SOA is in parentheses. *** stands for the statistical significance level of 1%. Δ SOA = (average SOA, 2000–2021) − (average SOA, 1969–1999).

Table 3b
Difference-in-Differences (DiD) Analysis.

Periods	(1) Average SOA (Electricity and Gas Utility firms)	(4) Average SOA (Matched Sample)	DiD
1969–1999	29 % (1 %)	39 % (2 %)	
(before deregulation) 2000–2021 (after deregulation)	39 % (1 %)	31 % (3 %)	
Δ SOA	10 %*** (1 %)	−8%*** (1 %)	18 % (1 %)

Notes: This table contains the average SOA for different subsamples. The averages are all in percentages. Standard deviation of the SOA is in parentheses. *** stands for the statistical significance level of 1%. Δ SOA = (average SOA, 2000–2021) − (average SOA, 1969–1999).

In that respect, we implement the variance decomposition method by adopting the intertemporal budget constraint of Lambrecht and Myers (2012), which is presented in Equation (2).

$$\Delta \,\mathrm{Net}\, Debt_i + N.Income_i = \; Inv_i + Payout_i \tag{2}$$

Equation (2) indicates that firms are able to adjust $N.Income_i$(Net Income) fluctuations by changing $NetDebt_i$ due to increasing (decreasing) their borrowings and adjusting the amount of cash holdings. Lambrecht and Myers (2012) propose this approach in Equation (2) that brings together a complete theory by adopting the intertemporal budget limitations and the dividend (payout) smoothing strategies. Following Lambrecht and Myers (2012)'s approach, we consider that firm's dividend payouts consist of both stock repurchases and cash dividends.

Equation (2) shows that fluctuations in net income will be reflected in the changes in borrowing, investment and dividend payouts. However, according to the budget constraint discussed above, if a firm aims to perfectly smooth their dividend payouts, the net income shocks might be buffered by changing net borrowings ($\Delta NetDebt_i$), and/or adjusting investment (Inv_i). The extent of shocks, which cannot be absorbed by the changes in debt and investment, will be reflected in the changes in firm' dividend payouts.

Focusing on publicly owned firms in different markets, Hoang and Hoxha (2016, 2021) find that firms might adjust their investments to have consistent net income fluctuations. In addition, firms may change their debt level to buffer the net income fluctuations and keep investment level constant. While previous studies (Lintner, 1956; Brav et al., 2005) provide evidence that firms prefer to smooth their dividend payouts, we estimate the extent to which these two channels (i.e., net borrowing and investment) absorb the net income fluctuations.

Our goal is to estimate whether electricity and gas firms as well as other energy-related firms in the US change their dividend policies after deregulation, and if they smooth their dividend. Additionally, we investigate the channels that firms use to smooth their dividend. We adopt the variance decomposition method by Sørensen and Yosha (1998), Hoang and Hoxha (2016) and Balli et al. (2013), to calculate the amount of the total smoothing. Accordingly, we rearrange the variance decomposition with the aforementioned intertemporal budget constraint (see Equation (3)). Considering the equation (2) where the identity demonstrates that $\Delta\,\mathrm{Net}\,Debt_i + N.\,Income_i$ is equal to $\mathrm{inv.\,and\,payout},$ we begin by multiplying and dividing Net income variable with $\Delta\,\mathrm{Net}\,Debt_i + N.\,Income_i$. Subsequently, the same procedure is applied to the payout variable, resulting in the equation being transformed as follows:

$$N.Income_i = \frac{N.\,Income_i}{N.Income_i + \Delta NetDebt_i} \times \frac{N.Income_i + \Delta\,\mathrm{Net}\,Debt_i}{Payout_i} \times Payout_i \quad (3)$$

In equation (3) as it is noticed we multiply and divide identities to capture the channels: debt and investment policies. The first channel which we consider is the debt policies ($\Delta NetDebt_i$), where firms may adjust the number of borrowings in response to shocks in net income. The second channel to smooth net income fluctuations is firm's investment level (Inv_i), which is the difference between $N.Income + \Delta\,\mathrm{Net\,Debt}$ and *Payout* when the net income shocks are not entirely smoothed by firm's borrowings ($\Delta NetDebt_i$).

Following Sørensen and Yosha (1998) and Hoang and Hoxha (2016), we apply the log transformation and take the first difference of the variables in the Equation (3). Next, we multiply both sides of Equation (3) by $\Delta \log NetIncome$ – the logged first difference of the net income. Subsequently, we create the cross-sectional variance decomposition that is presented in Equation (4).

$$\begin{aligned} var\{\Delta logN.\,Income_i\} = {} & cov\{\Delta logN.\,Income_i, \Delta logN.\,Income_i - \Delta log(N.\,Income_i \\ & + \Delta\,\mathrm{Net}\,Debt_i)\ \} + cov\{\Delta logN.\,Income_i, (\Delta log(N.\,Income_i + \Delta NetDebt_i) \\ & - \Delta logPayout_i)\ \} + cov\{\Delta logN.\,Income_i, \Delta logPayout_i\} \end{aligned} \quad (4)$$

Next, we divide both sides of Equation (4) by $var\{\Delta logN.\,Income_i\}$. Accordingly, we obtain the slopes from different regression estimations in which the sum of the slope coefficients of the univariate regressions will be equal to 1. Mathematically, the slopes of the coefficients are expressed as in Equation (5).

$$\beta_D + \beta_I + \beta_P \ = 1 \quad (5)$$

Each of the coefficients represents the slope of each panel regressions, respectively. β_D corresponds to the estimated slope of the regression $\Delta\log(\mathrm{N.\,Income}) - \Delta log(\mathrm{N.Income} + \Delta \mathrm{Net\,Debt})$ on $\Delta logN.Income$, which measures the amount of the net income shocks could be absorbed by firm's borrowings. β_I is derived from regressing $\Delta log(\mathrm{N.\,Income} + \Delta\mathrm{Net\,Debt}) - \Delta log\mathrm{Payout}$ on $\Delta log\mathrm{N.\,Income}$, which measures how much of the net income shocks could be absorbed by firm's investment. Lastly, β_P is derived from regressing $\Delta log\mathrm{Payout}$ on $\Delta\log(\mathrm{N.\,Income})$, which represents the unsmoothed part, or the part of the of the net income fluctuations that gets reflected in the year-by-year dividend payout changes.

The univariate equations derived from Equation (4) are presented as in Equation (6a-6c).

$$\Delta logN.\,Income_{it} - \Delta log(N.\,Income_{it} + \Delta NetDebt_{it}) = a_{fd} + \beta_D \Delta logN.\,Income_{it} + \epsilon_{itD} \quad (6a)$$

$$\Delta log(N.\,Income_{it} + \Delta NetDebt_{it}) - \Delta logPayout_{it} = \mathrm{a_{fI}} + \beta_I \Delta logN.\,Income_{it} + \epsilon_{itI} \quad (6b)$$

$$\Delta \mathrm{log} Payout_{it} = \mathrm{a_{fp}} + \beta_P \Delta \mathrm{log} N.Income_{it} + \epsilon_{itP} \quad (6c)$$

The panel equations above have two dimensions: "*i*" corresponds to the firms in our model and "*t*" represents the time dimension of the panel. Each equation has time fixed effect variables (a_{fd}, $\mathrm{a_{fI}}$, $\mathrm{a_{fp}}$), assuring that we control for the time fixed effects in accordance with Asdrubali et al. (1996) and Balli et al. (2013). Equation (6a) estimates the share of the net income fluctuations that firms are able to smooth by adjusting their net borrowings. If the β_D coefficient is 1 or approaches to 1, it shows that the part of the independent variable $\Delta log(N.\,Income_{it} + \Delta\,Net\,Debt_{it})$ should be adding up to zero. Therefore, when net income increases, the borrowings (debt) would have to decrease by the same amount. Thus, we can claim that as β_D is 1, it is evident that firm's net income fluctuations are fully smoothed via its net borrowings (net debt). When this coefficient is not 1, but lower than 1, then net income fluctuations are not fully absorbed by firm's borrowings, and hence there would be room for other channels (investment or dividend payout) to absorb the net income fluctuations.

Next, we look at the investment channel that firms use to smooth their net income shocks. The estimated coefficient in Equation (6b), β_I quantifies the extent of the smoothing via investment channel. If β_I approaches to 1, it means that firms would cut back on investments when they face a negative income shock or invest all the extra income in case of positive income shock.

Table 4
Estimation of dividend payout smoothing via different channels (Energy Firms).

	1969–2021 (Entire period)	1969–1999 (Before deregulation)	2000–2021 (After deregulation)
Debt (β_D)	38 %***	40 %***	39 %***
	(1 %)	(1 %)	(1 %)
Investment (β_I)	46 %***	47 %***	43 %***
	(1 %)	(1 %)	(2 %)
Dividend Payout (β_P)	15 %***	13 %***	14 %***
	(1 %)	(1 %)	(1 %)

Notes: Table contains the estimations of the channels of the dividend smoothing. β_D – the extent of smoothing via debt service – is estimated using $\Delta logN.\,Income_{it} - \Delta log(N.\,Income_{it} + \Delta\,Net\,Debt_{it}) = \beta_D \Delta logN.\,Income_{it} + \epsilon_{itD}$. The extent of smoothing via investment channel (β_I) is estimated via $\Delta log(N.\,Income_{it} + \Delta\,Net\,Debt_{it}) - \Delta logPayout_{it} = \beta_I \Delta logN.\,Income_{it} + \epsilon_{itI}$ and the unsmoothed part(β_P) is estimated via $\Delta \mathrm{log}Payout_{it} = \beta_P \Delta \mathrm{log}N.Income_{it} + \epsilon_{itP}$. We provide the standard errors with brackets. ***, ** and * on the coefficients correspond to the statistical significance levels at the 1 percent, 5 percent and 10 percent, respectively.

In Equation (6c), we estimate the coefficient β_P, which measures the share of the net income shocks that is reflected in the dividend payouts. If the β_P coefficient is higher than zero, it shows the percentage of unsmoothed net income fluctuations that cannot be buffered by debt and investment channels. Theoretically, if firms perfectly smooth their dividend payouts, then dividend payouts remain constant regardless of the magnitude of the income fluctuations. Empirically, a perfect dividend smoothing takes place when β_P is zero. As β_P becomes statistically significant and its magnitude gets bigger, the investment and borrowing channels become less effective in smoothing the dividend payouts. In this part, we are interested in how deregulation has affected the ability of firms to smooth their dividends. Therefore, the channels of the dividend smoothing, and the unsmoothed parts are all tested via panel regressions, by estimating Equation (6a), Equation (6b) and Equation (6c). We present all the results of variance decomposition in Tables 4, 5, 6 and 7.

4.2.2. Estimation results

Tables 4-7 present the estimation results of the Equations (6a-6c) for the entire period (1969–2021), the period before deregulation of the electricity markets (1969–1999), and the period after deregulation (2000–2021). Similar to the previous analysis, we have sampled subgroups, including (i) energy firms, (ii) electricity and gas utility providers, (iii) non-energy firms which are the rest of the firms listed in the US market, and (iv) the matched sample in our analysis to compare our estimations.

In Table 4, we present the results for all energy firms. The unsmoothed part of the net income shocks corresponds to the coefficient for the entire period (1969–2021) is 15 % (β_P). Meanwhile, the dividend payout coefficient (β_P) increases to 19 % for electricity and gas providers only (see Table 5). As can be seen from Table 6, in case of the rest of firms which are non-energy firms, the β_P coefficient is around 5 % for the entire period, but this coefficient is not statistically significant. These findings show evidence that energy firms (including electricity and gas firms) do not smooth their dividends as much as other firms do.

In the second and third columns in Tables 4-6, we recalculate the coefficients for the subperiods before and after the energy deregulation (i.e., 1969–1999 and 2000–2021, respectively). We observe an increase in the dividend payout coefficient (β_P) after deregulation in case of energy firms (Table 4), and electricity and gas utility firms (Table 5). For instance, in Table 4, the β_P coefficient increases from 13 % to 14 % for all energy companies after the energy deregulation. Meanwhile, for electricity and gas utility providers only (Table 5), the β_P coefficient increases from 18 % to 27 %. This substantial increase in the dividend payout coefficient (β_P) suggests that energy firms including electricity and gas firms, are more vulnerable in smoothing the net income shocks. The co-movement of dividend payout growth and net income growth shows that after deregulation; firms' financial positions are insufficient to support dividend smoothing for them. This finding is consistent with the results in Table 3a, which shows that dividend smoothing decreases after deregulation.

Table 6 presents the estimation results for the rest of firms that are non-energy firms listed in the US. We do not observe a big change in term of β_P after deregulation. Indeed, the β_P coefficient goes down, showing that dividend smoothing has increased in the recent period. This finding provides evidence that the change in dividend policy is not a general trend over time for all firms. It implies that the energy deregulation tends to have a strong impact on dividend smoothing for energy firms only.

The impact of energy deregulation on electricity and gas firms can be observed especially from the investment channel (β_I). We find a significant decrease in the investment channel's role in smoothing net income shocks for electricity and gas providers (see Table 5). After deregulation, the increase in competition among firms in different states and the mandatory investments in electricity plants makes the investment channel ineffective channel to absorb the net income shocks for those firms. Given the new pressure coming from competition, firms need to invest in infrastructure regardless of the size of the net income shocks. Therefore, in Table 5, we note that net income smoothing via the investment channel (β_I) has a substantial drop from 32 % to 14 % after the start of energy deregulation. We also observe a decrease in β_I for all energy firms from 47 % to 43 % (Table 4), even though the drop in the β_I coefficient is not as severe as electricity and gas firms (Table 5). Interestingly, for the rest of listed firms which are non-energy firms (Table 6), the investment channel (β_I) remains stable at 35 % for the entire sample and both subsamples. Based on these results, one can easily observe the impact of deregulation on firms' ability to use the investment channel to absorb their net income shocks.

Next, we identify how much of the net income shocks are smoothed via the debt channel (β_D). For electricity and gas firms

Table 5
Estimation of dividend payout smoothing via different channels (electricity and gas utility providers).

	1969–2021 (Entire period)	1969–1999 (Before deregulation)	2000–2021 (After deregulation)
Debt (β_D)	54 %***	50 %***	59 %***
	(4 %)	(1 %)	(4 %)
Investment (β_I)	24 %***	32 %***	14 %***
	(1 %)	(1 %)	(5 %)
Dividend Payout (β_P)	19 %***	18 %***	27 %***
	(3 %)	(1 %)	(1 %)

Notes: Table contains the estimations of the channels of the dividend smoothing. β_D – the extent of smoothing via debt service – is estimated using $\Delta logN.Income_{it} - \Delta log(N.Income_{it} + \Delta Net Debt_{it}) = \beta_D \Delta logN.Income_{it} + \epsilon_{itD}$. The extent of smoothing via investment channel(β_I) is estimated via $\Delta log(N.Income_{it} + \Delta Net Debt_{it}) - \Delta logPayout_{it} = \beta_I \Delta logN.Income_{it} + \epsilon_{itI}$ and the unsmoothed part(β_P) is estimated via $\Delta logPayout_{it} = \beta_P \Delta logN.Income_{it} + \epsilon_{itP}$. We provide the standard errors with brackets. ***, ** and * on the coefficients corresponds to the statistical significance levels at the 1 percent, 5 percent and 10 percent, respectively.

Table 6
Estimation of dividend payout smoothing via different channels (non-energy firms).

	1969–2021 (Entire period)	1969–1999 (Before deregulation)	2000–2021 (After deregulation)
Debt (β_D)	60 %***	59 %***	61 %***
	(4 %)	(1 %)	(4 %)
Investment (β_I)	35 %***	35 %***	35 %***
	(1 %)	(1 %)	(5 %)
Dividend Payout (β_P)	5 %	5 %	4 %
	(3 %)	(3 %)	(3 %)

Notes: Table contains the estimations of the channels of the dividend smoothing. β_D – the extent of smoothing via debt service – is estimated using $\Delta logN.Income_{it} - \Delta log(N.Income_{it} + \Delta\,Net\,Debt_{it}) = \beta_D \Delta logN.Income_{it} + \epsilon_{itD}$. The extent of smoothing via investment channel(β_I) is estimated via $\Delta log(N.Income_{it} + \Delta\,Net\,Debt_{it}) - \Delta logPayout_{it} = \beta_I \Delta logN.Income_{it} + \epsilon_{itI}$ and the unsmoothed part(β_P) is estimated via $\Delta log Payout_{it} = \beta_P \Delta log N.Income_{it} + \epsilon_{itP}$. We provide the standard errors with brackets. ***, ** and * on the coefficients corresponds to the statistical significance levels at 1 percent, 5 percent and 10 percent, respectively.

Table 7
Estimation of dividend payout smoothing via different channels (Matched Sample).

	1969–2021 (Entire period)	1969–1999 (Before deregulation)	2000–2021 (After deregulation)
Debt (β_D)	58 %***	57 %***	58 %***
	(5 %)	(1 %)	(4 %)
Investment (β_I)	37 %***	38 %***	38 %***
	(2 %)	(2 %)	(2 %)
Dividend Payout (β_P)	4 %	3 %	4 %
	(4 %)	(2 %)	(4 %)

Notes: Table contains the estimations of the channels of the dividend smoothing. β_D – the extent of smoothing via debt service – is estimated using $\Delta logN.Income_{it} - \Delta log(N.Income_{it} + \Delta\,Net\,Debt_{it}) = \beta_D \Delta logN.Income_{it} + \epsilon_{itD}$. The extent of smoothing via investment channel(β_I) is estimated via $\Delta log(N.Income_{it} + \Delta\,Net\,Debt_{it}) - \Delta logPayout_{it} = \beta_I \Delta logN.Income_{it} + \epsilon_{itI}$ and the unsmoothed part(β_P) is estimated via $\Delta log Payout_{it} = \beta_P \Delta log N.Income_{it} + \epsilon_{itP}$. We provide the standard errors with brackets. ***, ** and * on the coefficients corresponds to the statistical significance levels at 1 percent, 5 percent and 10 percent, respectively.

(Table 5), we find a significant increase from 50 % to 59 % in smoothing the net income shocks via the debt channel (β_D) after energy deregulation. Given that the importance of the investment channel (β_I) decreases due to firms' inability to adjust the needed infrastructure investments as well as the trade-off between dividend payouts and debt policy, utility provider firms appear to choose to increase the use of debt channel to absorb the shocks to their net income. Meanwhile, for all energy firms (Table 4) and non-energy firms (Table 6), the β_D coefficient's magnitude does not change significantly after deregulation. We find that debt policy can be considered the primary channel to smooth firms' net income shocks for both energy and non-energy firms.

Overall, for electricity and gas utility firms and all energy firms, there is a substantial change in the smoothing channels of net income shocks. Especially for electricity and gas firms, due to the increase in the competition and investment in energy plants, the investment channel in smoothing net income shocks become less effective. Therefore, energy firms, particularly electricity and gas utility firms tend to sacrifice dividend smoothing and use the debt channels more effectively in order to remedy the significant drop in the investment channel. Before deregulation in energy sector, for all firms in energy and non-energy sectors, debt and investment were the main sources of absorbing net income shocks, leaving the firms with possibility of some dividend smoothing. However, we notice that after deregulation, the order of investment channel and dividend payout channel to absorb the net income shocks has changed, in case of electricity and gas utility providers. Before deregulation, all firms tried to smooth their dividend payout as much as they could. Meanwhile, after energy deregulation, electricity and gas firms appear to pass a greater share of net income shocks to the shareholders. However, we note that this is not the case for other groups of firms as those firms continue to smooth their dividend payouts, especially non-energy firms.

One argument could be that electricity and gas firms tend to be different from the firms in the other non-energy sectors. To address this concern, we perform the estimations using only a subsample of non-energy related firms. Specifically, we use a matched sample that has the same sample size with the subsample of electricity and gas firms but includes firms from non-energy sectors. Selected firms in the matched sample are matched with any firm in the subsample of electricity and gas firms based on their age, size and dividend payout ratios. Accordingly, we are able to investigate whether the impact of deregulation is only for electricity and gas providers.

The estimation results for the matched sample are presented in Table 7. We observe that there is almost no difference for this subsample before and after deregulation of the matched sample. The net income shocks get absorbed at similar levels for all channels of smoothing in both subperiods, providing evidence that the change in the electricity and gas utility firms is driven by the changes coming from deregulation. While there is a slight increase in the dividend payout channel, the coefficient is at the same magnitude of the one reported in Table 6 for non-energy firms.

5. Summary and concluding remarks

We explored how electric and gas utility firms in the U.S. adjusted their dividend strategies in the wake of industry deregulation in this paper. Drawing on Lintner's (1956) speed of adjustment model, the analysis shows a clear shift: unlike non-energy firms and other energy-related companies, which generally maintained or even increased their dividend smoothing, utility firms significantly scaled back this practice after deregulation. Digging deeper through a variance decomposition approach as Hoang and Hoxha (2016), we find that these firms leaned more on debt financing while reducing their reliance on investment as a way to manage earnings fluctuations. The findings suggest that as competition increased and capital needs grew, utility firms were often faced with difficult trade-offs. In many cases, they chose to keep investing in their operations, even if it meant accepting more volatility in their dividend payments.

While the study sheds useful light on how these firms adjusted their financial strategies in response to deregulation, it is worth noting a few points. To begin with, the deregulation in the U.S. did not happen all at once or in the same format and level, as it unfolded gradually and varied widely across states. Therefore, it could be harder to draw clean, across-the-board comparisons between what firms did before and after deregulation. Also, while we focus on how companies adjusted their use of debt, investment spending, and dividends, we are not capturing internal dynamics like differences in corporate governance, access to financing, or the strategic preferences of individual managers. All three of them can also shape financial decisions. Finally, because our analysis is limited to publicly traded U.S. firms, the results may not directly apply to privately held utility firms or firms operating in other countries with different regulatory and market environments. However, these findings shed light on the issues that regulators in other countries need to consider in the process of deregulation of regulated industries.

Even taking into consideration these limitations, we believe the findings offer meaningful insights for policymakers, investors, and regulators about how firms respond to major policy changes and financial pressures. While deregulation is typically evaluated in terms of market efficiency and competitive outcomes, its broader financial effects, especially on how firms manage dividends, warrant further consideration. For many years, dividend payments in the utility firms have been seen as a reliable sign of financial stability and strength. Our analysis suggests that this signal may no longer carry the same weight. That is not because firms are being mismanaged, but because the financial landscape they operate in has fundamentally changed. In an era where utility firms must juggle the demands of major capital investment with different investor expectations, regulators may need to adopt a broader view of the financial pressures these firms face.

Looking ahead, there are several promising directions for future research. It would be interesting to take a closer look at how different state-level approaches to deregulation may have influenced firm behavior in unique ways. Not all firms operate under the same rules or pressures, and variations in policy could lead to very different financial responses. It's also worth considering how ownership structures, like municipal versus investor-owned utilities, might shape these outcomes. Some setups might soften the impact of deregulation, while others could make it more pronounced. While our study focuses on U.S. electricity and gas utility firms, we note that the U.S. represents the largest and most significant market for energy utilities, making it an important case study with implications for other regions. Looking beyond the U.S. could also add depth to the analysis. Our findings provide insights that can inform understanding of dividend policy and deregulation in other countries. Especially, countries that have gone through similar regulatory changes might offer useful points of comparison and help us see which patterns hold up across different systems. Lastly, digging into the sequence of financial decisions such as whether firms tend to borrow first or cut dividends first could reveal more about how they manage uncertainty. Understanding the order in which these choices are made can give us a clearer picture of how firms try to stay balanced when they're under financial pressure.

CRediT authorship contribution statement

Faruk Balli: Writing – original draft, Validation, Methodology, Data curation. **Hatice O. Balli:** Writing – review & editing. **Indrit Hoxha:** Writing – review & editing, Writing – original draft, Supervision. **Hannah Nguyen:** Writing – review & editing, Writing – original draft. **Tam Hoang Nhat Dang:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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