The Stability of Dividends and Wages: Effects of Competitor Inflexibility

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Daniel A. Rettl
University of Georgia

Alex Stomper
Humboldt University and ECGI

Josef Zechner
Vienna University of Economics and Business and ECGI

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Abstract

We analyze how industry-wide risks are shared between firms' employees and their owners. Focusing on the electricity industry, we study firms which are subject to similar risks but use different production technologies. We document that firms are more exposed to industry shocks when their competitors use lower-cost production technologies, since this mitigates their response to negative demand shocks. This "competitor inflexibility" destabilizes payouts to equityholders, but there is no evidence that it compromises wage stability. Firms do not share systematic risk due to competitor inflexibility with their employees and set wages as if their shareholders' risk preferences were given.

Keywords: risk-sharing within firms, payout stability, wage stability, competitor inflexibility

JEL Classifications: D22, G35, J33, J41, L13, L94

Daniel A. Rettl
Assistant Professor of Finance
University of Georgia, Terry College of Business
620 South Lumpkin Street
Athens, GA 30602, United States
e-mail: daniel.rettl@uga.edu

Alex Stomper
Professor of Finance
Humboldt University, School of Economics and Business
Dorotheenstr 1
10099 Berlin, Germany
phone: +49 302 093 994 22
e-mail: alex.stomper@hu-berlin.de

Josef Zechner*
Professor of Finance and Investments
Vienna University of Economics and Business, Department of Finance, Accounting and Statistics
Welthandelsplatz 1
1020 Vienna, Austria
phone: +43 131 336 6301
e-mail: josef.zechner@wu.ac.at

*Corresponding Author

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Daniel A. Rettl and Alex Stomper and Josef Zechner*

January 16, 2020

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*Rettl: University of Georgia, 620 S Lumpkin St, Athens, GA 30602, USA, daniel.rettl@uga.edu. Stomper: Humboldt University, Dorotheenstr 1, 10117 Berlin, Germany, alex.stomper@hu-berlin.de. Zechner: Vienna University of Economics and Business, Welthandelsplatz 1, 1020 Vienna, Austria, josef.zechner@wu.ac.at. We thank Tim Adam, Tania Babina, Xin Chang, Christian Laux, David Matsa, Juliusz Radwanski, Jacob Sagi, Leigh Salzsieder, seminar participants at ESMT Berlin, the National Research University Higher School of Economics Moscow, the New Economic School Moscow, UNC Chapel Hill, the University of Georgia, the University of Hamburg, the University of Innsbruck, the University of Missouri - Kansas City, the University of Southern Denmark at Odense, Wharton, and participants at the SFS Cavalcade (Toronto), the WFA (Park City), and the EFA (Oslo) for helpful comments and discussions. The paper benefited from excellent research assistance by Natesh B Arunachalam and Martin Müller. All errors are our own.

President Obama, 2012:[1]

> *"The family business in Warroad, Minnesota, that didn't lay off a single one of their four thousand employees during this recession, even when their competitors shut down dozens of plants, even when it meant the owners gave up some perks and pay - because they understood their biggest asset was the community and the workers who helped build that business – they give me hope."*

1 Introduction

Firms' role as facilitators of risk sharing between employees and shareholders has been a central building block of the theory of the firm at least since Knight (1921), who referred to industry's enterprise and wage system as the "system under which the venturesome and confident [...] insure the doubtful and timid.". While there exists empirical evidence that firms insure workers against idiosyncratic risks (see, for example, Guiso, Pistaferri, and Schivardi (2005)), little is known to what extent this is also true for, arguably more important, systematic risks. In this paper, we analyze this question with respect to industry-level shocks, exploiting the fact that a firm's exposure to such a shock crucially depends on its competitors' behavior. If competitors respond to a negative shock by reducing their output and shutting down plants, as described in President Obama's statement above, then this reduces a firm's exposure to the shock. This is so since the missing supply of the shut down plants leaves more demand for the firm and may also reduce its input prices, due to reduced input demand. If, by contrast, the competitors do not adjust their output or only moderately so, then the firm's exposure to the industry-wide shock is larger. We refer to this latter case as "competitor inflexibility".

Our empirical strategy uses within-industry variation in competitor inflexibility to test how the resulting risk exposures affect the stability of firms' wage payments and their payouts to shareholders. Given that we focus on firms in one industry, we implicitly control for all industry-level

[1]Baltimore Sun, "Obama's full remarks", September 6, 2012. We thank Ellul, Pagano, and Schivardi (2018) for pointing us to this quote.

determinants of within-firm risk-sharing, e.g., industry-level variation with respect to the relevant risk factors, the scope for risk-sharing with third parties, determinants of workers' willingness to accept wage cuts, etc.[2]

We first show that competitor inflexibility has a destabilizing effect on firms' sales, resulting in firm-level sales being more highly correlated with variation in the aggregate sales of firms targeting the same output market. Given this supporting evidence for our notion of competitor inflexibility, we test for its effects on the stability of firms' wages and payouts to shareholders. Our main finding is that competitor inflexibility affects the stability of firms' payouts to their shareholders, but we cannot find effects on wage stability. Rather than striking a trade-off, the firms in our sample seem to prioritize wage stability. These results come from an industry in which variation in firms' aggregate sales is associated with systematic risk because the industry produces a key input in any economy: electricity.[3] Standard arguments suggest that a firm's workers and shareholders should share systematic labor productivity risks according to some trade-off between the two groups' risk exposures.[4] While the firms in our sample exhibit different exposures to such risks, depending on their competitor inflexibility, we find no evidence that this affects the risk exposure of their workers. Instead, we find that the shareholders of firms with more inflexible competitors receive substantially less stable payouts. For the listed firms in our sample, competitor inflexibility also increases the systematic risk of equity as measured by their stocks' betas with respect to the headquarter countries' MSCI index returns.

Our results are relevant for discriminating between alternative hypotheses regarding the sharing of systematic risk between firms' shareholders and employees. Danthine and Donaldson (2002) contrast various possible cases, including the scenario of efficient risk sharing between workers and shareholders and the polar case, in which employees are perfectly insured against systematic

[2]For example, workers' willingness to accept wage cuts could vary at the industry level due to variation in workers' displacement costs. Lagakos and Ordoñez (2011) report evidence of cross-industry variation in workers' risk exposure associated with variation in displacement costs.

[3]It is well-documented that the shareholders of firms in electricity generation are exposed to systematic risk. In fact, this exposure is regularly measured as an input to electricity price regulation because the electricity prices in many countries are set to allow for risk premia that compensate firms' shareholders for bearing systematic risk. See Lazar (2016) and Perrin (2013).

[4]These ideas are developed more formally in the Online Appendix.

risk. While they contrast these cases in terms of their macroeconomic implications, we provide micro-evidence supporting their insurance hypothesis. As discussed below, insuring workers against varying systematic risk exposures may be efficient if firms regard their shareholders as marginally risk neutral.

We now describe our analysis in greater detail. Our choice of industry focus is motivated by a number of observations. First, electricity is a key resource in any economy and thus demand fluctuations are likely to represent at least partly systematic risk. Second, electricity generation is an industry in which firms supply local markets with a particularly homogeneous output. Third, while electricity is a homogeneous good, it is produced via a very wide range of technologies. In choosing from the technological options, firms face a trade-off between fixed and variable costs of production. Once the choices are made, a firm's response to a drop in the electricity price depends on the extent to which it keeps plants running because the plants can produce output at a relatively low marginal cost. We can therefore measure a firm's (in-)flexibility in responding to price changes based on the fraction of its production capacity coming from low-cost plants. The higher this fraction, the less the firm adjusts its output to a given change in price. Competitor inflexibility can be measured in a similar way as the fraction of the production capacity of a firm's competitors that comes from low-cost plants.

Our regressions focus on three dependent variables: firm-level sales, wages, and payouts to shareholders through dividends and share repurchases. We estimate elasticities of these variables with respect to changes in the aggregate sales of firms supplying the same market. The firms in our sample have sufficiently many competitors and sufficiently low market share that the aggregate sales variation can be regarded as exogenous. We test whether the dependent variables respond to this variation with elasticities that increase in competitor inflexibility. If this is the case, it documents a negative effect of competitor inflexibility on the stability of the respective dependent variable.

We first test the prediction that competitor inflexibility destabilizes firms' sales revenues. This prediction results from a Cournot-Nash model, presented in the Online Appendix, in which firms face heterogeneous production costs and each firm chooses its output optimally, taking the other firms' output as given. The model illustrates that a firm's risk exposure depends on the production costs of its competitors: If the competitors can produce at lower marginal cost, then the firm is more exposed to demand shocks because the competitors respond less to these shocks. Our empirical analysis yields strong evidence that this is indeed the case. We find that the sales of firms with lower-cost (i.e. inflexible) competitors vary more strongly in response to aggregate sales variation.

We next test whether competitor inflexibility destabilizes firms' wages and payouts to shareholders. With respect to payout stability, we find strong empirical evidence that shareholders of firms with more inflexible competitors receive substantially less stable payouts. According to our most conservative empirical estimates, the payout elasticity increases by about 20 percentage points when competitor inflexibility increases from its first quartile value to its third quartile value. By contrast, we fail to find evidence that competitor inflexibility compromises wage stability. Rather than striking a balance between the risk exposures of their workers and their shareholders, the firms in our sample seem to prioritize wage stability. This is surprising, because, on average, the firms' payouts account for a much smaller fraction of their sales than their wages (2.6 percent vs. 10 percent).

Our results can be interpreted in two possible ways. One explanation is based on the idea that, in wage contracting, firms take the preferences of their shareholders as given. In the Online Appendix, we formalize this idea, assuming that firms ignore the effects of their wage contracting on the risk-neutral probabilities that determine shareholders' valuation of firms' payouts. We show that, by treating their shareholders as marginally risk-neutral, firms would end up prioritizing wage stability over payout stability, rather than striking a trade-off between the risk exposures of their shareholders and workers.

An alternative explanation results from the idea that the shareholders can hedge against payout variation induced by competitor inflexibility. In fact, such hedging could be key to reducing wage variation and it could eliminate effects of competitor inflexibility on wages. For example, the shareholders of competing firms could use derivatives markets to share risk with each other and third parties, allowing the firms to pay similarly stable wages even if they are subject to competitor inflexibility to different extents. As a consequence, it may actually be efficient that competitor inflexibility compromises payout stability, rather than wage stability.

We distinguish between the two possible explanations using data about futures markets for electricity. For each country in our sample, we check whether such markets exist in the country and, if so, in which year the markets were created. We then use these data to split our sample into subsamples that should differ in terms of shareholders' ability to hedge against payout-destabilizing effects of competitor inflexibility. However, in all subsamples we observe rather similar effects of competitor inflexibility on payout stability. This suggests that our results are not driven by risk-sharing between competing firms' shareholders.

As discussed above, our industry focus is a key advantage of our research strategy, but it also raises specific concerns regarding the robustness and external validity of our results. By focusing on electricity generation, we analyze an industry that is largely characterized by market segmentation along countries' borders.[5] Our baseline specification is therefore based on the assumption that markets correspond to countries. In a robustness test, we also take into account that within-country electricity markets may be partially segmented due to transmission costs. While this robustness check is based on a small sample (firms in countries for which we can obtain precise data about the locations of power plants), it shows that our results are robust to allowing for within-country market segmentation and also to changing the set of fixed effects included in our regressions.[6]

Our industry focus could also raise concerns regarding possible effects of regulation and/or government control of firms. To address the issue of regulation, we analyze data from three different subsamples. In the first subsample, we simply exclude firms with market shares above 25%. These firms are particularly likely to be regulated as they exhibit a dominant market position. The second subsample is based on all firms headquartered in countries with rules for "ownership-unbundling"

[5] Oseni and Pollitt (2014) report that global exports of electricity are still only about 3% of total production.

[6] If we consider within-country market segmentation, we can use country-year fixed effects. This is, however, only possible in a sample which includes too few countries for computing conservative standard errors by clustering at the country-level. Our baseline sample allows for such standard errors. The baseline analysis uses fixed effects at the firm- and year-level.

that separate the electricity generation business from the heavily regulated business of electricity transmission. Our third subsample focuses on firms in countries with liquid wholesale electricity markets. This is motivated by the observation that such markets are typically introduced in the process of electricity sector deregulation.[7] We implement our baseline specification in all three subsamples and find that our results all survive these robustness tests. Moreover, we also test whether our results are driven by firms controlled by governments as the firms' majority owners. We find that our main results regarding effects of competitor inflexibility are not driven by effects of government control of firms, even though this does seem to (independently) compromise payout stability.

This paper is related to contributions regarding effects of product market competition on employment relationships. In labor economics, Bertrand (2004) analyzes how import competition affects the elasticity of wages to unemployment rates and provides evidence that competitive pressure causes firms to change their wage-setting policies so that workers receive less insurance against changes in their outside options. Cuñat and Guadalupe (2009) extend Bertrand's identification strategy and analyze how import penetration affects CEO compensation, while instrumenting import penetration using exchange rates and tariffs. They find that more foreign competition is associated with a higher sensitivity of CEO pay to performance. Our contribution differs from this literature since it focuses on firms' technological choices and the *nature* of competition, i.e., the degree of competitor inflexibility. Moreover, we explicitly analyze risk-transfers between firms' owners and workers by comparing the effects of competitor inflexibility on payments to *both* groups of stakeholders. We thus focus on the issue of "insurance within the firm" and add to the literature following the seminal contribution by Guiso, Pistaferri, and Schivardi (2005). As discussed above, we use variation in competitor inflexibility to analyze insurance within the firm with respect to systematic risk. By using horse-race specifications and different sets of fixed effects, we establish that, as a driver of firms' exposure to systematic risk, competitor inflexibility does not simply proxy for effects of country or firm-level determinants of workers' risk exposure, e.g., features of countries'

[7] See Reinartz and Schmid (2016).

social insurance systems, corporate governance, or government ownership of firms.[8]

Our paper is also related to the large finance literature on payout policy, recently surveyed by Farre-Mensa, Michaely, and Schmalz (2014) who note that payout policy is usually analyzed in isolation, i.e. without taking potential links to other corporate policies into account. Against this backdrop, our paper stresses the trade-off between using corporate revenues to finance payouts or wages. Findings of Brav, Graham, Harvey, and Michaely (2005) suggest that this trade-off is indeed relevant: They report that managers of public firms consider it a high priority to maintain stable dividends, and that some even consider laying off employees in order to avoid dividend cuts. Related evidence appears in Almeida, Fos, and Kronlund (2016) who find that managers are willing to cut employment in order to meet earnings forecasts. Below, we also analyze the stability of employment, but we find no significant effects of competitor inflexibility in this respect.

By analyzing how the stability of firms' payouts depends on competitors' technological choices, we also add to a small literature regarding the effects of competition on payout policy, but where the focus is mostly on the level of payouts, rather than on payout stability. Hoberg, Phillips, and Prabhala (2014) use a novel measure of product market competition ("fluidity") to show that firms facing competitive threats are less likely to pay dividends or repurchase shares, and also pay lower dividends. Grullon and Michaely (2014) also analyze effects of product market competition on payout policy based on data about U.S. firms and standard measures of competition. They find that the relation between industry concentration and dividend payout ratios became more negative after the passage of business combinations laws.

The rest of the paper is organized as follows. Section 2 presents our research strategy, followed by a description of our data and main variables in Section 3. Section 4 presents our results, and Section 5 discusses various robustness checks. Section 6 concludes.

[8] For analyses of these effects, see Ellul, Pagano, and Schivardi (2018) and Kim, Maug, and Schneider (2018). We analyze effects of government ownership in Table 8. Table IA5 in the Online Appendix reports regressions in which we control for cross-country variation in social security (gross replacement rates) and labor market tightness.

2 Research strategy

Our main objective is to analyze firm-level elasticities of sales, payouts to shareholders (dividends and share repurchases), and wages with respect to market-wide aggregate sales variation. Importantly, we allow the estimates of these elasticities to vary in a measure of competitor inflexibility. We first test whether aggregate sales variation affects firms' sales with an elasticity that increases in competitor inflexibility.[9] If so, then competitor inflexibility has a destabilizing effect that may also affect firms' wage bills and their payouts to shareholders, i.e., the two other dependent variables of our main regressions. Formal definitions of the main dependent and explanatory variables of our analysis appear below in Section 3.

A theoretical foundation for our regressions is provided in the Online Appendix. There, we present a model linking the variation in the dependent variables to variation in the profitability of an industry's average-cost firm, i.e., a firm that can produce output at a marginal cost equal to the average of the marginal production costs of the firm's competitors. Our empirical proxy for this variation is the growth of the aggregate sales of a firm's competitors for which sales data are available.[10] We interact this proxy with measures of competitor inflexibility based on data about countries' power plants. As discussed in Section 3.2, the plant-level data also includes plants of firms for which we have no sales data.[11] Our proxies for competitor inflexibility therefore typically include many more competitors of a firm than our measures of market-level aggregate sales growth.

To define the competitors of a given firm, we use data about the locations of firms and power plants since electricity is traded in local markets. In fact, electricity markets are subject to a surprisingly high degree of market segmentation at the country-level, so that a country's electricity supply will typically come from power plants in this country.[12] For each firm in our sample,

[9] To make sure that we are not explaining firms' sales using their own sales data, we measure the aggregate sales variation using data about the sales of a firm's competitors.

[10] Instead of using competitors' aggregate sales, we could use their average sales. We prefer to use aggregate sales since there is considerable variation in data availability regarding small firms, and this variation has a stronger effect on average sales than on aggregate sales.

[11] The firms for which we have sales data own 42 percent of the total electricity generation capacity of all plants located in their countries according to our plant-level data.

[12] Oseni and Pollitt (2014) and Bahar and Sauvage (2013) discuss possible reasons for the lack of international trade in electricity. The reasons include insufficient cross-country transmission capacity and system operators' incentives to

we therefore measure competitor inflexibility based on data about the production capacities and technologies of power plants in the country in which the firm is headquartered. This will be further discussed below.

In our baseline regressions, we regard firms in different countries as firms that compete in different output markets.[13] By simply treating different countries as different markets, we abstract from costs of within-country electricity trading. These costs will be taken into account in Section 5.2, where we define local markets based on data about the precise locations of power plants.

The following regression illustrates our baseline specification:

$$\begin{aligned}\Delta Y_{i,c,t} = \quad & \beta_1 \Delta AGG\,SALES_{-i,c,t} + \beta_2 \Delta AGG\,SALES_{-i,c,t} \times CINFLX_{i,c,t} \\ & + \beta_3 CINFLX_{i,c,t} + \gamma \boldsymbol{X}_{i,c,t} + \nu_i + \tau_t + \epsilon_{i,c,t},\end{aligned} \tag{1}$$

where i indexes firms, c indexes countries, and t represents years. We consider three dependent variables: the growth of firm i's sales, wage bill, and total payout to shareholders (via dividends and share repurchases). Throughout, we use Δ to denote differences between variables' logarithmic values in year t and the year before. The explanatory variables are: the growth in aggregate sales of electricity generation companies that compete with firm i in country c of the firm's headquarters, $\Delta AGG\,SALES_{-i,c,t}$, a measure of competitor inflexibility denoted as $CINFLX_{i,c,t}$ (defined below), and control variables, $\boldsymbol{X}_{i,c,t}$. ν_i and τ_t are fixed effects at the firm and year level, and $\epsilon_{i,c,t}$ denotes an error term. In robustness checks, we also use country-year fixed effects. To do so, we need a measure of competitor inflexibility that varies to a sufficient extent within country-year. As discussed below, we can generate a suitable measure based on data about power plants' locations within countries. The requisite data are, however, only available for a small number of countries. In our baseline analysis, we instead use a much broader sample. Besides avoiding selection effects,

push congestion towards a country's borders, the problem that promoting trade may require the abolition of energy subsidies, a reluctance to export electricity in countries in which electricity is a main input of other industries, etc.

[13] The US will be treated as an exception. For the US we assign states to three virtual countries associated with the three main interconnections, i.e. the Eastern, Western, and Texas Interconnect. We distinguish between these three networks because they still operate largely independently from each other. See *www.eia.gov/todayinenergy/detail.php?id=27152* for further details (Link as of 08/20/2019).

this approach allows us to report baseline results featuring standard errors clustered at the country level (since the number of clusters is sufficiently large).

We will interpret our regression estimates based on the notion that any firm i takes competitor behavior as given. This requires that we focus on markets (countries) with sufficiently many/small firms so that our measures of competitor inflexibility and aggregate sales growth are credibly exogenous. In a typical country-year included in our baseline sample, we have sales data for 35-40 firms. This sample includes all firms with at least 5 competitors for which we can find sales data. In robustness checks, we double this cutoff and also test whether our results are driven by markets featuring firms with market shares above 25%. In the Online Appendix (Table IA6), we further test whether our results are robust to measuring competitor inflexibility by only using data about power plants that started to operate well before the start of our sample period.

Our key explanatory variable is the interaction of aggregate sales growth $\Delta AGG\ SALES_{-i,c,t}$ and competitor inflexibility $CINFLX_{i,c,t}$. We test whether the interaction term enters the regression with a significantly positive or negative coefficient β_2. If we obtain a positive estimate, then higher values of competitor inflexibility are associated with a higher elasticity of the dependent variable with respect to aggregate sales growth. To measure the economic significance of the estimate, we compare point estimates of the elasticity given the first and third quartile value of competitor inflexibility.[14]

We use regressions similar to that in expression (1) to analyze the effects of competitor inflexibility on the stability of other dependent variables. Besides analyzing the stability of firms' total payouts to their shareholders, we also analyze the stability of their dividend payouts. Moreover, we test whether competitor inflexibility destabilizes firms' wages, and we compare the results to those regarding firms' payouts to shareholders. While we cannot measure effects of competitor inflexibility on individual workers, we use employment data to distinguish between two components of the growth of total firm-level wage payments, i.e., employment growth and the growth of the average

[14]Whenever our set of control variables includes interactions of the aggregate sales shocks with variables other than competitor inflexibility, we set those variables to their median values when we estimate elasticities for different quartiles of competitor inflexibility.

wage of a firm's workers.

It is also possible that competitor inflexibility affects the average levels of firms' wages and their payouts to shareholders. We test for such effects by regressing wages and payouts on competitor inflexibility and a set of control variables. The regressions yield further evidence regarding the effects of competitor inflexibility on the risk sharing between firms' workers and shareholders. In particular, we can test whether wages contain risk premia associated with effects of competitor inflexibility on workers' risk exposure.

Summarizing, our regressions should identify the effects of competitor inflexibility, a variable that modulates firms' exposure to aggregate sales shocks. We essentially compare firms with different levels of exposure and test how they differ in terms of the stability of their wages and payouts to shareholders. If workers and shareholders are engaged in risk sharing, we should see that competitor inflexibility destabilizes firms' payments to both groups by increasing the elasticities of wage and payout growth with respect to aggregate sales growth. A formal analysis appears in our Online Appendix. There, we also analyze reasons why competitor inflexibility may only affect the stability of firms' payouts to shareholders, but not that of wages. We can summarize this analysis in terms of two null hypotheses regarding the effect of competitor inflexibility on wage stability.

The first hypothesis is based on the idea that, in wage contracting, firms take the risk preferences of their shareholders as given. This behavior can be interpreted as a form of price-taking behavior with respect to the price of increasing shareholders' risk exposure. While firms may recognize that their shareholders are risk averse, they may treat them as marginally risk neutral in striking tradeoffs between the shareholders' risk exposure and that of workers. As a result, the firms could end up prioritizing wage stability over payout stability, even for non-diversifiable risks.

The second hypothesis follows from the idea that effects of competitor inflexibility on shareholders' risk exposure can be offset by risk sharing between the shareholders of competing firms and third parties. In this case, it may actually be efficient that competitor inflexibility only compromises the stability of firms' payouts to shareholders since the shareholders may have access to risk sharing opportunities not available to workers. If competitor inflexibility is not correlated with worker risk aversion, we should find that it does not affect wage stability.

The second hypothesis differs from the first one by requiring that competitor inflexibility affects firms' exposure to risks that cannot be hedged. To provide specific evidence for the second hypothesis, we can test whether the existence of derivatives markets changes the effects of competitor inflexibility on the stability of firms' wages and payouts to shareholders.

While expression (1) presents our main type of regression, we also use other regressions to obtain evidence complementing our main findings. For example, we test for risk premia in wages, and for effects of competitor inflexibility on the systematic risk of firms' stock returns, based on betas measured with respect to their headquarter countries' MSCI index returns. These regressions appear in the Internet Appendix, in Tables IA2 and IA3.

3 Variables and data

We now describe the construction of our main variables. The variables are based on balance sheet data about firms in electricity generation that we link to an extensive data set regarding power plants. We describe the underlying data work in Section 3.2.

3.1 Variables

3.1.1 Dependent variables

We use three sets of dependent variables in our main analysis: Firm-level sales growth, growth in total wage payments, and growth in total payouts. We include both dividend payments and share repurchases in our measure of total payouts. Growth rates are defined as first differences between log-values of two consecutive annual observations. We exclude observations with values below the 5%-ile or above the 95%-ile to avoid spurious results due to outliers.

3.1.2 Competitor inflexibility.

Our measures of competitor inflexibility are inspired by our theoretical analysis in the Online Appendix. The analysis shows that the lower the average marginal production cost of a firm's competitors, the more will the firm's profit respond to variation in the price of the firms' output. The reason is that such variation will trigger a smaller change in the competitors' aggregate output if they can produce at lower cost.

To bring this concept of competitor inflexibility to our data about firms in electricity generation, we classify power plants according to the variable costs at which they can produce electricity. We then compute the fraction of competitors' total production capacity coming from plants that can produce electricity with low variable costs. The result is our measure of competitor inflexibility.

As an alternative to classifying power plants based on production costs, one could classify the plants based on costs of shutting-down or restarting them. We believe that our classification is more consistent with our focus on risk sharing between the owners and workers of power plants since the underlying risks concern relatively persistent changes in worker productivity. Plant shutdown costs mainly determine the speed with which firms respond to temporary productivity shocks, but such shocks should have small effects on workers.

To classify power plants based on production costs, we use information provided by the U.S. Energy Information Administration (EIA) about the fixed and variable costs of operation and maintenance of different types of plants.[15] The information is summarized in Table 1. Variable costs of operation and maintenance include fuel costs. Costs of capital are separately reported. The final two columns list the ratio of variable costs to the sum of variable and fixed costs, and the ratio of variable costs to the sum of variable, fixed, and levelized capital costs.[16]

[Table 1 about here.]

We consider a power plant as a "low variable cost" (LVC) plant if the source of energy is nuclear,

[15]See Table 1 on the page *http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf* which is based on the EIA's Annual Energy Outlook 2014.

[16]Levelized capital costs are the cost of capital required to build and operate a power plant over its lifetime divided by the total power output of the plant over that lifetime.

hydro, geothermal, wind or solar power. Table 1 shows that, for these energy sources, the variable costs of plant operation and maintenance account for a relatively small share of total costs compared to, say, energy sources such as coal or gas power. We further distinguish between power plants based on intermittent energy sources (wind and solar power) and plants whose capacity is continuously available. Our baseline estimates result from considering nuclear, hydro, and geothermal power plants as LVC plants, but we add wind and solar power plants in a robustness check that appears in the Online Appendix (Table IA7). In this robustness check, we also test whether our results are robust to classifying coal plants as LVC plants.

In our analysis, we use two different measures of competitor inflexibility. The first measure is motivated by the observation that the volume of electricity trade within countries dwarfs that of such trade between countries. Given this observation, we assume that different countries represent segmented markets, but all power plants in any given country supply the same market. Our second measure of competitor inflexibility takes into account that within-country transmission of electricity is costly, so that any given plant only competes with nearby plants in the same country.

For a firm i headquartered in country $c(i)$, our first measure of competitor inflexibility is defined as follows:

$$CINFLX_{i,c(i),t} = \frac{\sum_{u \in U_{c(i),t} \setminus U_{i,t}} CAPACITY_u \times 1_{u=LVC}}{\sum_{u \in U_{c(i),t} \setminus U_{i,t}} CAPACITY_u}, \tag{2}$$

where u indexes power plant units (e.g. a turbine),[17] $CAPACITY_u$ is the capacity (measured in mega watts) of unit u, $U_{c(i),t}$ is the set of all units in country $c(i)$ (based on all of our plant-level data for year t), $U_{i,t} \subset U_{c(i),t}$ is the subset of units owned by firm i, and $U_{c(i),t} \setminus U_{i,t}$ is the subset of units with other owners. As discussed above, our baseline specification sets the indicator variable $1_{u=LVC}$ to one for nuclear, hydro and geothermal power plant units.

We compute the above-stated measure of competitor inflexibility based on all data for power plants that are available for a given country-year through the WEPP database, described in Section 3.2. As a consequence, this measure of competitor inflexibility does not depend on the extent to

[17] A power plant may contain several power-generating units. We exclude all units that are marked in our data as units which are either retired, planned, still in design, or under construction. For simplicity, we refer to power plant units as power plants.

which we can match power plants to firms for which we have balance sheet data. Moreover, this measure will be available for a large number of countries because it can be computed without use of data regarding plant locations within countries. Given that we have ample data about power plants, we can also test the robustness of our result with respect to using lagged data. In the Online Appendix (Table IA6), we report a robustness check based on measuring competitor inflexibility as described above, while only using data about power plants that started to operate before the year 1996, i.e. well before our sample period (2002-2014).

We next turn to our second measure of competitor inflexibility. As discussed above, this measure takes into account that, due to costs of electricity transmission, two firms are more likely to compete with each other if they own power plants that are closer to each other. More specifically, we assume that two power plants must be less than 300 miles apart so that they can both supply the same customers via a medium length line.[18] This assumption is formalized in terms of the following measure of competitor inflexibility:

$$CINFLX_{i,m(i),t} = \frac{\sum_{u \in U_{m(i),t} \setminus U_{i,t}} CAPACITY_u \times 1_{u=LVC}}{\sum_{u \in U_{m(i),t} \setminus U_{i,t}} CAPACITY_u}, \tag{3}$$

where $U_{m(i),t}$ is the set of all power generating units in firm i's country $c(i)$ which are no further than 300 miles away from any of firm i's units. We refer to this region as firm i's market $m(i)$.

To determine distances between power plants, we first link plant locations with their respective coordinates. The WEPP database contains city, state, and country information, which we map to the GeoNames geographical database to obtain coordinates.[19] These can then be used to calculate the shortest distance between any two plant locations.[20] Because our matching is done by hand, we focus on countries for which we have more than 150 sales observations and sufficient data for matching at least 40 % of the plant locations to their respective coordinates. The resulting sample consists of electricity generating firms from 16 countries.

[18]For a classification of power transmission lines, see Grainger and Stevenson (1994). The 300 mile distance is twice the maximum length of a medium line, i.e. 240 km (150 miles).

[19]GeoNames contains names of places and their coordinates. See www.geonames.org for further details.

[20]We define distance as the geodetic distance on the WSG 1984 earth ellipsoid.

From an econometric perspective, the main advantage of using the second measure of competitor inflexibility is that this measure can be used with country-year fixed effects since it varies to a sufficient extent within country-years. However, it is less exogenous than the first measure (because power plant locations may be endogenously chosen), and it is only available for a sample of countries that is too small for measuring standard errors based on country clustering.[21] We therefore use the first measure of competitor inflexibility as our baseline measure, and use the second measure in robustness analyses.

Besides measuring competitor inflexibility, we also construct a variable which describes firms' own production technologies. We use this variable as a control, and refer to it as "own inflexibility". It is defined as follows:

$$OINFLX_{i,t} = \frac{\sum_{u \in U_{i,t}} CAPACITY_u \times 1_{u=LVC}}{\sum_{u \in U_{i,t}} CAPACITY_u}. \tag{4}$$

While this control variable is potentially endogenous, it is largely pre-determined by technological choices that the firms in our sample made long before the start of the sample period (2001-2014).[22]

3.1.3 Aggregate sales

We combine our two measures of competitor inflexibility with arguably exogenous measures of market-level aggregate sales variation. Like our baseline measure of competitor inflexibility, our baseline measure of markets' aggregate sales is defined at the country-level: For each year t and for each firm i in our sample, we sum the sales of competing firms in firm i's country $c(i)$. The competing firms are all firms classified as electricity generation businesses in Worldscope or Amadeus (Worldscope: SIC code 4911– Electric Services, Amadeus: NAICS code 2211: Electric Power Generation, Transmission and Distribution). Our baseline results are obtained by restricting the sample to country-years for which we can find sales data for at least 6 firms in order to measure

[21] See Bertrand, Duflo, and Mullainathan (2004).

[22] We check that our results do not depend on whether one controls for firms' potentially endogenous own technological choices. See Table 5.

the aggregate sales of a firm's competitors based on data about at least 5 competing firms. In a typical country-year included in our sample, we use sales data for 35-40 firms.[23] In various robustness checks, we exclude markets (country-years) with few competitors or dominant firms.

Given the aggregate sales of firm i's competitors in two years $t-1$ and t, we compute the variable that is included in our regressions: $\Delta AGG\,SALES_{-i,c(i),t} = \log(AGG\,SALES_{-i,c(i),t}) - \log(AGG\,SALES_{-i,c(i),t-1})$. Whenever this variable takes a value below the 5%-ile or above the 95%-ile, we treat the observation as an outlier and remove it from our regressions.

When we use our second measure of competitor inflexibility, we define a firm's competitors as firms with at least one plant no further than 300 miles away from any plant in the firm's portfolio of plants. We thus use the same definition of local markets that we use in computing competitor inflexibility according to expression (3). Given the set of competing firms, we measure the variation in their aggregate sales based on data about all firms for which we can find sales data.

3.1.4 Control variables

Our choice of firm-level control variables is inspired by Ellul, Pagano, and Schivardi (2018), and we also follow their approach by using lagged values of these control variables to avoid endogeneity. Thus, we control for the logarithm of firm-level total assets (Size), the ratio of long-term debt to total assets (Leverage), the ratio of operating profits to total assets (Profitability), and the ratio of fixed assets to total assets (Tangibility).[24]

In addition, we use three control variables that are based on our data about power plants. The first is a Herfindahl-Hirschman index (HHI) measuring market concentration based on power plant capacities. This measure is based on the same data as our measure of competitor inflexibility, i.e. all power plants in our data set, irrespective of whether we can match them to financial data. As a consequence, controlling for HHI raises no additional concerns about endogeneity so that we include this control variable and its interaction with competitors' aggregate sales growth in

[23] This number varies a bit across our regressions because we use different dependent variables.

[24] Given our research question, it is particularly important that we control for leverage because firms' technological choices may correlate with their financial structures. See Reinartz and Schmid (2016).

all of our regressions. We thus make sure that our estimates regarding destabilizing effects of competitor inflexibility on our dependent variables are not biased due to competitor inflexibility being correlated with market concentration.

The second variable that is based on our power plant data is the growth of firm-level electricity generation capacity (Own Capacity Growth), which is likely to be associated with firm-level sales and employment growth. The third variable is our measure of own inflexibility, defined in expression (4). We use this variable to address the concern that the technological choices of firm i's competitors (that determine competitor inflexibility) are correlated with those of firm i, and that such correlation could bias our estimates of the regression coefficients associated with competitor inflexibility.

Since several of the firm-level control variables may not be fully exogenous, we check the robustness of our main results across specifications with and without these control variables. In a robustness check in the Online Appendix (Table IA5) that is inspired by Ellul, Pagano, and Schivardi (2018), we also add country-level control variables that should measure determinants of workers' demand for wage and employment stability. Moreover, we check whether our results are robust to controlling for country-year fixed effects.

3.2 Data and descriptive statistics

3.2.1 Data sources

Firm-level financial data. For balance sheet data, we rely on three different data sets. Global data on public firms is obtained from Thomson Reuters Worldscope. We use all firms that are classified as Electric Services (SIC code 4911). For a subset of US firms, we hand-collect additional wage data from filings with the Federal Energy Regulatory Commission (FERC).[25] In particular, we extract the line item "Total Salaries and Wages" from the respective table in FERC Form 1 Annual Reports. The third data source is Bureau van Dijk's Amadeus database. We obtain data on European private firms with the industry classification "Electric Power Generation, Transmission

[25]Our matching is based on firm names in FERC's online eLibrary.

and Distribution" (NAICS code 2211). We download firm-level financial data for the period 2000 - 2014.

Power plant data. The data on electric power generating units comes from the UDI World Electric Power Plants (WEPP) Database. The database covers nearly 196,000 units in more than 230 countries. We obtained 14 editions of the data for the period 2001 to 2014. Each edition contains data for a number of plant characteristics such as plant operator, generation technology, fuel type, installed electricity production capacity, and plant location. Many power plants consist of multiple power generation units. For each of these units, the database separately reports fuel type, generator technology, and production capacity.

Data link. We rely on company names and addresses to establish a link between our plant- and firm-level data. Our primary link results from a manual matching of company names in both databases. We also use corporate websites to identify subsidiaries and assign their power plants to their parent companies. Overall, we are able to identify 1,019 firms for which we also have financial data. The firms operate in 47 countries and own 42 percent of the total electricity generation capacity of all plants located in these 47 countries (according to our plant-level data). The US will be treated as three countries, corresponding to three systems of electricity distribution grids ("interconnections") into which energy producers can feed their produced capacities.[26]

While our measures of competitor inflexibility are based on essentially complete data about the power plants in most countries, the availability of data about our dependent variables varies substantially and differently across countries. Table IA1 in the Online Appendix presents country-level information on the number of observations with respect to our main dependent variables.

Country-level data. We use web searches to identify countries with markets for electricity futures trading, and to determine in which year the trading started. Nagayama (2007) provides country-level information on the introduction of electricity wholesale markets and ownership unbundling regulation. We use these data and add hand-collected data from the web in order to cover our

[26]See Lazar (2016) p.15. California, Nevada, Arizona, Montana, Washington, Oregon, Idaho, Utah, New Mexico, Colorado, and Wyoming form the Western Interconnection. Texas is the only state in the Texas Interconnection. With the exception of Hawaii and Alaska, the remaining US states belong to the Eastern Interconnection.

entire sample period and countries not listed in Nagayama (2007).

3.2.2 Descriptive statistics

Table 2 provides summary statistics for the observations that are sufficiently complete to be included in regressions of our dependent variables on the control variables. As discussed above, we base these regressions on observations for which aggregate sales growth can be measured using data about at least 5 competitors of a firm. We refer to the resulting samples as our full samples, and report summary statistics in Panel A. Due to differences in data availability across countries, the overlap between these samples is somewhat limited.[27] We therefore also present descriptive statistics for a more balanced sample. These statistics appear in Panel B of Table 2. They are based on all observations (firm-years) with data about both a firm's wage growth (Δ WAGES) and its payout growth (Δ POUT), as well as data about all control variables. This balanced sample can be used to measure effects of competitor inflexibility on the risk sharing between firms' workers and shareholders since it excludes firm-years for which we only have data about one of the two groups of stakeholders.

[Table 2 about here.]

In both samples, we observe average growth rates of about 8% regarding the main dependent variables of our analysis, as well as aggregate sale growth, Δ AGG SALES. Our main variable of interest, competitor inflexibility (defined in expression (2)), has a mean of 42 percent in the full sample, while its mean in the balanced sample equals only 34 percent. Both values are a bit higher than the corresponding values of firms' average own inflexibility (OINFLX). These differences are due to the fact that we measure competitor inflexibility using all available plant-level data for a given country, while we measure firms' own inflexibility based on a country's data about firms for which we managed to find balance sheet data. It seems that firms' technological choices correlate with the availability of balance sheet data.

[27] Unlike the US, many countries in our sample provide more comprehensive data on firms' wages as opposed to their dividends. In addition, payout data is not available for the private firms in our sample. We report differences in data availability across countries in Table IA1 in the Online Appendix.

The firms in the balanced sample are on average larger and more profitable than those in the full sample. In terms of the Herfindahl-Hirschman Index, the two samples are not very different. In both samples, we find values lower than the critical value of 1500 (i.e., 0.15) below which the U.S. Department of Justice and the Federal Trade Commission classifies markets as unconcentrated markets.[28]

[Table 3 about here.]

We conclude this section by presenting more detailed statistics regarding our two measures of competitor inflexibility in Table 3. The average share of competitor capacity coming from LVC plants is 42 percent according to our baseline measure (CINFLX), but it equals 30 percent according to our alternative measure (CINFLX 300 miles), which allows for within-country segmentation of energy markets. This difference can be explained as a consequence of data availability. The alternative measure of competitor inflexibility is only available for 16 countries, while the baseline measure is available for 49 countries (including the three virtual countries that we define based on the US interconnections, as discussed above).

The two measures of competitor inflexibility also differ in terms of the extent of within-country variation. If competitor inflexibility is measured according to expression (2), the resulting measure varies little within countries. This is a consequence of our focus on countries in which electricity generation is a sufficiently competitive business, with many competitors and power plants and no dominant firms. Within these countries, different firms face rather similar groups of competing firms / power plants if the countries are treated as fully integrated markets.

By relaxing the assumption that countries are fully integrated markets, the second measure of competitor inflexibility allows for more within-country variation in the set of competitors of different firms. As a consequence, this measure of competitor inflexibility (defined in expression (3)) varies more strongly within countries than our first measure. This is key for using country-year fixed effects. While these fixed effects cannot be used with the first measure of competitor inflexibility,

[28] See U.S. Department of Justice & FTC, *Horizontal Merger Guidelines* §5.3 (2010) for details.

this measure does allow us to measure standard errors with country-clustering since it is available for sufficiently many countries. We therefore use the first measure to obtain our baseline results, and use the second measure in robustness checks.

4 Main results

We start our empirical analysis by testing whether competitor inflexibility reduces the stability of firms' sales. If so, then the sales-destabilizing effect of competitor inflexibility may also compromise the stability of firms' payouts to workers and shareholders. This hypothesis will be tested in the second part of this section, which contains our main results.

4.1 The stability of firms' sales

Table 4 presents regressions of firm-level sales growth on the growth of the aggregate sales of firms' competitors and its interaction with competitor inflexibility. The interaction term measures changes in the elasticity of firm-level sales with respect to aggregate sales. The estimates are based on the full sample, which includes all observations for which we have firm-level sales data.[29] In unreported regressions, we checked that the balanced sample yields similar results.

[Table 4 about here.]

Column (1) of Table 4 presents our baseline results. We find that firm-level sales growth is significantly correlated with market-level aggregate sales growth and with market concentration, measured in terms of the Herfindahl-Hirschman index (HHI) of a country's power plant capacities. While the baseline coefficient of aggregate sales growth is insignificant, its interaction with competitor inflexibility has a significantly positive coefficient. We thus find that the sales of firms with more inflexible competitors exhibit a significantly higher elasticity with respect to competitors'

[29] When we analyze wages and payouts to shareholders, we restrict the analysis to the balanced sample. We thus rule out that we compare different firmsâĂŹ shareholders and workers. This is key to interpreting the results as evidence regarding the within-firm risk-sharing between the two groups. This is of no concern in our regressions regarding firm-level sales, which are therefore based on the full sample.

aggregate sales. This finding is consistent with the idea that competitor inflexibility destabilizes firms' sales. To assess the economic magnitude of this effect, we estimate elasticities of firm-level sales to aggregate sales given the first and third quartile value of competitor inflexibility (and median industry concentration and median own inflexibility). The estimates are stated at the bottom of Table 4, in the rows labeled $Q1(CINFLX)$ and $Q3(CINFLX)$. We find that an increase in competitor inflexibility by one interquartile range is associated with a substantial increase in the elasticity of firm-level sales to aggregate sales. This elasticity increases from 24% to 45% (column (1)). Given these estimates, the destabilizing effect of competitor inflexibility on sales is not only statistically, but also economically significant.

The estimates in column (1) result from the sample of firms for which we can compute the aggregate sales growth of firms' competitors using data about at least 5 competitors. While the average observation in this sample is based on sales data about 35 competitors, it is possible that our results are driven by firms with the ability to influence competitor behavior, rather than taking the output of their competitors as given. We therefore check whether our results change if we exclude firms with few competitors or dominant market positions. Column (2) of Table 4 shows that the results in column (1) are not driven by firms in small markets: We obtain similar results if we double the cut-off regarding the number of competitors and only consider firms for which we can compute the aggregate sales growth of firms' competitors based on data about at least 10 competitors. Column (3) presents estimates obtained by excluding firms whose market shares exceed 25%. Again, the results are similar to those in column (1).

Another potential concern is that we may be measuring effects of vertical integration and electricity market regulation. Our measure of competitor inflexibility may be a proxy for vertical integration of electricity generation businesses, and some electricity producers may be vertically integrated with heavily regulated electricity transmission companies. This concern motivates two robustness checks which appear in columns (4) and (5) of Table 4.

The estimates in column (4) are based on the subsample of firms in country-years with "ownership unbundling" regulation, i.e. rules requiring that the ownership and control of transmission grids is separated from the ownership and control of electricity generation businesses.[30] Our focus on this subsample is motivated by the idea that the case for regulation is much stronger for electricity distribution than for electricity generation. Ownership unbundling regulation therefore should lighten the regulation of electricity generation businesses by preventing vertical integration with electricity distribution. We find that, within the subsample, competitor inflexibility has a similar sales-destabilizing effect as in our baseline sample.

Column (5) reports a second robustness check motivated by concerns about regulation. In this column, we present estimates obtained by restricting the sample to firms that operate in the presence of liquid wholesale electricity markets. The focus on this subsample is motivated by the idea that wholesale markets are typically introduced when countries deregulate their electricity sector.[31] Our results are again consistent with the baseline coefficients reported in column (1).

Given the evidence in Table 4, we conclude that competitor inflexibility destabilizes firms' sales. We next measure effects of competitor inflexibility on the stability of firms' wages and their payouts to shareholders through dividends and share repurchases.

4.2 The stability of firms' wages and payouts to shareholders

In this section, we present the main results of our empirical analysis, i.e. our regressions explaining wage and payout growth. The underlying data set only includes observations (firm-years) with data about both a firm's wage bill and its payouts to shareholders during the same year. We focus on this balanced sample to rule out that our results are driven by effects of competitor inflexibility on firms for which we only have data about their wage bills or payouts to shareholders, but not both. This is key for interpreting our results as evidence regarding the risk sharing between firms' workers and shareholders.

Table 5 presents our baseline results. Columns (1), (3) and (5) report tests regarding effects of competitor inflexibility on the stability of firm-level wage growth, while columns (2), (4) and (6)

[30] Unbundling regulations have been adopted by many countries over the last 20 years. An overview is provided by Nagayama (2007). Gugler, Rammerstorfer, and Schmitt (2013) show that ownership unbundling resulted in increased competition within 16 European countries over the period 1998 - 2008.

[31] By focusing on countries with liquid wholesale electricity markets, we follow Reinartz and Schmid (2016).

report similar tests regarding the stability of payout growth. We report results obtained without using potentially endogenous firm-level control variables (columns (1) and (2)),[32] results of regressions in which we only control for firms' own inflexibility (columns (3) and (4)), and results of regressions based on the full set of control variables (columns (5) and (6)).[33]

[Table 5 about here.]

We first discuss the regressions measuring wage stability. We obtain significantly positive estimates for the baseline elasticity of firms' wages with respect to the aggregate sales of competing firms, but it turns out that competitor inflexibility has no statistically significant effect on this elasticity. A different picture emerges from the results regarding firms' payouts to shareholders, in columns (2), (4) and (6) of Table 5. While we obtain no statistically significant estimates regarding the baseline elasticities of firms' payouts with respect to the aggregate sales of competing firms, the estimates for the coefficient of the interaction of aggregate sales growth with competitor inflexibility are significantly positive: Competitor inflexibility increases the elasticity of payouts with respect to aggregate sales. This result is consistent with the destabilizing effect of competitor inflexibility on firms' sales, and it clearly differs from our previous finding that wage stability is not compromised by competitor inflexibility. Instead, the sales-destabilizing effect of competitor inflexibility seems to compromise the stability of firms' payouts. To assess the economic magnitude of this effect, we estimate elasticities associated with the first and third quartile value of competitor inflexibility. Given the first quartile value, our point estimates for the elasticity of payouts with respect to aggregate sales are essentially zero, but column (6) reports a 85% estimate for this elasticity given the third quartile value of competitor inflexibility. We conclude that competitor inflexibility has a statistically and economically significant effect destabilizing firms' payouts to their shareholders.

Overall, the results in Tables 4 and 5 constitute new evidence regarding the risk sharing that

[32] In unreported regressions, we also checked that the coefficient of $\Delta AGG\ SALES \times CINFLX$ in column (1) of Table 4 is robust to excluding potentially endogenous control variables.

[33] We include our measure of market concentration (HHI) in all regressions because it is correlated with firm-level sales growth. See Table 4. As discussed above, HHI is based on the same plant-level data as our measures of competitor inflexibility.

occurs between firms' workers and shareholders. Competitor inflexibility is a variable that determines firms' exposure to risks affecting market-level aggregate sales. Our results show that these risks affect the stability of electricity producers' payouts to shareholders, but we find no evidence that they compromise wage stability.

We next contrast two possible explanations for our results. The first explanation is based on the idea that, in wage contracting, firms treat their shareholders as marginally risk-neutral. We formalize this idea in the Online Appendix, and show that it leads to firms prioritizing wage stability over payout stability, rather than striking a trade-off between the risk exposures of their shareholders and workers. Given that this is what we observe in the data, our findings can be interpreted as evidence concerning firms' objective functions and governance.

There is, however, also an alternative way to interpret our results. This second interpretation is based on the idea that shareholders can hedge against payout variation induced by competitor inflexibility. If such hedging opportunities exist, it may be efficient that shareholders bear risk associated with competitor inflexibility. For example, the shareholders of competing firms could use derivatives markets to share risk with each other and third parties, allowing the firms to pay similarly stable wages even if they are subject to competitor inflexibility to different extents.

In the next step of our analysis, we check the explanatory power of the second way to interpret the results we obtained so far. We do so using data about hedging opportunities due to the existence of electricity futures markets. Table 6 reports results of regressions in which we check whether the effect of competitor inflexibility is driven by electricity futures markets. The regressions include interaction terms of aggregate sales growth with a dummy indicating the existence of electricity futures markets, as well as triple interactions of the dummy with aggregate sales growth and competitor inflexibility. The latter interaction terms test whether the effects of competitor inflexibility on wage and payout stability differ across country-years with and without electricity futures trading. It turns out that the coefficients of the additional interaction terms are statistically insignificant. We again find that competitor inflexibility destabilizes firms' payouts to shareholders, but not their wage bills. There is no evidence that electricity futures markets affect firms' prioritizing of wage stability over payout stability because they allow shareholders to hedge against payout fluctuations.

[Table 6 about here.]

Given the evidence in Tables 5 and 6, we conclude that competitor inflexibility destabilizes firms' payouts to shareholders, but not their wage bills. It appears that the firms in our sample shield their workers from extra risk due to competitor inflexibility by prioritizing wage stability over the stability of their payouts to shareholders. If their workers are not extremely risk averse, the firms in our sample seem to abstain from using the workers' risk-bearing capacity. We find no evidence that this behavior can be explained as a consequence of the existence of hedging opportunities. A potential explanation follows from a hypothesis regarding firms' objective functions, i.e. that, in wage contracting, firms take the risk-preferences of their shareholders as given, thus ignoring that their shareholders mind a reduction in payout stability associated with an increase in wage stability.

4.3 Further results

In this section, we discuss analyses complementing our main findings. We start with regressions analyzing whether competitor inflexibility affects the stability of certain components of firms' total wage bills and payouts to shareholders. We decompose firms' total wage growth into employment growth and the growth of wages per employee, and separately analyze whether competitor inflexibility affects the elasticities of these variables with respect to market-level aggregate sales growth. Moreover, we analyze whether competitor inflexibility destabilizes dividend growth. So far, our results regarding payout stability were based on firms' total payouts via dividends and share repurchases. Given that share repurchases are less common, we test whether our results concerning payout stability survive if we measure payouts based on dividends only.

Table 7 reports results of regressions similar to those in Table 5, but with alternative dependent variables. The first four columns report regressions explaining employment growth and the growth of wages per employee (WPE), i.e., the ratio of a firm's wage bill and the number of its employees in a given year. The estimates are consistent with the notion that competitor inflexibility does not affect the stability of firms' total wages. We find no evidence that the two components of total wage growth respond to market-level aggregate sales growth with elasticities determined by competitor inflexibility. All estimates regarding coefficients of the interaction of aggregate sales growth with competitor inflexibility are statistically insignificant.

[Table 7 about here.]

The last two columns of Table 7 report estimates of regressions explaining dividend growth. The regressions yield significantly positive coefficients of the interaction of competitor inflexibility and market-level aggregate sales growth. These results are consistent with the notion that competitor inflexibility destabilizes firms' payouts to shareholders by increasing the elasticity of dividends with respect to aggregate sales growth. Estimates for this elasticity are reported at the end of Table 7, where we distinguish between the first and the third quartile value of competitor inflexibility. In terms of their economic magnitudes, these estimates are comparable to the corresponding estimates regarding the elasticity of total payouts to shareholders, reported in Table 5.

Another analysis complementing our main results appears in Table IA2 in the Online Appendix. This analysis tests for effects of competitor inflexibility on the levels of firms' wage bills and payouts to shareholders. It is motivated by the idea that wages should contain risk premia if wage stability were compromised by competitor inflexibility. To detect such risk premia, we run regressions explaining firms' logarithmic wages per employee ($\log WPE$) and the ratio of wages to sales (WtS, also measured at the firm-level). If competitor inflexibility were associated with risk premia, we should find evidence that higher levels of competitor inflexibility are associated with higher wage levels. There is, however, no such evidence in Table IA2. In the same table, we also report results of regressions explaining the level of firms' payouts to shareholders, measured in terms of the ratio of payouts to sales (PtS). The regression yields no evidence for an effect of competitor inflexibility on the payout ratio.

A final set of complementary results appears in Table IA3 in the Online Appendix. We test whether competitor inflexibility increases firms' exposure to systematic risk. The test is based on all of the firms in our (full) sample for which we managed to obtain monthly stock return data. We first estimate the beta of each firm's stock with respect to its headquarter country's MSCI index, and then regress the estimated betas on competitor inflexibility and control variables while including firm and year fixed effects. The regression shows that competitor inflexibility has a statistically and economically significant effect on firms' exposure to systematic risk. This result is consistent with prior evidence that the shareholders of firms in electricity generation are exposed to systematic risk.[34]

5 Robustness checks

In this section, we present our main robustness checks. Further robustness checks appear in the Online Appendix.

5.1 Cross-sectional heterogeneity

Our first set of robustness checks addresses the concern that our measure of competitor inflexibility may proxy for some other kind of cross-sectional heterogeneity in within-firm risk sharing than that we intend to measure. We check the robustness of our results with respect to two kinds of heterogeneity: differences associated with financial leverage and government ownership of firms. Table 8 presents the robustness checks. The first two columns present estimates obtained from a horse-race-specification in which our measure of competitor inflexibility competes against a measure of firms' financial leverage, i.e., the ratio of long-term debt to total assets. This variable, denoted as LEV in Table 8, has so far been used as a control variable, as discussed in Section 3.1.4. In the robustness check, we not only control for the main effect of financial leverage, but also add its interaction with aggregate sales growth, so that this variable appears in the regressions in exactly the same way as our measure of competitor inflexibility, $CINFLX$. It turns out that our results

[34] See Norton (1985).

regarding the effects of competitor inflexibility are robust. See the first two columns of Table 8. We again find no significant effect of competitor inflexibility on wage stability, while the effect on payout stability is quite similar to that in our baseline specification.

The third and fourth column of Table 8 present a robustness check concerning effects of government ownership. Given our focus on electricity generation, government ownership is an issue in our sample. The robustness check is based on an indicator variable which equals one for firms under government (majority) control. It turns out that government-control has no significant effect on the elasticity of firm's wages with respect to market-level aggregate sales variation, but it does increase the elasticity of payouts to shareholders. The latter effect does, however, not compromise the robustness of our main result, i.e., that competitor inflexibility destabilizes payouts. This also remains true if we extend the specification by adding our measure of financial leverage, as done in the regressions reported in the last two columns of Table 8. In unreported regressions, we also tested whether government control affects the extent to which competitor inflexibility compromises payout stability, but found no significant effect.

[Table 8 about here.]

5.2 Alternative measures of competitor inflexibility

We next test the robustness of our results with respect to varying the way in which we measure competitor inflexibility. Our baseline measure abstracts from costs of within-country electricity transmission. In order to take such costs into account, we repeat our analysis using the alternative measure of competitor inflexibility defined in expression (3). This measure varies sufficiently within countries that it can be used in a specification with a full set of country-year fixed effects. The requisite data are, however, only available for relatively few countries: 16 countries out of the baseline sample of 47 countries. As a consequence, we can only use the alternative measure of competitor inflexibility if we relax other restrictions limiting the samples behind our regressions. Up to now, our wage and payout regressions were based on the sample of observations (firm-years) with data about *both* a firm's wage bill and its payouts to shareholders during the same year. In the robustness checks discussed below, we instead use all observations that are sufficiently complete to be included in a given regression. The resulting estimates are partly based on observations that are incomplete in that we only observe either a firm's wages or its payouts to shareholders. As a consequence, the estimates cannot really be interpreted as evidence regarding the risk-sharing between a firm's workers and shareholders. Instead, they should only be seen as a robustness check.

Besides relaxing sample restrictions, we must also change the way we measure standard errors. So far, we have used standard errors clustered at the country level. If we use the alternative measure of competitor inflexibility instead of our baseline measure, we can only obtain a sufficiently large number of clusters by using country-year clusters.[35]

Our results appear in Table 9. The first four columns are based on our alternative measure of competitor inflexibility (expression (3)) and a consistently defined measure of competitors' aggregate sales growth.[36] The last two columns present the estimates we obtain if we just use the alternative measure of competitor inflexibility, while sticking to the baseline measure of aggregate sales growth.

[Table 9 about here.]

We start by discussing the estimates in the first two columns of Table 9. These estimates result from a specification with a full set of country-year fixed effects that control for many country-level determinants of workers' and shareholders' willingness to bear risk.[37] We obtain estimates that are less precise than our baseline estimates, but that confirm our findings: Competitor inflexibility has no effect on wage stability, but it destabilizes firms' payouts to shareholders by increasing the elasticity of the payouts with respect to market-level aggregate sales growth. According to our baseline estimates, this elasticity equals about 85 percentage points when competitor inflexibility is at its third quartile value. This estimate drops to about 23 percentage points when we use the

[35] Bertrand, Duflo, and Mullainathan (2004) document the effect of few clusters on rejection rates.

[36] As discussed at the end of Section 3.1.3, the latter measure is based on sales data of a firm's competitors in the firm's local markets, defined by a 300 mile radius around the firm's power plants.

[37] In the Online Appendix, we explicitly analyze potential effects of country-level variation in social security (gross replacement rates) and labor market tightness. See Table IA5. The country-year fixed effects also absorb the variation in HHI so that we cannot estimate the respective coefficient.

coefficients obtained from our alternative measures of competitor inflexibility and aggregate sales growth.

We next check two potential explanations for the smaller economic magnitude of the payout-destabilizing effect of competitor inflexibility that we observe in column (2). The estimates in this column result from a specification that differs in three respects from our baseline specification, i.e. in the ways we measure competitor inflexibility and competitors' aggregate sales growth, and in the fixed effects specification. To analyze how these differences affect our estimates, we first check the effect of switching back to year fixed effects and subsequently also that of switching back to our baseline measure of aggregate sales growth.

It turns out that the use of country-year fixed effects does not drive the reduction in the economic magnitude of the payout-destabilizing effect of competitor inflexibility. Column (4) of Table 9 shows the coefficient of the interaction of our alternative measures of competitor inflexibility and aggregate sales growth that we obtain if we use year fixed effects rather than country-year fixed effects. The point estimate is actually smaller than that in column (2) which is based on country-year fixed effects.

We next check the effect of using our baseline measure of competitors' aggregate sales growth, rather than the alternative measure. It appears that, by switching back to the baseline measure, we obtain estimates that are more in line with our baseline results in Table 5 in terms of the economic magnitude of the payout-destabilizing effect of competitor inflexibility. The estimates are reported in columns (5) and (6) of Table 9. The latter column reports a coefficient of the interaction of competitor inflexibility and aggregate sales growth that is substantially higher than the corresponding estimates in columns (2) and (4).

Notably, none of the robustness checks in Table 9 yields any evidence for a destabilizing effect of competitor inflexibility on wages. Instead, it again appears that, in dealing with competitor inflexibility, firms prioritize wage stability over the stability of their payouts to shareholders.

In the Online Appendix, we report further robustness checks concerning the way we measure competitor inflexibility. Table IA6 presents estimates that result from our standard measure of competitor inflexibility if we only use data about power plants that started to operate at least five years before the start of our sample period. Table IA7 reports robustness checks in which we compute competitor inflexibility as defined in expression (2), while adding wind, solar, and coal powered plants to the set of LVC plants. Both robustness checks yield estimates in line with our baseline results.

5.3 Effects of regulation

In our final set of robustness checks, we test whether our results are robust to excluding firms subject to heavy regulation. We conduct two types of robustness checks that are based on two ways of excluding heavily regulated firms from our sample.

Our first way of excluding heavily regulated firms is based on the idea that the case for regulation is typically much stronger for firms in electricity distribution than for firms in electricity generation. As a consequence, we check the robustness of our results by excluding firms that may be active in both areas. The robustness check is based on rules for "ownership unbundling" that have been adopted by many countries over the last 20 years.[38] These rules require that the ownership and control of electricity transmission businesses is separate from that of electricity generation businesses.

The second robustness check addressing concerns about regulation is based on country-level data about the existence of electricity wholesale markets. This robustness check is inspired by the idea that wholesale markets are typically introduced when countries deregulate their electricity sector. The robustness check tests whether our results are robust to excluding country-years without wholesale markets.

The results of those robustness checks appear in Table 10. The first two columns present the robustness check based on rules for ownership unbundling, while the remaining columns report the robustness check based on wholesale markets. The results of both robustness checks are similar to our baseline results. We find that competitor inflexibility increases the elasticity of firms' payouts

[38] See Nagayama (2007).

with respect to market-level aggregate sales variation, but not that of firms' wages.

The results in Table 10 are complemented by robustness checks that test whether our results are robust to varying our sample selection criteria in order to exclude markets with dominant players or few market participants. We report the latter robustness checks in Table IA4 in the Online Appendix. They also address concerns about effects of regulation because the case for regulation is stronger in less competitive markets.

[Table 10 about here.]

6 Conclusion

In this paper, we analyze how industry-wide risks are shared between firms' employees and their owners. We focus on firms from a single industry, namely the electricity industry, that are exposed to the same systematic risk factors, but with different sensitivities. We then demonstrate to what extent these different sensitivities to the risk factors are passed on to employees and to shareholders, respectively. Our industry focus is motivated by the observation that, within this industry, firms use a variety of different production technologies that lead to different production cost structures. To which extent a firm is exposed to industry shocks then depends on the technology that its competitors use. If a firm's competitors use mostly low-cost technologies, then their production will be less responsive to negative industry shocks. This effect of "competitor inflexibility" tends to make the firm riskier. Our empirical measures of competitor inflexibility are based on data about the production technologies of firms in electricity generation. With these, we show that the sales of firms with more inflexible competitors indeed vary more strongly relative to the aggregate sales variation in the firms' markets, so that competitor inflexibility destabilizes firms' sales with respect to this aggregate sales variation.

We next look for evidence that competitor inflexibility also compromises wage stability and the stability of firms' payouts to their shareholders through dividends and share repurchases. This analysis is motivated by the notion that efficient risk sharing between firms' workers and shareholders requires some trade-off between wage stability and payout stability. Our findings instead suggest that firms prioritize wage stability: Competitor inflexibility affects the stability of firms' payouts to their shareholders, but there are no effects on wage stability. By measuring the stability of firms' wages and payouts with respect to variation in markets' aggregate sales, we focus on variation that is not driven by firm-specific risks. As a consequence, our findings cannot be interpreted as evidence that shareholders bear diversifiable risk. Instead, it appears that the firms in our sample abstain from using the risk-bearing capacity of their workers. A possible explanation is that the firms treat their shareholders as marginally risk neutral, rather than striking a trade-off between the systematic risk exposure of their workers and shareholders. This interpretation of our results raises the question whether firms also appear to expose their shareholders to too much systematic risk in other corporate policies.

Our paper represents a first step towards a broader view of risk sharing between firms' workers and their owners. We consider such risk sharing in a single-firm context, but we take into account that a firm's risk exposure is subject to external effects of competitor behavior rooted in competitors' production technologies. Future analyses could aim at analyzing within-firm risk sharing based on an industry equilibrium view which takes into account that, at the industry level, there is an optimal degree of heterogeneity in both firms' technological choices and within-firm risk sharing. Such analyses would extend an earlier literature focused on industry-level heterogeneity in firms' technological choices and their capital structures/financial leverage.[39] Rather than putting a focus on financial leverage, the focus would be on operating leverage associated with fixed wages.

[39] For example, see Maksimovic and Zechner (1991) and Maksimovic, Stomper, and Zechner (1999).

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Table 1:
Costs per MWH (in 2012 US$)

This table presents levelized capital costs, fixed costs of operation and maintenance (O&M) and variable costs of O&M for several types of power plants. The table reproduces data contained in Table 1 of *http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf* which is based on the Annual Energy Outlook 2014 published by the U.S. Electricity Information Association (EIA). The data is for plants entering service in 2019. Levelized capital costs are the cost of capital required to build and operate a power plant over its lifetime divided by the total power output of the plant over that lifetime. Variable costs of O&M include costs of fuel. Abbreviations: IGCC integrated gasification combined cycle, CCS carbon capture and storage, CC combined cycle, PV photovoltaic.

Plant type	(1) Levelized capital cost	(2) Fixed costs of O&M	(3) Variable cost of O&M	(4) Ratio $\frac{(3)}{(2)+(3)}$	(5) Ratio $\frac{(3)}{(1)+(2)+(3)}$
Natural gas:					
Convtl CC	14.3	1.7	49.1	96.7%	75.4%
Advcd CC	15.7	2.0	45.5	95.8%	72.0%
Advcd combstn turbine	27.3	2.7	70.3	96.3%	70.1%
Convtl combstn turbine	40.2	2.8	82.0	96.7%	65.6%
Advcd CC with CCS	30.3	4.2	55.6	93.0%	61.7%
Coal and biomass:					
Biomass	47.4	14.5	39.5	73.1%	39.0%
Convtl coal	60.0	4.2	30.3	87.8%	32.1%
Coal IGCC	76.1	6.9	31.7	82.1%	27.6%
Coal IGCC with CCS	97.8	9.8	38.6	79.8%	26.4%
Other:					
Advcd nuclear	71.4	11.8	11.8	50.0%	12.4%
Hydroelectric	72.0	4.1	6.4	61.0%	7.8%
Geothermal	34.2	12.2	0	0%	0%
Wind	64.1	13.0	0	0%	0%
Wind offshore	175.4	22.8	0	0%	0%
Solar PV	114.5	11.4	0	0%	0%
Solar thermal	195.0	42.1	0	0%	0%

Table 2:
Summary statistics

This table reports summary statistics for an international panel of electricity generation firms. The sample period is 2002-2014. The variables are defined in Section 3. Δ AGG SALES denotes market-level aggregate sales growth, Δ SALES is firm-level sales growth, Δ WAGES is firm-level growth of the wage bill, and Δ POUT is firm-level growth of payouts to shareholders. $CINFLX$ is our measure of competitor inflexibility (defined in expression (2), HHI is a Herfindhal-Hirschman index of market concentration, and $OINFLX$ is our measure of firms' own inflexibility (defined in expression (4). Panel A provides summary statistics for the samples of observations that are sufficiently complete to be included in regressions of our dependent variables on our control variables. In Panel B, we additionally require that the observations contain data about both wage growth and payout growth. We thus obtain a balanced sample.

	Panel A				Panel B			
Variable	Mean	Median	StDev	N	Mean	Median	StDev	N
Δ AGG SALES	0.078	0.070	0.101	6,492	0.089	0.077	0.100	1,279
Δ SALES	0.083	0.064	0.208	6,492	0.082	0.072	0.188	1,279
Δ WAGES	0.081	0.049	0.169	4,940	0.088	0.060	0.156	1,279
Δ POUT	0.083	0.049	0.471	1,840	0.080	0.051	0.477	1,279
CINFLX	0.418	0.293	0.286	6,492	0.340	0.230	0.246	1,279
HHI	0.117	0.082	0.130	6,492	0.088	0.047	0.121	1,279
OINFLX	0.376	0.018	0.453	6,492	0.316	0.037	0.403	1,279
Size	6.483	6.239	3.338	6,492	9.359	9.381	1.942	1,279
Leverage	0.246	0.215	0.221	6,492	0.258	0.271	0.144	1,279
Profitability	0.024	0.000	0.052	6,492	0.065	0.060	0.062	1,279
Tangibility	0.661	0.711	0.222	6,492	0.578	0.617	0.204	1,279
Own capacity growth	0.063	0.000	0.475	6,492	0.064	0.000	0.454	1,279

Table 3:
Measures of competitor inflexibility

This table reports summary statistics for our measures of competitor inflexibility. The sample period is 2002-2014. For each variable, we report the mean, standard deviation, minimum, and maximum. In addition, we decompose the variances in their between- and within-country components, and report the corresponding standard deviations. CINFLX is our baseline measure of competitor inflexibility (defined in equation 2). CINFLX 300 miles is an alternative measure (defined in equation 3) which allows for within-country electricity market separation. The number of observations N counts all firm-years for which the measure of competitor inflexibility is available, along with all control variables included in our regressions.

Measure	Variance	Mean	Std. Dev.	Min	Max
CINFLX	overall	0.4181	0.2857	0.0000	0.9798
	between		0.2918	0.0000	0.9725
N = 6492	within		0.0234	0.0958	0.5637
CINFLX 300 miles	overall	0.3042	0.2563	0.0000	0.9959
	between		0.2476	0.0000	0.9809
N = 1619	within		0.0697	-0.2671	0.7059

Table 4:
Effects of competitor inflexibility on the stability of firm-level sales

This table reports elasticities of firm-level sales with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. The results in column (1) are based on our full sample. (See Panel A of Table 2.) In column (2), we drop all firm-years for which we have less than 10 observations per country-year to compute aggregate sales. In column (3), we drop all firm-years in which a firm's market share exceeds 25 percent. Column (4) is based on country-years in which ownership unbundling regulations are in place. Column (5) is based on country-years in which electricity is traded in competitive wholesale markets. In the rows Q1(CINFLX) and Q3(CINFLX), we report elasticities given the first and third quartile value of competitor inflexibility $CINFLX$ (and median values of market concentration HHI and of a firm's own inflexibility $OINFLX$). In each specification, we include firm and year fixed effects. Control variables include firm size, leverage, profitability, tangibility, and a firm's own capacity growth. Standard errors (in parentheses) are clustered by country. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Δ SALES	Full Sample	10 Firms	25% Mkt SH	Unbundle	Wholesale
Δ AGG SALES	0.149	0.156	0.180	0.121	0.040
	(0.112)	(0.120)	(0.120)	(0.124)	(0.119)
× CINFLX	0.427***	0.416**	0.466***	0.529***	0.619***
	(0.163)	(0.185)	(0.178)	(0.157)	(0.165)
× HHI	0.019	−0.012	−0.119	0.091	−0.150
	(0.403)	(0.459)	(0.494)	(0.410)	(0.416)
× OINFLX	−0.146	−0.118	−0.187	−0.192	−0.166
	(0.108)	(0.117)	(0.114)	(0.125)	(0.131)
CINFLX	−0.024	−0.060	−0.034	0.038	−0.104
	(0.123)	(0.129)	(0.148)	(0.136)	(0.206)
HHI	0.458***	0.489***	0.456**	0.572**	0.849***
	(0.142)	(0.153)	(0.194)	(0.238)	(0.235)
OINFLX	0.070	0.051	0.074	0.073	0.010
	(0.050)	(0.053)	(0.052)	(0.061)	(0.050)
Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C	C
N	6,492	6,108	6,208	4,722	4,769
R^2	0.082	0.081	0.083	0.090	0.085
Q1(CINFLX)	0.244***	0.246***	0.273***	0.227**	0.157*
Q3(CINFLX)	0.452***	0.452***	0.503***	0.506***	0.489***

Table 5:
Effects of competitor inflexibility on firm's workers and owners

This table reports elasticities of firm-level wages and payouts to shareholders with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. The estimates are based on our balanced sample. (See Panel B of Table 2.) In the rows Q1(CINFLX) and Q3(CINFLX), we report elasticities given the first and third quartile value of competitor inflexibility $CINFLX$ (and median values of market concentration HHI and of a firm's own inflexibility $OINFLX$). In each specification, we include firm and year fixed effects. Control variables include firm size, leverage, profitability, tangibility, and a firm's own capacity growth. Standard errors (in parentheses) are clustered by country. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Dependent Variable	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT
Δ AGG SALES	0.176*	−0.484	0.175*	−0.482	0.158	−0.535
	(0.100)	(0.362)	(0.101)	(0.359)	(0.102)	(0.370)
× CINFLX	−0.239	1.684***	−0.289	1.845***	−0.176	1.916***
	(0.184)	(0.491)	(0.277)	(0.567)	(0.283)	(0.636)
× HHI	0.214	0.446	0.212	0.461	0.240	0.541
	(0.475)	(1.469)	(0.477)	(1.461)	(0.497)	(1.462)
× OINFLX			0.052	−0.169	0.007	−0.114
			(0.167)	(0.345)	(0.174)	(0.349)
CINFLX	0.174	−0.146	0.179	−0.169	0.209	−0.198
	(0.177)	(0.648)	(0.180)	(0.644)	(0.152)	(0.636)
HHI	0.023	1.445	0.024	1.436	0.023	1.192
	(0.167)	(0.901)	(0.167)	(0.889)	(0.192)	(0.949)
OINFLX			−0.010	0.095	0.022	0.131
			(0.061)	(0.122)	(0.049)	(0.172)
Control Variables	No	No	No	No	Yes	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C	C	C
N	1,343	1,343	1,343	1,343	1,279	1,279
R^2	0.031	0.045	0.031	0.045	0.039	0.060
Q1(CINFLX)	0.138**	−0.088	0.127**	−0.049	0.135**	−0.082
Q3(CINFLX)	0.022	0.731***	−0.014	0.849***	0.049	0.851***

Table 6:
Effects of competitor inflexibility and futures markets

This table reports elasticities of firm-level wages and payouts to shareholders with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. We extend the specifications in Table 5 using a dummy, *Futures Market*, that indicates country-years with electricity futures trading. The estimates are based on our balanced sample. (See Panel B of Table 2.) In the rows Q1(CINFLX) and Q3(CINFLX), we report elasticities given the first and third quartile value of competitor inflexibility $CINFLX$ (and median values of market concentration HHI and of a firm's own inflexibility $OINFLX$). In each specification, we include firm and year fixed effects. Control variables include firm size, leverage, profitability, tangibility, and a firm's own capacity growth. Standard errors (in parentheses) are clustered by country. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Dependent Variable	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT
Δ AGG SALES	0.146	−0.355	0.121	−0.436
	(0.105)	(0.464)	(0.141)	(0.491)
× CINFLX	−0.048	1.835**	0.044	2.412***
	(0.286)	(0.806)	(0.302)	(0.905)
× HHI	0.309	0.395	0.335	0.529
	(0.486)	(1.402)	(0.705)	(1.886)
× OINFLX	−0.029	−0.148	−0.075	−0.582
	(0.177)	(0.363)	(0.195)	(0.608)
× Futures Market	0.095	−0.195	0.125	−0.183
	(0.158)	(0.681)	(0.173)	(0.732)
× CINFLX × Futures Market	−0.610	−0.340	−0.743	−1.156
	(0.503)	(1.261)	(0.508)	(1.316)
× OINFLX × Futures Market			0.103	1.194
			(0.219)	(1.058)
× HHI × Futures Market			−0.068	−0.723
			(0.864)	(2.334)
Control Variables	Yes	Yes	Yes	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C
N	1,279	1,279	1,279	1,279
R^2	0.019	0.025	0.020	0.030
Q1(CINFLX)	0.023	−0.004	−0.009	−0.127
Q3(CINFLX)	−0.297	0.724	−0.349	0.484

Table 7:
Effects of competitor inflexibility on firm's workers and shareholders

This table reports elasticities of firm-level employment (EMP), wages per employee (WPE), and dividends (DIV) with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. The estimates are based on our balanced sample. (See Panel B of Table 2.) The first four columns report estimates resulting from firm-years with data about both the growth of employment and wages per employee. In the rows Q1(CINFLX) and Q3(CINFLX), we report elasticities given the first and third quartile value of competitor inflexibility $CINFLX$ (and median values of market concentration HHI and of a firm's own inflexibility $OINFLX$). In each specification, we include firm and year fixed effects. Control variables include firm size, leverage, profitability, tangibility, and a firm's own capacity growth. Standard errors (in parentheses) are clustered by country. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Dependent Variable	Δ EMP	Δ WPE	Δ EMP	Δ WPE	Δ DIV	Δ DIV
Δ AGG SALES	0.028	0.015	0.034	0.003	−0.066	−0.119
	(0.040)	(0.066)	(0.041)	(0.069)	(0.278)	(0.289)
× CINFLX	0.112	−0.177	0.097	−0.181	1.280**	1.251**
	(0.087)	(0.116)	(0.081)	(0.125)	(0.510)	(0.556)
× HHI	−0.153	0.100	−0.145	0.095	−0.588	−0.537
	(0.125)	(0.236)	(0.126)	(0.266)	(1.166)	(1.201)
× OINFLX	−0.030	0.113	−0.028	0.130	−0.163	−0.025
	(0.045)	(0.083)	(0.042)	(0.082)	(0.335)	(0.340)
CINFLX	0.088	−0.112	0.065	−0.049	0.822	0.625
	(0.112)	(0.124)	(0.105)	(0.125)	(0.511)	(0.473)
HHI	0.295***	0.223	0.228*	0.212	0.894	0.681
	(0.110)	(0.146)	(0.121)	(0.161)	(0.641)	(0.682)
OINFLX	0.026	−0.002	0.023	−0.003	0.053	0.030
	(0.024)	(0.024)	(0.024)	(0.023)	(0.120)	(0.156)
Control Variables	No	No	Yes	Yes	No	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C	C	C
N	3,381	3,381	3,144	3,144	1,312	1,248
R^2	0.018	0.014	0.024	0.017	0.051	0.059
Q1(CINFLX)	0.042	−0.017	0.046	−0.030	0.173	0.117
Q3(CINFLX)	0.097*	−0.103	0.093*	−0.118	0.797	0.726

Table 8:
Robustness check: financial leverage and government controlled firms

This table reports elasticities of firm-level wages and payouts to shareholders with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. We extend the specifications in Table 5 using financial leverage (LEV, long-term debt to total assets) and a dummy (GOV) indicating firms under government (majority) control. The estimates are based on our balanced sample. (See Panel B of Table 2.) In the rows Q1(CINFLX) and Q3(CINFLX), we report elasticities given the first and third quartile value of competitor inflexibility $CINFLX$ (and median values of market concentration HHI and of a firm's own inflexibility $OINFLX$). In each specification, we include firm and year fixed effects. Control variables include firm size, leverage, profitability, tangibility, and a firm's own capacity growth. Standard errors (in parentheses) are clustered by country. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Dependent Variable	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT
Δ AGG SALES	0.062	−0.165	0.156	−0.534	0.050	−0.221
	(0.167)	(0.539)	(0.101)	(0.372)	(0.169)	(0.562)
× CINFLX	−0.151	1.818***	−0.099	2.107***	−0.068	2.015***
	(0.283)	(0.630)	(0.292)	(0.592)	(0.291)	(0.598)
× HHI	0.262	0.456	0.018	−0.689	0.029	−0.723
	(0.492)	(1.462)	(0.548)	(1.794)	(0.546)	(1.787)
× OINFLX	0.009	−0.121	−0.077	−0.341	−0.079	−0.336
	(0.168)	(0.367)	(0.186)	(0.343)	(0.178)	(0.361)
× LEV	0.339	−1.315			0.371	−1.102
	(0.450)	(1.123)			(0.450)	(1.187)
× GOV			0.260	1.237*	0.275	1.194*
			(0.190)	(0.726)	(0.185)	(0.705)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C	C	C
N	1,279	1,279	1,251	1,251	1,251	1,251
R^2	0.040	0.061	0.042	0.063	0.043	0.064
Q1(CINFLX)	0.103	0.044	0.135**	−0.121	0.099	−0.013
Q3(CINFLX)	0.029	0.930***	0.087	0.904***	0.065	0.968***

Table 9:
Robustness check: alternative measures of competitor inflexibility

This table reports elasticities of firm-level wages and payouts to shareholders with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. The estimates are based on the specifications that also appear in Table 5, but with an alternative measure of competitor inflexibility $CINFLX$. In columns (1) - (4), we also use an alternative measure of aggregate sales growth Δ AGG SALES. The first two columns report estimates with firm and country-year fixed effects. The other columns report estimates with firm and year fixed effects. Standard errors (in parentheses) are clustered by country-year. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

	Change to alternative measure(s) of					
	AGG SALES & CINFLX				CINFLX	
Dependent Variable	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT
Δ AGG SALES	−0.066	−0.144	0.020	−0.090	0.048	−0.381
	(0.051)	(0.099)	(0.039)	(0.083)	(0.090)	(0.309)
× CINFLX	0.090	0.728**	−0.024	0.390**	0.113	1.220*
	(0.122)	(0.287)	(0.095)	(0.193)	(0.250)	(0.652)
× HHI	0.579	−1.852	0.135	0.217	−0.193	0.709
	(1.272)	(1.255)	(0.545)	(0.770)	(0.332)	(1.580)
× OINFLX	0.014	0.078	0.035	0.041	0.032	−0.237
	(0.071)	(0.149)	(0.065)	(0.124)	(0.133)	(0.455)
CINFLX	−0.071	−0.547	0.087	−0.487	−0.063	−0.341
	(0.237)	(0.372)	(0.153)	(0.327)	(0.085)	(0.231)
HHI			0.668	0.583	0.704***	0.658
			(0.538)	(1.159)	(0.257)	(0.953)
OINFLX	−0.137*	−0.107	−0.139*	−0.078	−0.018	0.173
	(0.075)	(0.245)	(0.071)	(0.192)	(0.038)	(0.124)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	F,C-Y	F,C-Y	F,Y	F,Y	F,Y	F,Y
Cluster	C-Y	C-Y	C-Y	C-Y	C-Y	C-Y
N	1,061	1,226	1,061	1,226	1,619	1,471
R^2	0.248	0.231	0.076	0.056	0.061	0.048
Q1(CINFLX)	−0.004	−0.124	0.025	0.011	0.059	−0.068
Q3(CINFLX)	0.040	0.230*	0.013	0.200**	0.114	0.526

Table 10:
Robustness check: effects of regulation

This table reports elasticities of firm-level wages and payouts to shareholders with respect to market-level aggregate sales variation. The sample period is 2002-2014. All variables are defined in Section 3, and in the caption of Table 2 which presents descriptive statistics. The estimates are based on the specifications that also appear in Table 5. In the first two columns, we use observations in country-years in which ownership unbundling regulations are in place. In the last two columns, we use observations in country-years in which electricity is traded in competitive wholesale markets. Standard errors (in parentheses) are clustered by country-year. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

	Unbundle		Wholesale	
Dependent Variable	Δ WAGES	Δ POUT	Δ WAGES	Δ POUT
Δ AGG SALES	0.173	−0.809**	0.106	−0.942*
	(0.129)	(0.399)	(0.162)	(0.492)
× CINFLX	−0.442	2.272***	−0.544	2.350***
	(0.372)	(0.871)	(0.480)	(0.736)
× HHI	0.551	2.075	1.717*	−0.784
	(0.389)	(1.928)	(0.888)	(2.300)
× OINFLX	−0.017	−0.307	−0.107	0.253
	(0.208)	(0.332)	(0.269)	(0.535)
CINFLX	0.298	0.132	0.123	−0.321
	(0.187)	(0.651)	(0.173)	(0.639)
HHI	0.271	1.305	−0.004	2.392
	(0.244)	(1.168)	(0.323)	(1.602)
OINFLX	0.035	0.128	0.058	0.273
	(0.050)	(0.189)	(0.036)	(0.191)
Control Variables	Yes	Yes	Yes	Yes
Fixed Effects	F,Y	F,Y	F,Y	F,Y
Cluster	C	C	C	C
N	1,042	1,042	780	780
R^2	0.044	0.051	0.046	0.032
Q1(CINFLX)	0.116*	−0.209	0.109	−0.513
Q3(CINFLX)	−0.117	0.991**	−0.182	0.748

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