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**Article**

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# EU Competition Policy Enforcement Supports Investment in the Energy Sectors

By Tomaso Duso, Jo Seldeslachts and Florian Szücs

Energy sectors—primarily power generation and gas production, but also energy transmission and distribution—require significant capital investment in infrastructure. Market structures as well as the degree of competition and regulation are key factors that determine firms' incentive to invest. Yet the empirical research on the link between these factors and private investment is still quite scarce, especially in the energy sectors. In this study, we empirically examine whether competition policy enforcement and regulatory intervention in European gas and electricity markets affects firms' incentive to invest. Our findings show that EU merger policy enforcement is significantly related to a higher investment in low-regulated markets.

In late 2008, the European Commission (EC) adopted the “Climate and Energy Package” with the aim of reaching a high degree of decarbonization of the EU economies. It states that by 2020, member states are required to cut their greenhouse gas emissions by as much as 20 percent and increase their share of renewables to 20 percent. To achieve these targets, substantial new investment in low-carbon technologies as well as in infrastructure is needed to ensure security of supply and to improve efficiency.<sup>1</sup> Which policy instruments and market structures are best suited to achieve these goals is a widely debated issue.

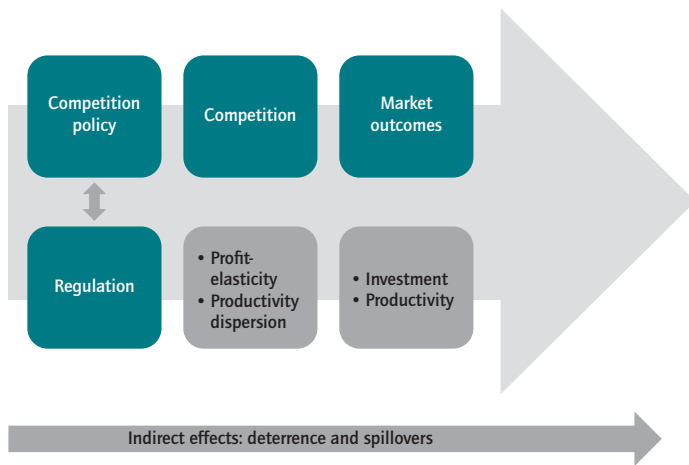
The three objectives of energy policy—security of supply, reduction of carbon emission, and energy affordability for consumers—often contradict one another, generating policy trade-offs and making it even more difficult to design effective policies. What is undisputed is that the economic and institutional frameworks that shape the function of energy markets also play a central role in the transition to a decarbonized economy. By affecting market structure and competitive processes, policy interventions determine the incentive for cost-effective private and public investment, as well as the distribution of the costs and benefits of such investment along the vertical chain from energy production to final consumers.

A crucial factor influencing the attractiveness of the market and hence the firms' incentive to invest is the intensity of competition. On this dimension, energy markets are complex and to some extent opaque. They exhibit certain features that can prevent, restrict, or distort competition, such as high entry costs, vertically integrated market structures, and complex pricing mechanisms. Some of these require government intervention: for

<sup>1</sup> See, for instance: Jürgen Blazejczak, Jochen Diekmann, Dietmar Edler, Claudia Kemfert, Karsten Neuhoff, and WolfPeter Schill, “Energy Transition Calls for High Investment,” in DIW Economic Bulletin 9 (2013) and Christian von Hirschhausen, Franziska Holz, Clemens Gerbaulet, and Casimir Lorenz, “European Energy Sector: Large Investments Required for Sustainability and Supply Security,” in DIW Economic Bulletin 7 (2014), p. 31–36.

Figure 1

**The link between policy interventions and market outcome**



Source: DIW representation.

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example, transmission and distribution networks are natural monopolies that need to be regulated. The resulting web of government policy interventions and regulations must be taken into account when examining the functioning of energy markets, particularly with regard to how policy interventions affect the incentive to invest.

This article is based on a study conducted for the Directorate-General (DG) for Competition of the EC.<sup>2</sup> The study seeks to provide exhaustive empirical evidence on the relationship between policy intervention—in the form of competition policy enforcement and regulation—and market outcomes such as the level of competition, firm investment, prices, and productivity measures. Our assessment aims to coherently measure this link across all EU member states and sectors of energy markets (production, transmission, and retail for both energy and gas) over the past decade.<sup>3</sup> The general framework for the empirical analysis is based firstly on the relationship between policy enforcement, competition, and market outcomes (Figure 1).

**2** See: DIW Berlin and ICF Consultancy Services, (2016) "The Economic Impact of Enforcement of Competition Policies on the Functioning of Energy Markets." <http://ec.europa.eu/competition/publications/reports/kd0216007enn.pdf>. The study is broader in nature than this article and encompasses additional econometric analysis of the link between competition policy enforcement and productivity, as well as two specific case studies.

**3** While in this article we present the analysis conducted at an aggregate level for the entire energy sector, in the report for the EC, we also separately analyze the effect of policy enforcement on several subsectors such as electricity production, transmission, distribution, and trade as well as gas distribution and trade.

Competition policy enforcement and regulation directly impact the strategic behavior of firms in oligopolistic markets, and therefore affect the degree of competition. As a result of changes in competitive pressure, firms adapt their investment behavior. As discussed above, measures of investment are pivotal variables to consider in understanding how competition and regulatory policies affect energy markets. Indeed, changes in market competition and firms' investment behaviors are shown to substantially impact long-term outcomes such as firms' productivity, which is seen as one of the main drivers of economic growth.

Each specific policy intervention not only affects the firms and markets directly involved in the specific case, but also has important indirect effects through spillovers across (vertically related) markets, as well as deterrent effects.<sup>4</sup> For example, specific policy decisions affecting investment in electricity generation capacity also affect incentives and market outcomes in transmission and distribution. Similarly, the enforcement of competition rules sends signals about the strength of the competition authorities. Consequently, individual decisions affect not only the firms specifically involved in that case, but also other firms' behavior in the same and related markets. These indirect effects are recognized to be important elements of competition policy enforcement and cannot be measured when only evaluating single decisions.<sup>5</sup>

Several studies have already looked at the effects of deregulation on investment in transport, communication, electricity, and gas sectors. They find that competition enhancing regulatory reform—such as liberalization of market entry or the introduction of more incentive-based form of regulations—has had a significant positive impact on investment in these sectors.<sup>6</sup> However, it has not yet been investigated how competition policy impacts investment or how competition policy and regulation interact in determining competition and market outcomes, especially in the energy sectors. The econometric analysis presented in this study provides empirical evidence for these links.

**4** See, for instance: Jo Seldeslachts, Pedro-Pita Barros, and Joseph Clougherty (2009), "Settle for now but block for tomorrow: the deterrence effects of merger policy tools," in *Journal of Law and Economics*, 52, 3, 607-634; Buccirosi, P., Ciari, L., Duso, T., Spagnolo, G., & Vitale, C., 2013, "Competition policy and productivity growth: an empirical assessment," in *Review of Economics and Statistics*, 95, 4, 1324-1336; and Duso, Tomaso: "Eine bessere Wettbewerbspolitik steigert das Produktivitätswachstum merklich," in *DIW Wochenbericht* 29 (2014), p. 687-697.

**5** Joskow, Paul L., 2012, "Transaction cost economics, antitrust rules, and remedies," *Journal of Law, Economics, and Organization* 18, 1, 95-116.

**6** See, for instance" Alesina, A., Ardagna, S., Nicoletti, G., & Schiantarelli, F., 2005, "Regulation and Investment," *Journal of the European Economic Association*, 3, 4, 791-825 and Cullmann, A., Dehnen, N., Nieswand, M., and Pavel, F., 2015, "No Barriers to Investment in Electricity and Gas Distribution Grids Through Incentive Regulation," in *DIW Economic Bulletin* 5/6 (2015), p. 82-87.

## Data and sample

The econometric analysis uses data on competition policy enforcement—our main explanatory variables—and measures of regulation, competition, and market outcomes. Competition policy in Europe is enforced by multiple bodies. Large cases with a Community dimension fall under the jurisdiction of Directorate-General (DG) for Competition of the EC, while smaller cases affecting single EU member states are generally scrutinized by the national antitrust authorities. For this study, we specifically collected measures of competition policy enforcement in energy markets from both levels.

We created a detailed dataset of EU competition policy enforcement in energy markets covering 2005 through 2014 in order to quantify the EC’s activities in the three main enforcement areas: i) merger control; ii) cartels and abuses (antitrust); and iii) state aid control. During this period, DG Competition reviewed 197 merger notifications (130 in the electricity sector and 67 in the gas sector) and analyzed 18 antitrust cases consisting of 15 abuses and 3 cartels (7 in the electricity sector and 10 in the gas sector). Moreover, it also made 115 state aid decisions (95 in the electricity sector and 20 in the gas sector) concerning energy markets (Figure 2).<sup>7</sup> There is an evident trend of increasing consolidation in the energy sector, as the large number of mergers show. Furthermore, state aid schemes have been much more frequently implemented over the last decade.

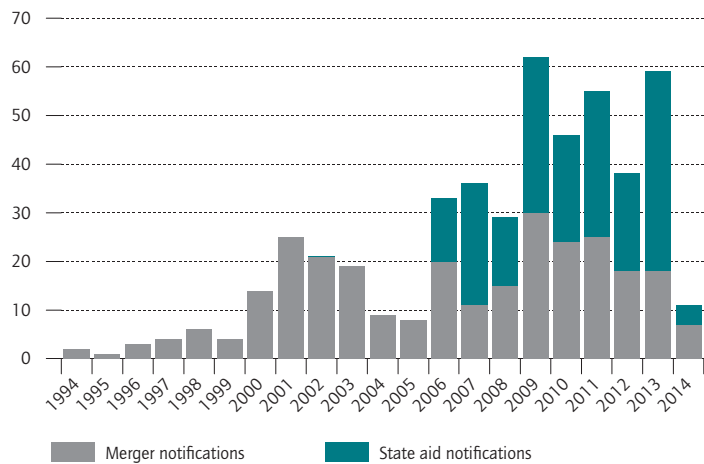
The number of notified cases cannot be seen as a measure of policy enforcement but rather as a measure of activity in these areas. To construct measures of enforcement, we looked at the true activities of the EC in each of the competition policy areas. In line with the EC’s interpretation, we consider remedies and merger withdrawals to be an ‘intervention’ of the EC in merger cases.<sup>8</sup> While prohibitions should also be considered the most extreme form of intervention, no merger was blocked in the energy sector during the sample period. In the case

<sup>7</sup> Note that the EC must be notified of all mergers in which the merging parties reach (i) a combined worldwide turnover amounting to more than 5,000 million euros and (ii) an EU-wide turnover for each of at least two of the firms amounting to more than 250 million euros. The alternative threshold is (i) a worldwide turnover of all the merging firms amounting to more than 2,500 million euros; (ii) a combined turnover of all merging firms amounting to more than 100 million euros in each of at least three member states; (iii) a turnover amounting to more than 25 million euros for each of at least two of the firms in each of the three member states included under ii; and (iv) EU-wide turnover of each of at least two firms amounting to more than 100 million euros. Thus the number of notified mergers is more indicative of the distribution of merger activities than of a measure of antitrust enforcement.

<sup>8</sup> Remedies are modifications to a proposed deal that the merging parties agree upon in order to resolve the competitive concerns raised by the EC. If an agreement cannot be reached, firms can also withdraw a notification and abandon the merger. Many commentators see withdrawn mergers as a kind of prohibition.

Figure 2

### Distribution of EU merger and state aid cases in electricity and gas markets



Source: DIW elaboration on DG COMP data. Based on data extracted on 26/09/2014. NACE codes D35.1 and D35.2. By case end date.

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Merger, anti-trust actions, and state aid schemes in energy sector have been increasing over time.

of state aid, we define an intervention as the decision to initiate a formal investigation. For abuses and cartels, we simply use the number of cases as a measure of intervention, since all led to remedies or fines (Figure 3).

Competition policy interventions substantially increased during the 2000s compared to the 1990s. Merger interventions were particularly concentrated in the early 2000s. Despite increasing merger notifications, there were no remedies in 2012 or the period between 2007 and 2010, and few interventions in 2011. Instead, the EC was much more active in the area of state aid and anti-trust (including cartels).

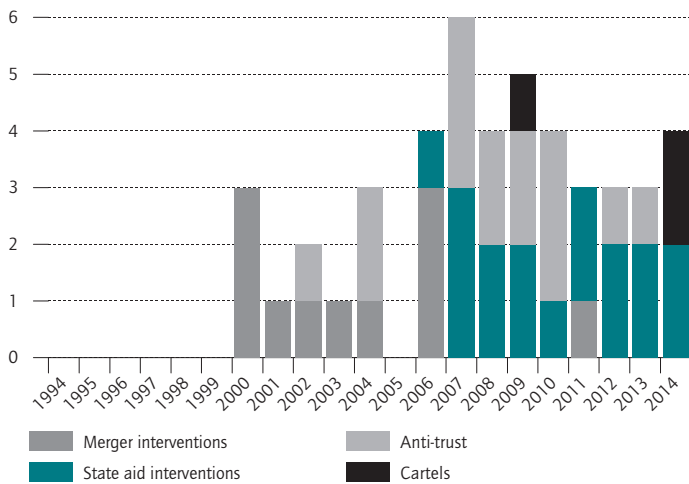
For merger policy and state aid control, enforcement intensity is defined as the ratio between the number of ‘interventions’ and the number of notified cases, as this measures the relative number of cases where competition authorities have taken action.

We transformed these variables to match the national level of analysis adopted in this study—the member state/year unit of observation—since energy markets still function primarily at national level.<sup>9</sup> The EC intervened, on

<sup>9</sup> In all state aid cases as well as in most of the antitrust cases, only one particular geographic national market is affected by the specific decision. In most merger cases, however, the relevant geographic market definition is broader than national, mostly EU-wide. Therefore, we allocated such cases to all member states involved in that decision.

Figure 3

**Distribution of EU competition policy interventions in electricity and gas markets<sup>1</sup>**



<sup>1</sup> Sector inquiry excluded from anti-trust cases reported in 2007. By case end date.

Source: DIW elaboration on DG COMP data. Based on data extracted on 26/09/2014. NACE codes D35.1 and D35.2.

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Competition policy interventions in energy sector have been increasing over time.

average, in less than 10 percent of the cases (0.5 interventions in each member state for each year), but there appears to be a negative time trend, as mentioned above. State aid programs are only rarely investigated. Similarly, only few cartels and abuse cases were opened during the sample period. The limited variability in the data is an important limitation of the econometric analysis, as it makes the empirical identification of a relationship between competition policy enforcement and the outcome variables more difficult.

**National competition policy enforcement data**

Constructing measures of national competition policy enforcement is much more challenging. Since no clear source of data is available, we created a template/questionnaire, which was then sent to all national competition authorities in the EU. We constructed measures of national competition policy enforcement based on these responses, whereby there are no state aid cases at the national level.

There is substantial variation in merger notifications at the country level: while some large EU states (particularly Germany and Italy) average more than 30 energy mergers per year, some smaller states have very little activity or none at all. This is also true for cartels and dom-

Box 1

**Competition policy enforcement—some examples**

Mergers control

EU merger control has played an important role in limiting horizontal and vertical integration in already highly concentrated energy markets. Some landmark cases are quite helpful to highlight this role. For instance, the July 2008 GDF/Suez merger sought to create one of the world's largest energy companies. As originally envisioned, it would have significantly weakened competition in the Belgian gas and electricity markets—both wholesale and retail—as well as the French gas market. In the study for the European Commission, we analyze this merger in detail, showing that the remedies offered by GDF and Suez effectively limited the potential anti-competitive effects of the merger in Belgian wholesale gas markets—the focus of the case study—and that ownership unbundling improved access to the Belgian gas hub Zeebrugge.

Several other landmark merger control cases focus on different potential anticompetitive effects. For instance in the case of the Electricité de France S.A. (EdF)/British Energy merger decision in 2008, the package of remedies secured by the Commission aimed to prevent unilateral horizontal effects. Similarly in 2004, the Commission decided to prohibit the proposed acquisition of joint control over Gás de Portugal (GDP), the incumbent gas company in Portugal, by Energias de Portugal (EDP), the incumbent electricity company in Portugal, and ENI, an Italian energy company. Since most competition in energy markets comes from electricity incumbents entering the gas market and vice versa, this case demonstrates the Commission's strict approach to mergers involving gas and electricity companies ('convergence' mergers). Finally, the remedies put in place by the Commission to mitigate the potential anti-competitive effects of a merger have also contributed to promoting market liberalization.

inance cases, where Germany and Poland show the most activity. Thus even though national competition policy enforcement is low on average (the member state/year observations are zero up to the 75th percentile), there is still variation across countries and time.

**Indicators of regulatory intensity**

Regulation is the additional policy dimension considered in our framework. Not only is regulation supposed to have a direct impact on firms' incentive to invest, it might also interact with the enforcement of competition policy to determine market outcomes. To measure

### Antitrust enforcement

The Commission has taken antitrust enforcement action to tackle several antitrust infringements by dominant incumbents such as exclusionary conduct and exploitative abuses as well as cartels and collusive behavior. For example, in 2007, the EC opened an investigation into ENI's suspected abuse of a dominant position in the market for the transport of gas. There were concerns that ENI may have foreclosed competition in the Italian gas supply market by not granting competitors' access to capacity available on the transport network (capacity hoarding) or doing so in an impractical way (capacity degradation) and by strategically limiting investment in ENI's international transmission pipeline system (strategic underinvestment). In response, ENI committed to divest its shares in the three companies operating the relevant international transport pipelines, thus ensuring that third-party requests to access the gas pipeline would be dealt with by an entity independent of ENI, thereby removing the potential conflict of interest resulting from the vertical integration of ENI.

In the electricity sector, the Commission investigated E.ON's alleged abuse of dominant position on the German wholesale market (2008). There were concerns that E.ON may have withdrawn available generation capacity from the German wholesale electricity markets to raise prices, and may have deterred new investors from entering the generation market. The case was settled before the Commission issued a formal decision and resulted in a substantial commitment by E.ON to divest 5000 MW of generation plants along with its extra-high voltage distribution network, thus structurally changing the German electricity market to the benefit of consumers. In a second case study presented in the report for the EC, we show

how these divestitures significantly impacted the functioning of German wholesale markets by substantially reducing electricity prices.

### State aid control

State aid control is a unique competition policy tool exclusively adopted by the EC. Not used by any other antitrust authority, it seeks to prevent public funds from being used by member states to favor specific companies, thereby hindering competition and the expansion of the European common market, when resolving a specific market failure. Typically, state aids cover areas such as power purchase agreements (PPA) and support schemes for renewable energy, but they also focus on capacity mechanisms seeking to prevent potential black-outs. For instance in 2008, the European Commission blocked PPAs utilized in Poland and in Hungary that came in the form of long-term contracts between electricity generators and wholesale suppliers/distributors at regulated prices. The rationale of such agreements was to ensure the security of supply so as to attract foreign investors. Yet, they were found to act as a barrier to market entry or expansion by reducing liquidity in wholesale markets.

Several direct grant schemes supporting the production of energy through renewable sources have been implemented. Typically, these interventions did not raise objections from the Commission as the objective of decarbonization has been seen of paramount importance and the potential reduction of competition has not been seen as substantial. As an example, the direct subsidy granted for electricity from renewable energy sources in 2013 in Åland (Finland) under an environmental protection rationale was approved by the Commission.

regulation intensity, we use the Product Market Regulation (PMR) indicators developed by the OECD. This is the most comprehensive and accurate source of data available and has been widely used to measure the effect of regulation on market outcomes for cross-country comparisons.<sup>10</sup>

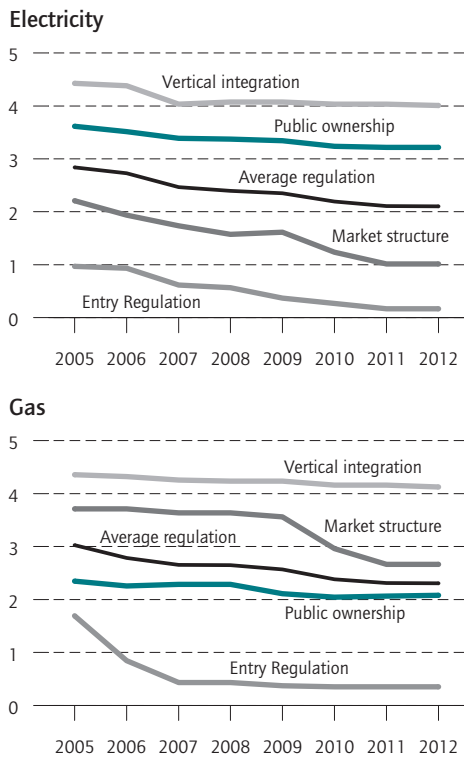
<sup>10</sup> For instance, see Alesina et al. (2015), Duso, Tomaso and Jo Seldeslachts, (2010): "The Political Economy of Mobile Telecommunications Liberalization: Evidence from the OECD Countries," *Journal of Comparative Economics*, 2010, 38, 2, 199-216; and Bourlès, R., Cettè, G., Lopez, J., Mairesse, J., & Nicoletti, G. (2013). "Do product market regulations in upstream sectors curb productivity growth? Panel data evidence for OECD countries." *Review of Economics and Statistics*, 95(5), 1750-1768.

While the indexes cover different dimensions of regulation (entry regulation, market structure, public ownership, and vertical integration), we use an aggregated version of the eight indexes that represent the median intensity of regulation in national energy (gas and electricity) markets in our econometric analysis to simplify the interpretation of the results (Figure 4). A general trend to more deregulation and liberalization can be observed as all indexes decrease from the high values in 2004 to much lower values in 2012 (maximum regulation is 6, minimum regulation is 0).



Figure 4

**Average rates of regulation across EU member states in energy markets**



Source: DIW representation of OECD data.

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Regulation intensity in energy sector has been decreasing over time.

**Outcome variables**

In this article we focus solely on firms' investment, while in our report for the EC, we also cover other outcomes, including the intensity of competition, total factor productivity, and productivity dispersion. The choice of the specific outcome variables implicitly also defines the analysis' level of aggregation. Investment can be defined at the most disaggregated firm-country-sector-year level.

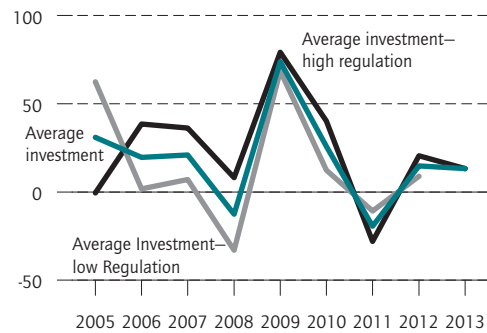
Firm-level data was obtained from the Bureau van Dijk's Amadeus/Osiris database. The database covers the 1997–2014 period, but since data availability is thin for the earliest and latest periods, we limit our analysis to the 2005–2012 period. We focus on firms active in energy markets, as represented by the NACE group D.35.<sup>11</sup> We analyze those firms classified by Amadeus as 'very

<sup>11</sup> The firms in the sample fall in the subgroups D35.1 (Electric power generation, transmission and distribution) and D35.2 (Manufacture of gas; distribution of gaseous fuels through mains).

Figure 5

**Time evolution of investment**

In million euros



Source: DIW calculations based on the Amadeus/Osiris database.

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Investment activities of large energy firms have been sluggish, especially in high-regulated markets.

large' to focus on the sizeable players in the market. It is only these firms that are expected to engage in significant investment activity and to react strongly to changes in the regulatory and competitive environment. The sampled firms have a median of 117 employees and median fixed assets of around 130 million euros. Over the entire sample period, we observed 1,438 different firms operating in 19 countries.

We follow Grajek and Röller (2012), who use monetary measures of investment defined as the change in fixed assets owned by the firms between two subsequent years.<sup>12</sup> While not perfect, this variable is a good first indicator of investment. The main advantage of using a monetary measure of investment is that fixed assets are observable for all firms present in the different sectors of energy markets and can be easily compared. On the downside, we cannot precisely identify the type of investment carried out by the firms.

The resulting variable has a mean of 18 million euros, with the 25th and 75th percentile at -7 and 11 million Euros, respectively. This represents the evolution of the average investment for the entire energy sector as well as for the sample of high-regulated countries and low-regulated countries (Figure 5).<sup>13</sup>

<sup>12</sup> Michal Grajek and Lars-Hendrik Röller, 2012, "Regulation and investment in network industries: Evidence from European telecoms," *Journal of Law and Economics*, 55, 1: 189–216.

<sup>13</sup> These sub-samples are defined using the median of all OECD regulation indices for each Member State and year. We assign countries to the high-regula-

Box 2

**The empirical model**

The specific functional form that constitutes our basic specification is the following:

$$Y_{ict} = \beta Reg_{ct-1} + \gamma_j EUEnf_{tool\ ct-1} + \delta_j NatEnf_{tool\ ct-1} + \sigma SI_t + Z_{ct-1} + \omega_i + \omega_t + \varepsilon_{ict},$$

where  $Y_{ict}$  is the investment of firm  $i$ , in country  $c$ , at time  $t$ . The variable  $Reg_{ct-1}$  denotes the intensity of regulation in a given national market  $c$  in year  $t-1$ , measured by using the means of the OECD regulation index for the energy sector. The variables ( $EUEnf_{tool\ ct-1}$  and  $NatEnf_{tool\ ct-1}$ ) are the lags of the above explained measures of competition policy enforcement at the EU and national level, respectively, covering different policy areas (mergers, abuse of dominance and cartel cases and, for the EU, state aid cases). To cleanly identify the effect of enforcement, we control for the number of merger cases notified to the Commission as well as the number of notified state aid cases as they are clearly important drivers of the level of competition. Specifically, the former measure the extent of country-specific merger waves while the latter measures the potential country-specific distortions in competitive outcomes.

We set a dummy  $SI$  equal to one in 2007, when the EU conducted a Sector Inquiry in gas and electricity markets to assess

the state of competition. This should capture the effect of this EU-wide event on competition outcomes. Of course, with this simple approach we cannot separately identify the effect of the inquiry from any other major event that might have affected energy market in the same year.

We further control for time-varying country-specific ( $Z_{ct-1}$ ) factors, such as GDP per capita and population growth, as well as the share of imports in total energy consumption. Additionally, the same vector includes controls for country-specific existing production capacities in combustible fuels, nuclear and renewable energy. Finally, we control for unobserved time-invariant firm specific heterogeneity by means of firm fixed-effects ( $\omega_{ic}$ ) as well as unobserved firm-invariant time-specific aggregate heterogeneity by means of year fixed-effects ( $\omega_t$ ). The error term  $\varepsilon_{ict}$  is assumed to be correlated among observations within the same country-sector.<sup>1</sup> All explanatory variables are lagged by one period to reduce endogeneity issues due to simultaneity bias.

<sup>1</sup> We cluster the standard errors at the country level, but we run robustness checks where we use different assumptions on the correlation structure (i.e., we use time cluster or country-time specific clusters).

We use several additional sources to construct possible control variables to be used in the econometric analysis to account for observable heterogeneity across firms, subsectors, countries, and periods that might be important drivers of investment. Firm-level controls such as size and cost efficiency come from the Amadeus database. To account for institutional differences across EU member states (e.g., GDP per capita, population growth, energy imports as a share of total energy consumption), we use data sourced from the World Bank. Information on the energy mix (i.e. the share of each fuel in energy production) used in different countries is obtained from fact sheets issued by DG energy.

tion sub-sample if the value of the regulation index in that country and year is higher than the median of the OECD regulation index over all countries and time periods in our sample. Conversely, a country is low-regulated if the index takes a value lower than the median. In this way, we use not only the cross-sectional but also the time variation in the measures of regulation as countries can move from one to the other sub-sample over time by implementing major deregulatory reforms.

**The model specification and results**

Our econometric framework is built on recent empirical literature analyzing the link between policy enforcement and market outcomes: specifically, the impact of regulation on investment.<sup>14</sup> We suggest that policy enforcement directly affects firms' investment outcomes in a given market through their impact on competition in this market. However, specific enforcement decisions in one market might also have indirect effects in related markets through spillovers and deterrence. Thus as each firm might directly or indirectly be affected by policy enforcement in the entire energy sector, we measure the link between policy enforcement and firms' outcomes by regressing firm level investments on country-specific measures of competition policy enforcement and regulation.

<sup>14</sup> See for instance Alesina et al. (2005) and Grajek and Röller, (2012).



Table

**Investment in full sample and low/high regulation subsamples**

	Full sample		Low regulation		High regulation	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
EU merger decisions (lagged)	-0.007	-0.31	0.226***	2.90	-0.006	-0.20
EU State aid enforcement (lagged)	-0.001	-0.07	-	-	-0.008	-0.38
EU abuse & cartel enforcement (lagged)	0.020	0.51	-0.265***	-2.60	0.059**	2.29
National merger decisions (lagged)	0.008	0.36	0.002	0.05	0.005	0.26
National cartel fines (lagged)	-0.003	-0.11	-0.038	-0.34	-0.018	-1.01
Sector Inquiry	0.058	1.07	-0.059	-0.65	0.062	1.23
Regulation (OECD indicator) (lagged)	0.178	1.67	2.815***	3.30	0.153	1.59
Controls		Yes		Yes		Yes
Firm fixed-effects		Yes		Yes		Yes
Year dummies		Yes		Yes		Yes
R <sup>2</sup>		0.17		0.18		0.21
Observations		8.344		4.098		4.246

The unit of observation is firm-country-year. The dependent variable is firm-level investment. All policy variables are lagged one year to reduce endogeneity issues. We further control for EU merger notifications, State aid cases, National merger cases, National cartel & abuse cases, Electricity capacity (combustible, nuclear, renewable), GDP per capita, Population growth, Energy imports as % of tot. We further control for firm fixed-effects as well as year dummies. We report standardized beta coefficients. Standard errors are robust and clustered at the country level. The symbols \*\*\*, \*\*, \* represent 1%, 5%, and 10% significance level respectively.

Source: Own calculations.

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Clearly, there are many different factors that also might explain investment decisions by firms and that need to be controlled for in order to causally interpret the link between policy enforcement and firms' outcomes. To deal with this potential omitted variable bias, we use firm-specific as well as time fixed effects and control for several other time-varying variables that we deem important, such as the numbers of merger notifications and state aid cases, electricity capacity (combustible, nuclear, renewable), GDP per capita, population growth, and energy imports as percentage of total energy. Moreover, we deal with issues of reverse causality—i.e., the fact that policy enforcement might be driven by investment decisions rather than affecting them—by lagging the policy variables.<sup>15</sup>

<sup>15</sup> In the report for the EC, DIW Berlin, and ICF International (2016), we present some additional robustness checks. Specifically, we look at heterogeneity across sectors (electricity generation, transmission, distribution, and trade as well as gas transmission and trade), estimating autoregressive investment equations where we assume that current investment is related to past investment in order to account for cyclical investment behavior, and we use an alternative measure of investment based on capacities.

Nevertheless, our identification strategy is not based on a clear source of exogenous variation since it is virtually impossible to find it in such a broad and heterogeneous framework. Therefore, we cautiously interpret our results as illustrating a correlation between EU merger policy enforcement and market outcomes rather than truly causal links.

We estimate a significant positive impact of the enforcement of EU merger control on firms' investment in the sub-sample of low-regulated countries. In particular, one standard deviation increase in the ratio between merger intervention and merger notifications is related to an increase in firm-level investment by 0.226 standard deviations (Table).

Among the other competition policy enforcement variables, only EU cartel and abuse cases significantly increase investment in highly regulated markets while significantly decreasing it in low-regulated markets. We also find a significant positive effect of regulation in the sample of low-regulated markets. The results suggest that an increase of one standard deviation in the regulation indexes is related to an increase in investment by 2.815 standard deviations.

**Conclusions**

In this article, we show that EU merger policy enforcement is significantly related to higher investment in low-regulated sectors. This is consistent with the reasoning that EU merger policy actions—by enhancing competition—encourage energy firms to invest more, ultimately generating higher productivity. Though the effect of other policy enforcement is more limited, this does not conclusively prove lack of effectiveness. It is possible that the low frequency of occurrence of such policy actions prevented us from empirically identifying consistent relationships.

Our results are strongest in low-regulated sectors, where we find an interaction among different policy instruments that affect competition. This is in line with the findings from previous studies that show competition policy is mostly effective where the competitive process is not influenced by very active regulation.<sup>16</sup> The potential mechanism explaining this effect is that if firms are highly regulated, changing the way competition works through competition policy will have little impact.

It has been extensively argued that once an industry has reached a particular threshold of deregulation, competition should be introduced and safeguarded through

<sup>16</sup> See Buccirossi et al. (2013).

competition policy.<sup>17</sup> According to this logic, regulation and competition are substitutes. Competition policy's

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**17** Bergman Lars, Chris Doyle, Jordi Gual, Lars Hultkrantz, Damien Neven, Lars-Hendrik Röller, Leonard Waverman (1998), "Europe's Network Industries: conflicting Priorities," Centre for Economic Policy Research (CEPR) and SNS, London.

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role and impact should therefore be higher in low-regulated industries. As regulation is reduced over time, competition should be gradually introduced and competition policy should be strengthened to safeguard competition.

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