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Energy price variation and competitiveness: Firm level evidence from Indonesia

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ABSTRACT

This paper uses firm survey data from the manufacturing and mining sectors in Indonesia, and investigates the extent to which energy prices affect competitiveness (proxied by profitability). Persistent regional price differences due to Indonesia's insular geography enable this study to show that energy prices have a small (but statistically significant) adverse long-run effect on competitiveness – though different energy types matter in different sectors. By estimating cross and own price elasticities and Uzawa-Allen partial elasticities of (inter-fuel) substitution, this study also shows that firms have the ability to respond to higher energy prices by adjusting their energy mix, i.e. substituting certain energy goods for others. Moreover, this study shows that firms also respond to higher energy prices by increasing energy efficiency, and by passing on costs to end-users. Nevertheless, these response measures are not sufficient to fully mitigate the adverse effect of energy prices on firms. Based on these results, policy recommendations are offered which are of immediate relevance for the design of energy pricing reforms.

1. Introduction and background

The IMF (2016) highlights that a central concern preventing governments from implementing green fiscal reforms is that the competitiveness of domestic firms may be adversely affected. Indeed, the concern that higher energy prices may harm firms features prominently in most debates on energy pricing reforms, in particular fossil fuel subsidy (FFS) removals or energy and carbon taxes. Case studies of FFS reforms for instance show that such energy price shocks have been a key reason why policy makers have struggled to win public support for reforms (Commander, 2012; Strand, 2013). However, while the adverse effects of FFS removal are increasingly well understood for households, the existing literature has largely ignored the effects of subsidy reform – and thus of higher energy prices – on firms (Rentschler and Kornejew, 2016).

This micro-econometric study investigates whether higher energy prices do indeed reduce the long-term competitiveness of firms. It uses a large firm survey dataset for Indonesian small enterprises in manufacturing and mining sectors. By exploiting regional price differences, it investigates whether and to what extent energy prices affect the performance of firms; and how firms adapt to energy price differences using inter-fuel substitution, energy efficiency, and price pass-on.

For the purpose of this analysis, the Indonesia constitutes an ideal case study. While 90% of the population are located on five main islands, the country covers over 1.8 million square kilometres of archipelagic land mass with almost 1000 permanently inhabited islands, distributed over 34 provinces. These geographic characteristics impose considerable obstacles to energy distribution and have resulted in heterogeneous supply patterns, which prevent an even transmission of prices (IEA, 2014, 2015).

In particular, regions with significant infrastructure gaps are prone to face energy shortages and high distribution costs, which raise local energy prices above the national average. Firms in such locations face higher average energy prices than their competitors elsewhere, while producing under identical regulatory conditions and supplying similar markets. As these inter-regional price differences are structural and persistent, the data allows us to estimate potential long-run effects of higher energy prices on the performance of firms. As such, our setting can yield insights as to how energy price shocks – e.g. due to FFS reform – affect firms in the long run, i.e. after having exhausted possible response measures.

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We find most energy prices to have a small (but statistically significant) adverse effect on the long-run performance of firms. More specifically, we observe that higher energy prices are associated with reduced profit margins, though the magnitude of the effect varies for different fuel types and industries. We find that firms respond to higher energy prices by increasing energy efficiency (i.e. reducing the energy intensity of output), and by passing energy costs on to consumers in the form of increased sales prices. Furthermore, we show that most energy types can be substituted by one another, thus allowing firms to respond to varying energy prices by adjusting their energy mix.

The remainder of this paper is structured as follows: Section 2 provides an overview of the relevant literature and existing empirical evidence. Section 3 offers a theoretical and conceptual discussion of competitiveness, and outlines firms' response measures for adapting to higher energy prices. Section 4 presents the dataset and descriptive insights. Section 5 presents the analytical methodologies and results. Section 6 offers a discussion of the robustness of results, and Section 7 concludes with observations and policy recommendations.

2. Literature

The question of whether environmental policies have an adverse effect on economic activity and competitiveness has been the subject of numerous studies. As part of this literature, research has focused on energy price regulation, in particular in the form of energy or carbon taxation, and investigated how such policy measures may affect the profitability and overall performance of firms. This section provides a brief overview of the relevant literature, its insights, and its shortcomings.

Studies on the competitiveness effects of energy and carbon taxes are of particular relevance, as these policy measures typically translate into energy price shocks. Arlinghaus (2015) reviews the empirical literature on the effects of carbon taxes on various indicators of competitiveness. Based on ex-post evaluations of a wide range of carbon and energy tax case studies, the review concludes that studies consistently fail to identify any significant adverse effects on common competitiveness indicators, such as employment, output, exports, and profits. Moreover, carbon taxes are found to significantly decrease the energy intensity of firms, while pass-on rates vary across different manufacturing sectors from 0% to over 100% of the tax.

Flues and Lutz (2015) study the effects of German electricity taxes on competitiveness. Using firm-level data for 1999 to 2005 and a regression discontinuity design, they show that electricity taxes (EUR 14.6/MWh or EUR 44.4/t CO_2) did not negatively affect common competitiveness indicators of firms, such as turnover, exports, value added, investment, and employment. Similarly, reviewing evidence for OECD countries, Zhang and Baranzini (2004) also conclude that overall, the competitiveness losses due to carbon taxes are small and in many cases not significant. However, for Egypt, Khattab (2007) estimates that a doubling of energy prices due to subsidy removal would reduce profit margins of firms in energy intensive sectors, e.g. in the cement (39% to 29% reduction), fertiliser (22%), and steel sectors (13%).

Moreover, the literature on environmental policies and regulation more generally can offer further useful insights. For instance, Dechezleprêtre and Sato (2014) review the evidence on the effect of environmental regulation on competitiveness, for a wide range of regulation types, industries and countries. They conclude that environmental regulation, including carbon taxes, has no adverse effect on indicators of international competitiveness, especially trade. At the firm-level, small adverse effects on employment and productivity may occur, especially in the short term and in energy-intensive industries.

In fact, a prominent strand of literature has investigated whether stringent environmental regulation may even have a positive effect on firm performance (Albrizio et al., 2014; Ekins and Speck, 2010; Enevoldsen et al., 2009). Porter (1990) argued that well designed environmental regulation can in fact enhance competitiveness, as firms are incentivised to increase investments in efficiency and innovation. In a comprehensive review Ambec et al. (2013) reviewed the empirical evidence for this so called Porter Hypothesis, and found that its validity appears to be conflicting. In certain countries and sectors, environmental regulation and policies were found to indeed have positive effects on competitiveness – measured as productivity or profitability. However, the opposite could be found in other cases. This emphasises the importance of relying on case specific analyses for ex-ante assessments of specific policy measures.

Gonseth et al. (2015) show that "adaptive capacity" can play a key role in determining whether energy taxes (and environmental policies more generally) increase or reduce the competitiveness of firms. For a sample of six European countries and eleven industrial sectors they show that human capital is an important determinant of the ability to mitigate negative impacts of energy taxes. Besides human capital, the capacity for technological innovation and substitution has also been argued to play a key role in determining how a green tax reform (e.g. energy tax) affects competitiveness (Koskela et al., 2001). Using a CGE model for Vietnam, Willenbockel and Hoa (2011) suggest that common energy efficiency measures can play a key role in enabling firms to cope with moderate energy price increases (5–10% per year). In a qualitative study of Indonesian micro, small, and medium enterprises, Tambunan (2015) finds that firms are most strongly affected by the indirect effects of energy price increases, as the costs of transportation, raw materials, and capital increase. The study also emphasises that the net effect of high energy prices crucially depends on firms' ability to adapt (e.g. increasing the output price, or energy efficiency).

Overall, the evidence presented above suggests that effects of energy taxes (and thus of higher energy prices) on indicators of competitiveness tend to be small on average, and even insignificant in many cases. This confirms the view that other factors such as infrastructure, finance, security, competition, and regulation play a far more significant role than energy prices in determining firms' performance (Dethier et al., 2011). However, it is also evident that studies focus predominantly on developed economies, and use macro-econometric approaches (based on country or sector level data), rather than analysing firm level data that can yield detailed and more nuanced insights.

Dethier et al. (2011) offer a critical review of empirical studies on the determinants of enterprise performance in developing countries. The authors argue that macro-econometric data conflates important dimensions of heterogeneity, including differences across regions and firm types (e.g. firm size) (Dethier et al., 2011). Hence, by analysing national averages or the behaviour of representative firms, macro-econometric approaches often fail to capture the heterogeneous effects of external shocks, e.g. due to changes in price or the business climate (Banerjee and Duflo, 2005; Pande and Udry, 2005). Moreover, by assuming profit-maximising behaviour, some basic features of standard growth models may contradict the evidence observed in firm surveys; e.g. about marginal costs and prices of production factors (Dethier et al., 2011).

Micro-level approaches using household surveys have offered crucial insights into how energy shocks due to fossil fuel subsidy reforms can affect the livelihoods of households (del Granado et al., 2012; Rentschler and Bazilian, 2016; Ruggeri Laderchi et al., 2013; Verme and El-Massnaoui, 2015). However, while the adverse effects of FFS removal are increasingly well understood for households, the existing literature has largely ignored the effect of subsidy reforms on firms (Rentschler and Kornejew, 2016). While some studies have considered economic activity and industrial sectors, their general equilibrium modelling approach lacks the granularity to offer concrete and nuanced policy recommendations for mitigating adverse effects on firms (Durand-Lasserve et al., 2015; Plante, 2014; Siddig et al., 2014; Solaymani and Kari, 2014). Hence, there is a clear need for empirical studies using micro-level firm data, which investigate exposure and vulnerability to high energy prices and firms' ability to cope (e.g. by reducing energy intensity, or substituting towards cheaper energy types). Just