
How does the price of electricity affect imports? A study of Swedish Manufacturing firms

By *Shon Ferguson* and *Mark Sanctuary*





ABOUT THE AUTHORS



Shon Ferguson is currently a Research Fellow at the Research Institute of Industrial Economics (IFN) in Stockholm, Sweden. Shon's current research interests focus on various aspects of international trade. Shon Ferguson was born in Canada, where he obtained a Bachelor's degree and Master's degree in Agricultural Economics and has lived in Sweden since 2005. He received his Ph.D. in Economics in 2010 from The Stockholm University with a dissertation titled Essays on Trade, Technology and the Organization of Firms.

Mark Sanctuary is a Researcher and Project Manager at IVL Swedish Environmental Research Institute, and a researcher at The Beijer Institute of Ecological Economics. Mark is the program manager for ENTWINED and his current research interests focus mainly on environmental and international economics. At IVL, Mark has led and managed several projects including a long-term initiative with the several Chinese government agencies on climate policy. Prior to IVL, Mark worked at the United Nations Environment Program's Economics and Trade Branch in Geneva. Mark has a Master of Science in Economics from the Stockholm School of Economics and is expecting to finish his dissertation in economics in 2013 at Stockholm University.



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THIS BRIEF TARGETS

- Policymakers and other professionals interested in how electricity prices influence imports of intermediate production inputs at the firm and sector levels

KEY MESSAGES

- Importing is an important coping mechanism for firms that face increasing domestic electricity prices.
- Higher electricity prices lead firms not only to significantly increase their relative use of imported intermediate inputs, but also to import more electricity-intensive products.
- Firms import intermediate production inputs for several reasons. Thus, a change in the price of electricity affects demand for imported intermediate inputs via several channels that can confound each other. The aim of this project was to disentangle these confounding effects.

PURPOSE OF THE ISSUE BRIEF: This issue brief provides a summary of research on the effects of increases in domestic electricity prices on the structure of imports within firms and sectors. The research described involved statistical examination of a detailed firm-level data set for Swedish manufacturing, including the products imported and electricity prices paid from 1998 through 2007. The aim of the project was to help policymakers identify the role of international trade in situations where electricity supply is undergoing a major transformation and higher electricity prices are a possible outcome. In particular, the results highlight the importance of international trade in intermediate production inputs in maintaining the competitiveness of domestic firms.

Introduction

Electricity supply and consumption are currently undergoing fundamental shifts in many economies. More change will be necessary if ambitious policy objectives are to be realized. For example, the potential restrictions in electricity supply facing the German and Japanese economies as nuclear facilities are taken offline could impose profound changes to their energy systems. Switzerland intends to follow suit. Furthermore, energy infrastructure in general will need to be restructured if ambitious commitments to reducing greenhouse-gas emissions within the next decades are realized, which may in turn lead to higher electricity prices. This is evident in the USA's commitment to reducing greenhouse-gas emissions by 17 per cent from 2005 levels by 2020, and the EU pledge to reduce its emissions by between 20 and 30 per cent from 1990 levels by 2020.



There is an additional international dimension. On the one hand, energy policies vary from country to country and common objectives are often pursued with differing levels of ambition. On the other hand, there is genuine concern that increasingly-open global markets are putting pressure on energy- and electricity-intensive industries facing competition from abroad. However, there is a dearth of evidence on how, generally, firms respond to higher energy prices and, more specifically, what such responses involve with respect to their engagement in international markets. The aim of this project was to address this scarcity of evidence.

Why do firms import intermediate inputs?

Trade in intermediate inputs is significant and growing, and is now a salient feature of international production. Trying to understand the drivers for the surge in global trade – and in particular for the

global reach of supply chains – is a subject of international economics research. Until recently, trade between countries was studied in terms of differences in endowments (for example differences in electricity prices) and Ricardian comparative advantage (driven by technological differences between countries, e.g., energy-efficiency differences between countries). Recently the focus has shifted somewhat, to study other drivers of trade. For example, producers (as well as consumers) have been shown to benefit from having access to a wider array of products available on international markets. The benefits of intra-industry trade entice firms to source inputs from abroad. All of these effects play a role in determining why firms source production inputs from abroad. Disentangling these effects presents a research challenge. In the research presented in this brief we took on this challenge, isolating the effect of a change in electricity price on Swedish manufacturing sectors.

How does the price of electricity affect a firm's imports?

A change in the price of electricity affects firm-level demand for imported intermediate inputs in several ways. An electricity price increase serves to increase the demand for imports while at the same time enhancing the productivity benefit of importing, which in turn serves to decrease the demand for imports. A change in the price of electricity also affects aggregate demand. As the price of electricity increases consumers spend more on electricity (directly because electricity bills increase and indirectly because electricity-intensive products become more expensive), causing aggregate demand to fall. This suggests that a change in the price of electricity affects demand for imported intermediate inputs via several – potentially contradictory – channels. The aggregate effect of the electricity price effect on a firm's imports can therefore vary from firm to firm.

The Swedish Electricity Market

In terms of per capita consumption, Sweden is one of the most electricity-intensive economies in the world, with only Iceland, Norway, Canada and Finland ranking higher. This is due to several factors: a cold climate, and; historically-low electricity prices, which have provided an incentive to use electricity as a source of energy for the household and industrial sectors. In contrast, per capita electricity consumption in the USA is 10 per cent lower than Sweden's, and consumption in the EU15 is on average 54 per cent lower. In 2008, Swedish hydropower met 47 per cent of Swedish electricity demand whereas nuclear power met 42 per cent. The remaining 11 per cent was produced using fossil- and biofuels. Moreover, from time to time, Sweden imports electricity from adjacent countries. Sweden participates in the Scandinavian electricity market, which evens out the price of electricity across the region.

About a third of Swedish industrial energy use in 2008 was electricity. The top six sectors, defined at the 2 digit level, accounted for around 88% of industrial electricity use (in 2008) with the pulp, paper and paper products sector accounting for approximately 33-40% of industrial electricity use over the period from 1998-2008. During the same period, the next 2 most important sectors were basic metals with approximately 13-20%, and chemicals and chemical products with approximately 12-18% shares respectively. Electricity prices prior to 2002 were low relative to continental Europe. The price of electricity increased in 2003, converging towards levels paid in Germany and other European countries. Several factors caused the sustained increase in prices illustrated in Figure A. Electricity markets in Scandinavia became more closely integrated with those of continental Europe. The sudden increase in prices, however, was most likely triggered by the particularly dry summer of 2002, which led to decreased hydropower production and high electricity prices in the winter of 2003. Water levels in the hydropower magazines did not return to normal until the end of 2004. The 2005 launching of the European Union's Emissions Trading system (EU ETS) – a policy initiative to reduce emissions that cause climate change – likely had an impact on electricity prices. This introduction of tradable emissions permits was intended to increase the cost of using greenhouse-gas-intensive energy. Swedish electricity production

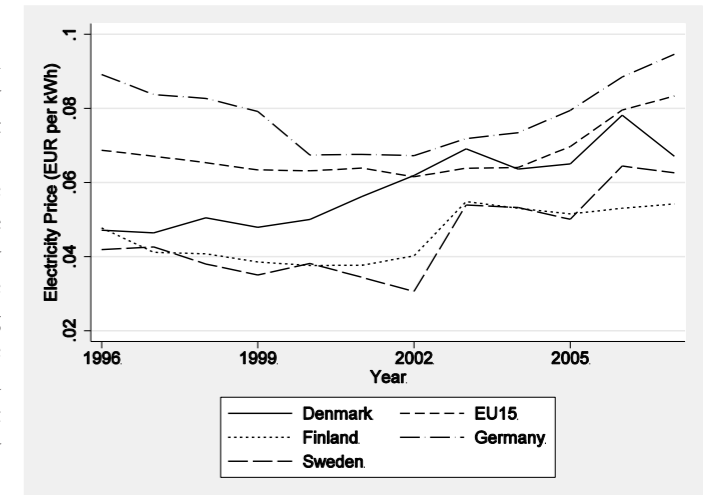


Figure A: European electricity prices and their fluctuations over time

is dominated by low-emission technologies (namely hydro- and nuclear power). However, the introduction of the EU ETS may have affected the relative prices of electricity and other, more emissions-intensive, energy carriers. Sorting out the impact of the EU ETS on the Swedish electricity market is a research question in its own right, but some suggest that the price of emissions permits has had a significant impact on the price of electricity in the Nordic countries. Sporadic closures of nuclear-power production facilities is another important factor that influences electricity prices in Sweden.

Electricity demand also changed over this period, which may also have affected electricity prices in Sweden. From 1998 through 2007 the Swedish economy was growing steadily. Swedish GDP grew at 2.5 per cent in 2002, 2.3 per cent in 2003 and 4.2 per cent in 2004. Changes in demand for products are therefore also a potential determinant of the impact of higher electricity prices on firms.

Sweden's manufacturing sectors and their electricity use

The data used in the project was obtained from the Swedish Survey of Manufacturers, conducted by Statistics Sweden, the Swedish government's bureau of statistics. We used data for 1998 through 2007, covering 4,194 firms with ten or more employees and 119 import products. The survey contains data on output, value-added, employment, capital stocks, investment and the value of raw materials at the firm level. The data also includes firm-level international imports (at the 6-digit Common Nomenclature (CN) level).

The electricity data used was also acquired from Statistics Sweden, and includes the quantity, value and average price of electricity paid annually by each firm. The distribution of electricity prices paid by six electricity-intensive sectors, defined at the two-digit NACE level, are presented in Figure B, which illustrates the significant variation in electricity prices paid across firms, within two-digit industry classifications.

The electricity prices paid by firms are not necessarily the electricity spot price described in Figure A. Firms can – and do

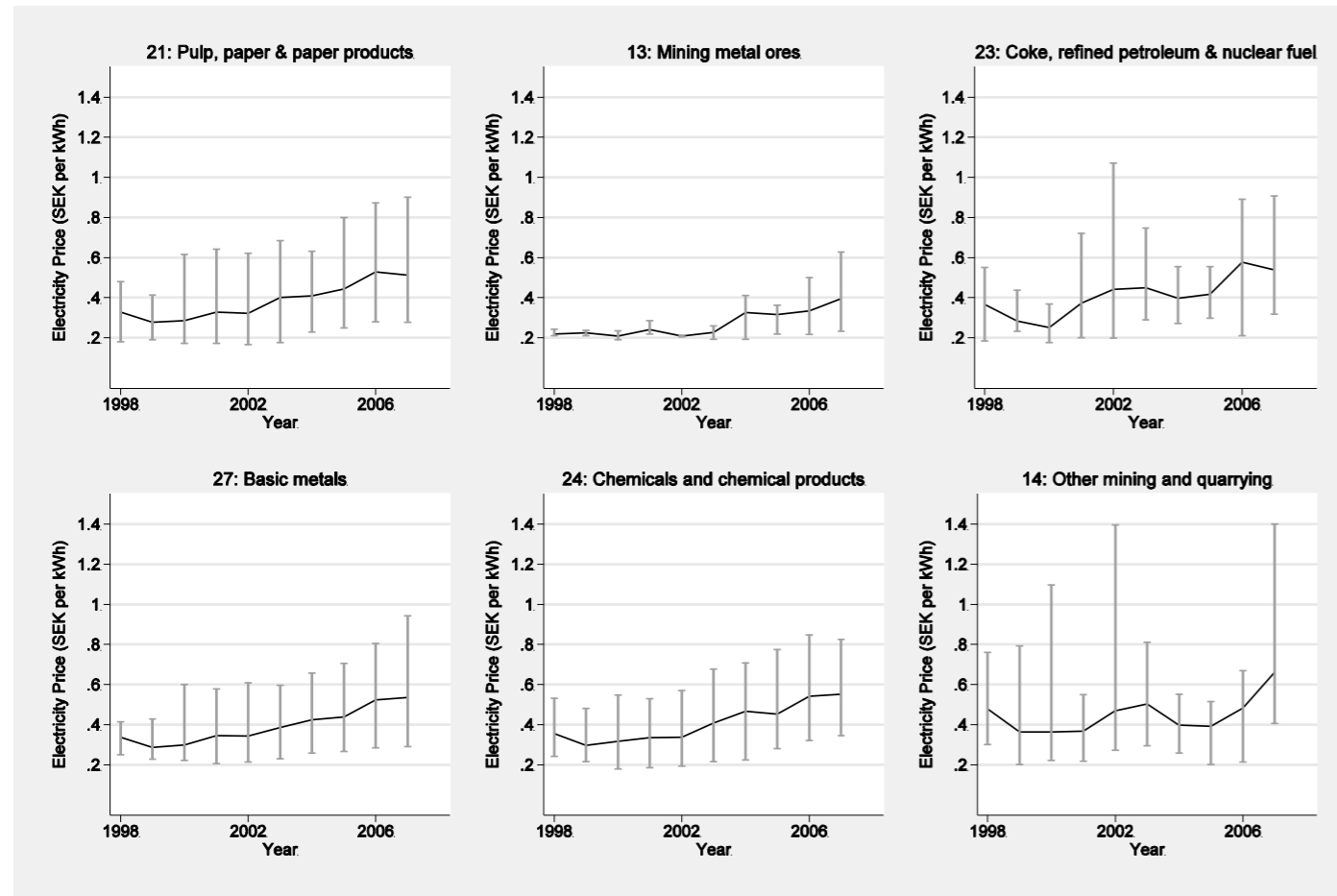


Figure B: Significant variation in electricity prices paid across firms, graphed by sector (defined at NACE 2-digit level)

– write contracts to insulate themselves from changing electricity prices. Contracts written directly with electricity suppliers or futures contracts, as well as other forms of risk management, are used to this effect. It was therefore important that the data used in this project included the actual average electricity prices paid in a given year. The actual electricity prices paid by firms are needed to understand how electricity prices influence firms' imports. Interestingly, Figure B suggests that some firms were better able than others to reduce the impact of the electricity price shock that occurred in early 2003, even within a given sector.

How did firm imports change with the price of electricity?

As noted, there are several effects that determine why firms import production inputs from abroad, and some of these have opposing effects. To sort through these effects, we examine firms' demand for imported inputs relative to each firm's demand for domestically-sourced inputs. The econometric results suggest that a 1 per cent increase in electricity prices results in a 1.1 per cent increase in the intensity with which a firm uses imported intermediates compared to domestic intermediates. There is also evidence that firms increased their imports of electricity-intensive intermediates. Thus, firms responded to electricity price increases not only by importing more of their production inputs, but also by importing the most electricity-intensive components of their production.

Conclusions

The increase in electricity prices experienced in Sweden after early 2003 presents an opportunity to study the impact of higher energy prices on imports of manufacturing production inputs. We have evaluated such impacts using detailed data on firms' imports and prices paid for electricity. The results suggest that Swedish firms have responded to higher electricity prices by importing more electricity-intensive intermediate inputs. We have found that importing is an important coping mechanism for firms facing electricity price increases. ■

POLICY RECOMMENDATIONS

Our study suggests that importing is an important way for firms to remain competitive in the face of increasing domestic production costs. This is a valuable insight for policymakers in countries where electricity supply is undergoing a major transformation and higher electricity prices are a possible outcome. Policymakers in such countries should strive to reduce impediments to importing intermediate inputs.

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ENTWINED
Box 210 60
SE-100 31 Stockholm
Sweden, +46 (0)8 598 56 300
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