SIX REASONS FOR GERMANY’S LEAD MARKET POSITION IN ENERGY EFFICIENT REFRIGERATORS

Thomas Cleff and Klaus Rennings

1 INTRODUCTION S. 108

2 LEAD MARKET ANALYSIS S. 108

3 DATA COLLECTION AND MEASUREMENT S. 109

4 RESULTS S. 111

5 CONCLUSION AND LIMITATIONS S. 114
1. Introduction

Global warming is an important driver for innovation in environmental and sustainable technologies. Increasing energy efficiency contributes not only to reach environmental targets. Furthermore it can be economically profitable. E.g. private households can reduce their costs by using efficient household appliances or lighting. It is therefore not surprising that the global market for energy efficiency technologies is expected to become an important future market\(^1\) that should double from € 540 billion in 2007 to € 1.030 billion in 2020.\(^2\) This paper analyzes Lead Market potentials of different countries for energy efficient refrigerators\(^3\). We apply an indicator-based approach to measure the relevance of different factors.

2. Lead Market Analysis

The Lead Market approach was first suggested in the 1980s by Porter\(^4\) and Bartlett/Ghoshal\(^5\) and has received increasing attention during the last 20 years. A Lead Market can be defined as a country where users prefer a specific innovation design that not only appeals to domestic users, but can subsequently be commercialized successfully in other countries as well. The technical design preferred by the Lead Market squeezes out other designs initially preferred in other countries and becomes the globally dominant design.

A Lead Market model has to give an answer to the question under which circumstances a country’s market characteristics are appropriate to the adoption of technological innovations that will succeed internationally and mark out the technological path to be followed worldwide. We will use the approach for environmental innovations of Beise and Rennings\(^6\) who identified six success factors for Lead Markets:

1. The demand advantage of a country relates to an early anticipation of developments that later become global trends. It can be expressed as the proportion of a country’s total consumption accounted for by these products. The difference between different countries’ markets does not lie in the direction in which they develop, but merely in the speed with which they move in the direction of the global trend.

2. It is obvious that decreasing prices of goods accelerate the diffusion of these goods. Price advantages refer to the situation when a certain innovation can squeeze out other innovation designs by a lower price.\(^7\) A price advantage of a Lead Market will occur only if the price difference is large enough to exceed the transaction costs incurred in changing over to cheaper innovation design.

3. The key characteristic of a Lead Market is that innovations realised there will not be limited to a certain country, but should be well-suited for export. An export advantage in the past may encourage innovators to make their products suitable for international markets.

4. Empirical studies show that sharp competition (market structure advantage) tends to facilitate

---

1 BMU (2009): GreenTech made in Germany 2.0., Bonn.
3 This study focuses on refrigerators. In case there exist no individual data for refrigerators, respective average values of the household appliances industry will be taken.
Six Reasons for Germany’s Lead Market Position in Energy Efficient Refrigerators

the emergence of Lead Markets. Customers in competitive markets can be “choosier” than in oligopolies or monopolies. Competition can therefore be understood as a process, by which all the participants attempt to achieve a better innovation design.

5. A country’s market has a transfer advantage if it raises the perceived utility of customers worldwide. The reputation and sophistication of the Lead Market’s users is considered to be a hallmark for high-quality innovation designs. The quality of demand is especially determined by user’s know-how and experience with similar products.

6. The regulation advantage is especially important for environmental innovations, since demand alone may not be sufficient for a success on the market due to the fact that the product has at least partially a public good character. Thus they need some regulatory support. “A country has a regulation advantage if the legal framework allows companies to plan on a mid- and long-term scale and at the same time exerts pressure on firms to come up with innovative ideas.”

3. Data Collection and Measurement

Demand Advantage

It is possible to measure the sector-specific demand specialization of a country (i) by subtracting the average share of total demand within the countries under consideration from the share of demand for one country:

\[
DA_i = \frac{C_{\text{household appliances},i}}{C_{\text{all products},i}} - \frac{C_{\text{household appliances},\text{all countries}}}{C_{\text{all products},\text{all countries}}}
\]

The data about country (i)’s demand can be estimated from international Purchasing Power Parities (PPP) statistics. PPP statistics provide information on total domestic demand (expenditure) and prices for a large variety of products. Data for major household appliances are available for 2005 upon request from different international institutions.

Price Advantage

Price information about household appliances is also available for 2005 from international PPP statistics. National currencies were converted to Euro (EU-27) using average annual exchange rates. The negative logarithmic quotient of the household appliances industry’s relative PPP level in a certain country k and the average price level of all sectors (\(\sum S_j\)) for the same country can serve as an direct indicator for price differences between countries in the household appliance industry.

\[
\ln \left( \frac{\text{PPP}_{k}^{T}}{\text{PPP}_{k}^{\text{all sectors}}} \right) \cdot (-1)
\]

11 Beise and Rennings (2005), op cit.
13 Eurostat/OECD PPP-Statistics; Worldbank ICP 2011; Penn World Tables.
A relative PPP level calculated in this way controls for country-specific differences in per-capita income and the different price levels that result. In order to answer the question about price-related demand factors for energy efficient household appliances, it is vital to take account of complementary factor costs for electricity. Research results could show that the higher the relative factor-prices, the higher are the cost savings in the demand of energy efficient products. The factor costs are measured through costs for electricity (including taxes) controlled for the country’s PPP.

Export Advantage
To assess the export advantage in the refrigerator manufacturing industry we have to evaluate the extent of export success for each country. We do this by examining export shares of the entire world trade for the most important refrigerator producing countries in the world using the respective SITC4 code 77521 of the UN Comtrade Database. An export share in world trade of five percent or more will be regarded as a market with an export advantage. This corresponds at the same time to the mean value of the top-20 export nations.

Market Structure Advantage
We want to analyze how an innovation can exist successfully on a high number of foreign markets. Thus, there is not the absolute sum of exports in the centre of analysis, but the concentration of these exports to different countries. The higher the concentration of exports, the lower is the global export capability of this market and the lower therefore is the market structure advantage. The grade of export concentration was determined with the Herfindahl Index for the export shares of total export of the respectively 20 largest export partners of a country. A Herfindahl Index smaller than 0.74 (average Herfindahl Index of all countries) shows a market structure advantage, a value greater than 0.74 stands for a disadvantage:

\[
MSA_j = \sum_{i=1}^{20} \left( \frac{Exp_i}{\sum_{i=1}^{n} Exp_i} \right)^2
\]

Transfer Advantage
Patent statistics, moreover, emphasize to what extent a company is able to secure legally their own know-how and the customers’ know-how in the form of patents. This becomes apparent through indicators like worldwide patent shares in the field of technology or the Relative Patent Advantage (RPA) for the product groups of household appliances using the Fraunhofer ISI patent database.\(^\text{14}\)

\[
RPA_{ij} = 100 \cdot \tanh \cdot \ln \left( \frac{p_{ij}}{\sum_i p_{ij}} \right)
\]

 Regulation Advantage
In all countries that are included in our analysis, mandatory energy efficiency labels and minimum performance standards (MEPS) have been introduced to foster the demand for energy efficient household appliances.\(^\text{15}\) We measure the regu-

---


tion advantage by calculating the negative difference between:

1. the year of introducing the first mandatory comparative label in a given country compared to the respective median of all countries and
2. the negative difference between the year of introducing the first MEPS in a given country compared to the respective median of all countries.

Only if both negative differences have a positive value is a country considered an early adopter of environmental regulation.

4. Results

Figure 1 contrasts price specialization for household appliances with factor costs for electricity (including taxes) controlled for the country’s PPP. In countries such as Germany (DE), Denmark (DK), Japan (JP) and Italy (IT) (see upper right quadrant of the portfolio) the relative prices for household appliances are not only below average but also the relative costs for electricity are above average so that customers are likely to have a greater incentive to buy energy efficient products.

Figure 1: Price Advantages and Disadvantages of different household appliances markets

Source: UK Department for Energy and Climate Change 2012; US Energy Information Administration; Eurostat/OECD PPP-Statistics; Worldbank ICP 2011; Penn World Tables. Own calculations.
In Figure 2, the relative PPP level is plotted against demand specialization for all countries. The best fit is a second order polynomial least squares regression to find out which countries show an above average propensity to consume for a given price. The countries that are of interest to us are those located above the regression line. Innovation designs that exploit this price elasticity can spread quickly and make use of market size advantages to increase their ability to compete on price.

**Figure 2: Price advantages and demand specialization for household appliances**

Remark: the demand advantage for Thailand is very low. It was omitted from the analysis, because of its huge leverage effect on the regression line.

Source: Eurostat/OECD PPP-Statistics; Worldbank ICP 2011; Penn World Tables.
In Figure 3, especially the countries China (CN), Korea (KR), Thailand (TH), Turkey (TK) and Germany (right upper quadrant), show not only an above average export advantage (compared to the average export share of the top-20 export nations) but also an above average international market structure advantage. The exports can be realized simultaneously to a number of markets. Manufacturers of these markets are somehow able to face global competition.

The shares of worldwide patents in the field of household appliances are limited to only a small number of countries. South Korean producers have on average between 2003 and 2007 about 30 percent of world shares, followed by German manufacturers with 26 percent. Far behind follows Italy (13), the USA (9), and Japan (5). Only the German (46), South Korean (96) and Italian (89) producers show an above average RPA. All other mentioned countries have below average RPA values (Calculation of Fraunhofer ISI). In summary it can be stated that important innovations in energy efficiency are implemented by German and South Korean manufacturers. For both countries, all indicators to describe the transfer advantage are positive.

Figure 3: Market Structure Advantage and Export Advantage

Source: UN Comtrade Database.
In Figure 4, one can see that the USA, the EU and Korea have a high regulatory advantage. The EU emphasized for a long time mandatory comparative energy labels and rather late MEPS. The opposite situation can be observed in China, where the state controlled the market through MEPS, while mandatory energy labels were introduced rather late.

5. Conclusion and Limitations

Table 1 summarizes the Lead Market potentials of different countries.

One can see that Germany has the most Lead Market advantages in the refrigerator producing industry. In countries that do not have sufficient Lead Market potentials, product innovations must be targeted to fit the preferences of users in the Lead Market. The screening of the Lead Market can take on varying degrees of intensity. These range from simply making use of listening posts in the Lead Market to testing and/or launching new products in the Lead Market. A good way for a company to establish ties with a Lead Market is via producers with long experience on the Lead Market. This can be realized through a simple sales co-operation or a merger with a local producer of the Lead Market. Compared to establishing a new subsidiary in a potential Lead Market, cooperation with an existing company has the advantage that it already has longstanding relationships with customers and can offer

Figure 4: Mandatory Comparative Energy Labels and MEPS for Refrigerators

considerable insight into conditions on the Lead Market. There are a number of other possible lag market strategies to ensure that adequate attention is paid to the Lead Market:

- Developing an innovation on the lag market but taking into account customer-specific preferences of the Lead Market.
- Developing dual-use innovations, which satisfy demand both on the lag and on the Lead Market.
- Avoid technological designs that would be atypical on the Lead Market.

Our research also needs to acknowledge limitations of the chosen approach. As a consequence of our definition of the household appliances industry it needs to be kept in mind that the Lead Market advantages identified refer to the aggregate sector. It may well be that Lead Market advantages within a sector vary from one product group to another or even between individual products. Another limitation refers to the relatively short time series of data available which hampers a comparison of the indicators over time. The main reason for this is that PPP and expenditure data are not available for more than one year (2005). Future research should thus try to put our results into perspective with other markets and their potential as Lead Markets.

Table 1: Top-five-Lead Market countries for energy efficient refrigerators

<table>
<thead>
<tr>
<th>Country</th>
<th>Lead Market Potentials</th>
<th>LM Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price</td>
<td>Demand</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Korea</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Denmark</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>France</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: 1: Above average advantage; 0: Not above average