# Manufacturing restructuring and the role of real exchange rate shocks[☆]

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## ARTICLE INFO

## ABSTRACT

Using a new and extensive micro data set we investigate the impact of a change in international competitive pressure on industrial performance and restructuring. Unlike previous studies we are able to account for the heterogeneity across firms in their exposure to foreign competition. We focus on a situation akin to a natural experiment, and examine the impact of a sharp real appreciation of the Norwegian Krone in the early 2000s on Norwegian manufacturing firms which differ substantially in their trade orientation. A change in the real exchange rate (RER) affects a firm through three different channels: (i) firm's export sales, (ii) firm's purchases of imported inputs, and (iii) import competition faced in the domestic market. Unlike previous studies, we are able to examine all three channels. Both net exporters and import-competing firms were exposed to increased competition due to the real appreciation. Both groups reacted by shedding labor, but only the first group experienced increasing labor productivity. Partly, the productivity improvements came from measured TFP gains, while capital deepening does not appear to have been affected by the shock.

## 1. Introduction

Real appreciations are typically feared by export-industry representatives and governments for their potential negative influence on profitability, investment and employment. However, real appreciations may potentially also strengthen competitive pressure and force industrial restructuring that in turn gives productivity gains. A long-standing issue in economics is whether competitive pressure matters for industrial performance. Based on theory we would expect there would be gains from increased competition. But the empirical evidence to support this view is still not overwhelming.[1]

Our objective is to investigate the impact of a change in international competitive pressure due to a distinct real appreciation on employment, production, investment, and productivity. In doing so we seek to shed light on the role played by competitive pressure on industrial performance and restructuring along the intensive as well as the extensive margin. We follow a route similar to that of Galdón-Sánchez and Schmitz (2002), focusing on a situation akin to a natural experiment, and examine the impact of a change in competitive pressure following a sharp real appreciation of the Norwegian Krone in the early 2000s.

The extent to which a real exchange rate (RER) shock changes the competitive pressure faced by a firm is determined by its exposure to trade. Recent theoretical and empirical contributions stress the importance of taking intra-industry firm heterogeneity into account when studying structural adjustment to changes in the trading environment and competitive pressure (see e.g. Melitz, 2003 and Melitz

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[1] A few recent studies have found evidence of productivity gains from increased competition due to developments in commodity markets. Recent important contributions have been made by Schmitz (2005) and Galdón-Sánchez and Schmitz (2002) through their work on detailed data for the iron ore industry. There is also a growing literature on the impact of trade liberalization and thus increased foreign competition, see, e.g., Pavnick (2002) and Trefler (2004).

and Ottaviano, 2008). In recent years, increasing evidence has emerged that firms' exposure to trade varies significantly even within export industries (see e.g. Bernard et al., 2007). This implies that firms within the same industry may be hit very differently by a RER shock. A real appreciation will tend to increase the competitive pressure for firms that sell a large share of their output in foreign markets. However, firms with a large share of exports in total sales often import a large share of their intermediate inputs. Since a real appreciation tends to make these inputs cheaper, the RER shock has an ambiguous effect on profitability and firm performance.[2]

Most of the literature on the impact of RER changes is based on industry-level analysis,[3] while some of the more recent contributions have used firm-level data.[4] We apply a new and extensive micro data set for Norwegian manufacturing with detailed information on firms' exports as well as imports of intermediates. This allows us, in contrast also to previous firm-level studies, to calculate precise measures of trade exposure. In doing so, we are able to account for the heterogeneity across firms with respect to their net currency exposure – taking into account the share of exports in total output as well as the share of imported inputs in total costs – and thus to overcome one severe shortcoming of previous analyses of RER shocks; the lack of detailed, firm-specific measures of trade exposure.[5]

Several conclusions emerge from the analysis. The real appreciation took place over a period of 2 years. Over this period and the subsequent 2 years employment fell by 11%. Almost half of this decline took place within ongoing firms. The RER shock led to reduced employment at the net exporters and the import competing firms — i.e. among those who were most exposed to the shock.

Over the same time labor productivity in Norwegian manufacturing rose dramatically. A growth decomposition reveals that the productivity increase primarily can be ascribed to within-firm improvements, while reallocations between firms and exits were less important. Our analysis shows that a substantial share of the increase in labor productivity can be ascribed to the RER shock. We find that the shock led to productivity gains at the firm level among the net exporters, who improved their efficiency in the face of tougher market conditions. But in contrast to previous studies, increased competition from imports in the domestic market did not appear to have promoted productivity growth.[6]

The rest of the paper is organized as follows: We first provide a brief background to the RER shock and industrial performance in the Norwegian manufacturing sector. We then proceed with a decomposition exercise to evaluate the relative contribution of the intensive and extensive margin to overall changes is employment, production and productivity growth. Based on the observation that adjustments within firms appear to have been important drivers behind the development at the aggregate level, we focus the empirical analysis on the contribution of the RER shock to the industrial performance of surviving firms. In Section 3 we lay out our identification strategy, describe the estimation procedure, present the data and discuss econometric issues. In Section 4 we present the empirical results, while in Section 5 we discuss their robustness. In Section 6 we conclude.
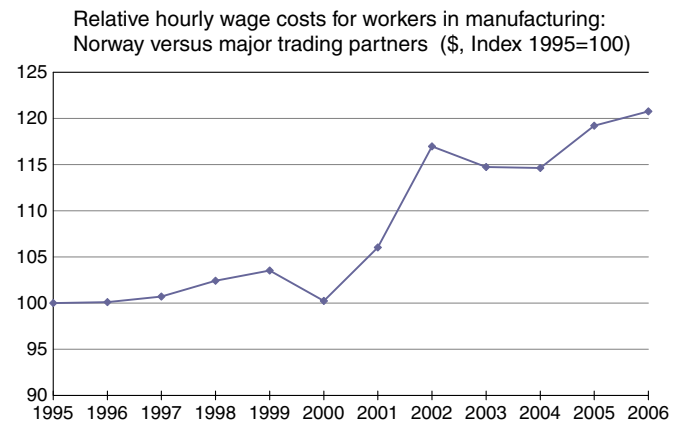


Fig. 1. The Norwegian RER shock 2000–2002.

## 2. The RER shock and industrial performance

The central bank of Norway adopted inflation targeting in March 2001. This was followed by very high wage settlements. In order to comply with the inflation target, the response of the central bank was to increase the interest rate, creating a large gap vis-à-vis foreign rates. This gap was further enlarged as the Federal Reserve Bank and the European Central Bank lowered their interest rates as the dot com bubble burst. Prior to 2000, the real exchange rate had been rather stable, but between 2000 and 2002 the real exchange rate appreciated by around 17%[7] (see Fig. 1).

The real appreciation led to increased competitive pressure for exporters and for import-competing firms. We follow Galdón-Sánchez and Schmitz (2002) and define an increase in competitive pressure as an increase in the firm's probability of closure. The probability of closure is determined by how the RER shock affects profits. According to this definition, an adverse effect of the RER shock on profits translates into an increase in competitive pressure.

If a substantial share of Norwegian firms experienced increased competitive pressure, we would expect this to result in marked changes in aggregate employment, production and productivity from 2000 onwards. A first look at the aggregated data supports such a hypothesis. From 2000 to 2004, manufacturing employment fell by 11%. In 20 out of 22 industries employment growth declined during and just after the real appreciation relative to the period before, 1996–2000.[8] 68% of the firms experienced a decline in employment growth relative to the 1996–2000 period. But over the same period gross production increased by 10.6%. Not surprisingly, from 2000 to 2004, real labor productivity in Norwegian manufacturing thus rose by 24%.[9]

We decompose the growth in employment, real gross production, and real labor productivity in order to get a better grasp of the adjustment process at the intensive as well as the extensive margin in response to the RER shock. The decomposition of employment and gross production takes the form

$$\Delta Q_t = \sum_{i \in C} \Delta q_{it} - \sum_{i \in X} q_{it-4} + \sum_{i \in E} q_{it}$$

where $\Delta Q_t \equiv Q_t - Q_{t-4}$ denotes total change in the outcome variable, $\Delta q_{it} \equiv q_{it} - q_{it-4}$ is the corresponding firm-level variable, and $C$, $X$ and

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[2] The correlation between export and import share for Norwegian firms with positive exports and imports was 0.71 in 2004.

[3] See e.g., Burgess and Knetter (1998), Branson and Love (1988), Campa and Goldberg (1995, 2001), Goldberg et al. (1999), Goldberg (1993), and Klein et al. (2003).

[4] See, e.g., Gourinchas (1999), Fung (2008) and Fung and Liu (2008).

[5] A somewhat related paper that uses a real exchange rate shock to identify firm-level responses is the recent contribution by Verhoogen (2008). However, his focus is on quality upgrading and wage inequality.

[6] Increased import competition was found to increase productivity in, e.g., the study by Pavnick (2002).

[7] Measured by relative hourly wages costs for workers in manufacturing in Norway relative to major trading partners, are denominated in a common currency. Other measures of the RER, e.g. from OECDs MEI (2008), show very similar trends.

[8] See Tables 20 and 21 in the Appendix.

[9] Henceforth all productivity measures refer to real productivity. Details about the deflators used are provided in the data section.