WORKING PAPER

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by
Horst Raff and Joachim Wagner

University of Lüneburg
Working Paper Series in Economics

No. 144

September 2009

www.leuphana.de/vwl/papers

ISSN 1860 - 5508

Intra-Industry Adjustment to Import Competition: Theory and Application to the German Clothing Industry[1]

Horst Raff
Kiel Institute for the World Economy
and Department of Economics
Christian-Albrechts-Universität zu Kiel
24098 Kiel, Germany
Email: raff@econ-theory.uni-kiel.de

Joachim Wagner
Department of Economics
Leuphana Universität
21314 Lüneburg
Email: wagner@leuphana.de

17 September 2009

[1]All computations for the empirical part of this paper were performed inside the research data centre of the statistical office in Berlin-Brandenburg. We thank Anja Malchin and Ramona Voshage for running the Stata do-files and checking the log-files for violation of privacy. To facilitate replication the Stata program is available on request from the second author.

Abstract

This paper uses an oligopoly model with heterogeneous firms to examine how an industry adjusts to rising import competition. The model predicts that in the short run the least efficient firms in the industry become inactive, surviving firms face a fall in output, mark-ups and profits, and the average productivity of survivors increases. These pro-competitive effects of import penetration on the domestic industry disappear in the long run. The predictions for the short run are confirmed in an empirical study of the German clothing industry.
JEL classification: F12, F15
Keywords: international trade, firm heterogeneity, productivity, clothing industry

1 Introduction

We examine how import-competing industries adjust to rising import penetration. In particular, we are interested in the effects on domestic firms' outputs and productivity. The analysis proceeds in two steps. First, we construct a simple model of an import-competing industry with heterogeneous firms and derive hypotheses regarding the short- and long-run adjustment to rising import penetration. Second, we use micro data for the German clothing industry for the period 2000–2006 to examine how some of these hypotheses hold up empirically. The clothing industry is an ideal candidate for such a study, since, in the period under investigation, there has been a significant increase in import penetration brought about in part by the successive elimination of import quotas under the Multi-Fibre Arrangement. We observe large changes in production, employment and market structure in this sector.

The focus of our analysis is on the adjustments that are channelled through changes in the competition between firms in the industry, i.e., through changes in equilibrium outputs and market structure. We therefore pursue a partial-equilibrium approach in which labor market and other general-equilibrium effects are neglected.[1] The model that we construct to investigate the competitive effects of greater import penetration is a variant of Long et al. (2008). Firms are ex post heterogeneous as in Melitz (2003): they decide whether to enter the industry before they observe their productivity draw. After entry firms individually learn their productivity, and finally play a Bayesian Cournot game determining their domestic sales. Specifically we let the output choices of domestic firms be best responses to each other and to the import volume. The quantity of imports is our policy variable; we assume that it is driven by forces outside of the model, such as by government policy regarding import quotas.[2] The model allows us to derive the comparative static effects of greater import penetration on the output of do-

[1] This is easily justified by the fact that employment in the clothing industry accounted for only 0.2% of total employment and 0.8% of industrial employment in Germany in 2002.

[2] In fact, European quotas on imports of textiles and clothing were raised twice during the sample period in connection with the phasing-out of the Multi-Fibre Arrangement agreed to in the Uruguay Round negotiations of GATT. The WTO Agreement on Textiles and Clothing (ATC) that regulates the phase-out specifies a significant integration step on January 1, 2002 and a final lifting of all quotas on December 31, 2004 (European Commission, 2000). For more information and estimates of export tax equivalents of the MFA quotas see Francois and Woerz (2009).

mestic firms, and it allows us to determine how import penetration affects the cut-off level of firm productivity that separates firms that are not able to sell any output from the more productive ones that serve the domestic market. From the changes in firm-level output decisions and the selection effect induced by changes in the cut-off productivity we can then compute how import penetration affects aggregate industry productivity.

In this framework we investigate the effects of greater import penetration in the short run when the number of potential entrants is fixed, and in the long run when the number of entrants adjusts to the new market conditions. We discover important differences in the adjustment patterns depending on the time horizon. In the short run, adjustment is driven by a selection effect: the least efficient and thus smallest firms are forced to seize production when the volume of imports rises. The number of active firms, and the outputs, mark-ups and profits of surviving firms fall. The elimination of the least efficient firms implies that the average productivity of domestic survivors rises. Hence greater import penetration has a pro-competitive effect in the short run. In the long run, however, the adjustment takes place through the exit of domestic firms, and the selection effect disappears. This has two important implications. First, in the long-run, exit should be observed across the whole size or productivity distribution and not just among the small firms. Second, there is no change in the average productivity of domestic firms. In other words, import penetration first hits the least efficient or smallest firms. In the long run, however, big firms also exit, which makes it possible again for smaller, less efficient firms to survive. The pro-competitive effects associated with greater import penetration thus wash out in the long run.

The data we have collected are suited to examine the short-run predictions of the model. Since our sample is comparatively short and import shocks appear throughout, we do not expect the industry to have settled in a long-run equilibrium yet by the end of the sample period. Our empirical analysis, in fact, strongly supports the model's short-run predictions.

The current paper contributes to the growing literature on intra-industry adjustment to trade liberalization, initiated by Bernard et al. (2003) and Melitz (2003). See Wagner (2007) and Greenaway and Kneller (2007) for recent surveys. On the theory side, our paper is related to Melitz and Ottaviano (2008) who also take a partial-equilibrium approach to investigating the effects of trade liberalization on industries with heterogeneous firms. Their model features monopolistic competition, whereas our model has

oligopolistic competition. However, the short- and long-run adjustment patterns predicted by the two models are qualitatively similar: unilateral trade liberalization that leads to greater import penetration has pro-competitive effects in the short run due to the selection effect. In the long run, these pro-competitive effects disappear or are even reversed.[3]

On the empirical side, our paper is related to Chen et al. (2009) who study the short- and long-run adjustments to trade liberalization by EU manufacturing industries, and to Fernandes (2007) who examines the effect of trade liberalization on productivity in Colombian manufacturing. The former paper examines the impact on prices, mark-ups and productivity, and finds a pro-competitive effect of trade liberalization in the short run, but no strong evidence for a pro-competitive effect in the long run. The latter concludes that greater import penetration has significant productivity enhancing effects. Other related papers include Baldwin and Gu (2009), and Lileeva and Trefler (2008) who study the firm-level impact of bilateral trade liberalization following the Canada-U.S. Free Trade Agreement.

The remainder of the paper is structured as follows. Section 2 introduces the model. In Section 3 we derive testable hypotheses concerning the effects of import penetration in the short and in the long run. The data and the empirical analysis are presented in Section 4. Section 5 concludes, and the Appendix contains proofs.

2 The Model

We build on Long et al. (2008) to construct a simple model of a domestic market, in which heterogeneous domestic producers compete with each other and with imports. The quantity of imports, M, is regulated by an import quota. Domestically produced and imported goods are homogeneous, and domestic firms engage in Bayesian-Cournot competition. Consumers have quadratic quasi-linear preferences over the homogeneous good and a numeraire that give rise to a linear inverse demand function,

$$p = A - Q - M, \tag{1}$$

[3] An anti-competitive effect appears in Melitz and Ottaviano (2008) if the unilateral removal of trade barriers leads to entry of relatively inefficient firms abroad, thereby raising prices of foreign exporters.

where p and Q denote price and total sales of domestic firms, respectively. Labor is the only factor of production and comes in fixed supply. Assuming that the numeraire good is produced under constant returns to scale at unit cost and traded freely on a competitive world market, the equilibrium wage at home is equal to one, and trade is always balanced.

Let n denote the number of domestic entrants. Firms produce under constant (but ex-ante unknown) marginal cost, equal to the unit labor requirement. We assume that the marginal cost of firm $i = 1, \ldots, n$, denoted by c_i, is revealed to the firm only after it has incurred a sunk set-up cost $f_e > 0$. The ex-ante cumulative distribution $F(c_i)$ has support on the interval $[0, \bar{c}]$; the density is denoted by $f(c_i)$. We assume that the marginal-cost realization is private information of each firm. Hence output decisions are made under asymmetric information. Upon learning its marginal cost, firm i will produce a quantity $q(c_i)$ for the domestic market. This output decision will depend on the expected output of all rival firms, denoted by $\widehat{Q}_{-i}$, and the import quota M. Firm i's first-order condition for its output $q_i(c_i)$ is

$$p(q_i(c_i)+\widehat{Q}_{-i}+M)+q_i(c_i)p'(q_i(c_i)+\widehat{Q}_{-i}+M)-c_i \leq 0, (= 0 \text{ if } q_i(c_i) > 0). \quad (2)$$

From (2), we may derive the critical marginal cost, $\widetilde{c}_i \equiv A - \widehat{Q}_{-i} - M$, for which firm i's output becomes zero. The first-order condition gives rise to the best response function

$$q_i(c_i) = \begin{cases} 0 & \text{if } c_i \geq \widetilde{c}_i, \\ \frac{1}{2}(\widetilde{c}_i - c_i) & \text{if } c_i < \widetilde{c}_i. \end{cases} \quad (3)$$

Since in the current model a firm's mark-up is the same as its output, the ex-post profit in the domestic market is equal to

$$\pi_i(c_i) = \begin{cases} 0 & \text{if } c_i \geq \widetilde{c}_i, \\ \frac{1}{4}(\widetilde{c}_i - c_i)^2 & \text{if } c_i < \widetilde{c}_i. \end{cases} \quad (4)$$

Using (4) we may write the total expected profit of firm i as

$$\Pi_i(c_i) = \frac{1}{4}\int_0^{\widetilde{c}_i} (\widetilde{c}_i - c_i)^2 \, dF(c) - f_e. \quad (5)$$

Since firms draw their marginal costs from the same distribution, their expected outputs will all be the same in equilibrium. Firm i will thus face $n-1$ domestic rivals, each expected to produce and sell $\widehat{q}$ units; hence,

$\widehat{Q}_{-i} = (n-1)\widehat{q}$. The critical value of the marginal cost can thus be written as

$$\widetilde{c} = A - (n-1)\widehat{q} - M. \tag{6}$$

We show in the Appendix that the expected output of a firm in equilibrium is[4]

$$\widehat{q} = \frac{1}{2}\int_0^{\widetilde{c}} F(c)dc. \tag{7}$$

We may also use symmetry to rewrite the expected equilibrium profit as follows

$$\widehat{\Pi} = \frac{1}{4}\int_0^{\widetilde{c}} \left[A - (n-1)\widehat{q} - M - c\right]^2 dF(c) - f_e. \tag{8}$$

In our analysis below we will refer to the effect of an increase in the import quota on firm and industry productivity. Following Melitz (2003) we define firm productivity as the inverse of the marginal production cost, and industry productivity as the inverse of the expected marginal cost, conditional on firms producing positive output. This conditional expectation is given by

$$E(c \mid c \leq \widetilde{c}) = \frac{1}{F(\widetilde{c})}\int_0^{\widetilde{c}} c dF. \tag{9}$$

3 The Effects of Import Penetration

We now examine how greater import penetration in the form of a marginal increase in M affects the equilibrium of the model. We distinguish between a short-run scenario in which there is no entry, and a long-run scenario in which firms enter or exit until their ex-ante profit is equal to zero.

3.1 Short-run Effects

In the absence of market entry the equilibrium $\widehat{q}$ is determined by equation (7). Using this equation we find that a marginal increase in the import quota reduces the expected output of domestic firms:

$$\frac{d\widehat{q}}{dM} = -\frac{F(\widetilde{c})}{2 + (n-1)F(\widetilde{c})} < 0. \tag{10}$$

[4]See also Lemma 1 in Long et al. (2008).

The rise in the import quota also induces a selection effect. Specifically we have

$$\frac{d\widetilde{c}}{dM} = -(n-1)\frac{d\widehat{q}}{dM} - 1 \tag{11}$$

$$= \frac{-2}{2+(n-1)F(\widetilde{c})} < 0, \tag{12}$$

so that the least efficient domestic firms are forced to produce zero output. It is also easy to see from (3) and (4) how the selection effect reduces the equilibrium outputs of the surviving firms. Since expected mark-ups and profits are proportional to output, they, too, fall. Greater import penetration thus has a clear pro-competitive effect in the short run.

The effect of a marginal increase in M on industry productivity is also driven by the selection effect: as the least efficient domestic producers are forced to reduce their output to zero, average industry productivity rises:

$$\frac{d}{dM}E(c \mid \leq \widetilde{c}) = \frac{d}{dM}\frac{1}{F(\widetilde{c})}\int_0^{\widetilde{c}} c dF \tag{13}$$

$$= \frac{\widetilde{c}f(\widetilde{c})}{F(\widetilde{c})}\frac{d\widetilde{c}}{dM} - \left[\int_0^{\widetilde{c}} c dF\right]\frac{f(\widetilde{c})}{F(\widetilde{c})^2}\frac{d\widetilde{c}}{dM} \tag{14}$$

$$= \frac{f(\widetilde{c})}{F(\widetilde{c})}\left[\widetilde{c} - E(c \mid c \leq \widetilde{c})\right]\frac{d\widetilde{c}}{dM} < 0. \tag{15}$$

We can summarize the testable hypotheses for the short run as follows:

Summary 1 *In the short run an increase in import penetration:*

(H1) forces the least efficient domestic firms to become inactive,

(H2) lowers the outputs (and hence mark-ups and profits) of surviving domestic firms,

(H3) raises the average productivity of domestic survivors.

3.2 Long-run Effects

Now consider the case of an endogenous market structure. Free entry and exit of firms ensures that expected profits (8) are zero, which implies that

$$\widehat{\Pi} = \frac{1}{4}\int_0^{\widetilde{c}} \left[A - (n-1)\widehat{q} - M - c\right]^2 dF(c) - f_e = 0. \tag{16}$$

The comparative static results of an increase in M on the expected equilibrium output $\widehat{q}$ and the number of firms n are obtained by total differentiation of (7) and (16); proofs are in the Appendix.

We find that an increase in the import quota has very different effects in the long run than in the short run. In particular, the exit of domestic firms ($dn/dM < 0$) turns out to be the only channel of adjustment in the long run. The output of surviving firms stays put ($d\widehat{q}/dM = 0$), and there is no selection effect ($d\widetilde{c}/dM = 0$). In other words, in the long run it is not just the least efficient and thus smallest firms that exit the market. Rather, exit occurs at all productivity and thus size levels such that the critical value of the marginal cost at which a firm remains active is unchanged. The absence of a selection effect also implies that in the long run there is no change in industry productivity, as can be easily ascertained from (15). Thus the pro-competitive effects of greater import penetration disappear completely in the long run, giving rise to a distinct intertemporal pattern of adjustment.

We can summarize the testable hypotheses for the long run as follows:

Summary 2 *In the long run an increase in import penetration:*

(H1-LR) lowers the number of domestic firms,

(H2-LR) leaves the output (and hence mark-ups and profits) of surviving domestic firms unchanged,

(H3-LR) leaves industry productivity unchanged.

4 Empirical Application: The German Clothing Industry, 2000 − 2006

To examine how the hypotheses derived from our model for the short run hold up empirically we perform a case study for the German clothing industry during the period 2000 to 2006.[5] In accordance with the WTO Agreement on Textiles and Clothing (ATC) European quotas on imports of clothing were raised significantly on January 1, 2002, and finally lifted on December

[5]Since our sample covers only the years from 2000 to 2006 and import shocks appear throughout, we do not expect the industry to have settled in a long-run equilibrium yet by the end of the sample period. Therefore, the hypotheses derived from our model for the long run cannot be tested empirically in this paper.

31, 2004. Table 1 documents basic facts for the German clothing industry between 2000 (before the first rise in import quotas) and 2006 (two years after the lifting of all quotas).[6] The lifting of quotas was accompanied by a dramatic decline in production by 46 percent, an increase in imports by 4.6 percent, and a pronounced increase in the ratio of imports to domestic production from 5.31 to 10.31 between 2000 and 2006.

[Table 1 near here]

During the period under consideration import prices declined in each segment of the clothing industry (although the decline was only tiny for underwear), while prices for clothing from domestic production increased (with the exception of other outerwear). The relation of prices for imports to prices for domestic products fell from 2000 to 2005 and 2006 in all segments of the clothing industry. This increase in price competitiveness of imports, however, was only minor in both other outerwear and underwear.

[Table 2 near here]

In our empirical investigation we use panel data for enterprises from the clothing industry. The data are based on information from a regular survey that is administered by the statistical offices in Germany. This survey, the monthly report for establishments in manufacturing industries, covers all local production units from manufacturing industries that have at least 20 employees or that belong to an enterprise with a total of at least 20 employees. Information from the monthly surveys is either summed up for a year, or average values based on monthly figures are computed, and a panel data set is built from annual data. Furthermore, the information collected at the establishment level has been aggregated at the enterprise level. A detailed description of the information in these data is given in Konold (2007).[7]

[6] The descripitve results at the industry level are for the clothing industry without "Dressing and dyeing of fur; manufacture of articles of fur (1830)" because no price index is available for domestic production and imports for this industry. The share of the fur industry in the clothing industry was tiny in both domestic production (0.57 percent) and imports (0.97 percent) in 2000. The six enterprises from this industry, however, that were active in 2000 in Germany are included in the empirical tests of the hypotheses.

[7] The data are confidential but not exclusive; see Zühlke et al.(2004) for information how to access the data in the research data centers of the statistical offices. To facilitate replication the Stata do-file used to compute the results reported here is available from the second author on request.

Firms in the clothing industry are heterogeneous. Table 3 shows that in the industry as a whole and in its segments enterprises differ considerably by size (measured by the number of employees) and labor productivity (measured by sales per employee). Firms from the 90th percentile are larger than firms from the 10th percentile by a factor of 10 in the clothing industry as a whole, and by a factor of 14 more productive.[8] The degree of heterogeneity is comparably large at the 4-digit level, especially in the large industries 1822 (other outerwear) and 1823 (underwear). This illustrates that our modeling framework that assumes firm heterogeneity in the industry is appropriate.

[Table 3 near here]

According to our first hypothesis, H1, an increase in import competition forces the least efficient domestic firms to become inactive. In the empirical investigation a firm is classified as inactive in a year if the number of employees reported in the data set is zero in the respective year. The number of employees reported in the data set is the average of the reported numbers of employees from the monthly report for all the months when the firm reported positive numbers of employees. If a firm was active, say, from January to October in year t but became inactive in November, we set the number of employees in year t equal to the average number of employees reported for the months January to October. In year $t+1$ (and in the following years) the firm is classified as inactive. A firm is classified as inactive, too, if the number of employees dropped below the cutoff-point of 20 employees that is decisive for the participation in the survey. Furthermore, a firm is classified as inactive if it is relocated from the clothing industry to another industry, or relocated out of Germany, because in these cases no employees are reported in the data set for this firm in the German clothing industry. Data protection laws prevent a closer investigation of the cases that, for various reasons, are classified as inactive. In what follows firms that are active in a year after 2000 will be labeled "survivors", and those that are not will be called "exits".

In our econometric investigation we measure firm efficiency by labor productivity, defined as the amount of sales per employee.[9] Results for H1 are

[8] Note that the minimum and the maximum of both the number of employees and the labor productivity are confidential because these numbers refer to specific enterprises.

[9] Note that the data do not include information on value added or the capital stock of the enterprise. Therefore, we cannot use value added per employee or total factor productivity to measure efficiency.

reported in Table 4. In 2000, there were 614 enterprises in the clothing industry. Only 310 of these enterprises were still active in 2005 and 274 in 2006. Only 45 percent of the firms, therefore, remained active over the whole period. In line with H1, labor productivity in the firms that became inactive before 2005 and 2006 was lower in 2000 than in the firms that remained active. This difference was large—on average, future survivors were more than 50 percent more efficient than future exits. The difference in means is statistically significant at any conventional level according to a t-test.

[Table 4 near here]

However, if one only looks at differences in the mean values for both groups, one focuses on just one moment of the distribution of productivity. A stricter test that considers all moments is a test for stochastic dominance of the distribution for survivors over the distribution for exits. More formally, let F and G denote the cumulative distribution functions of productivity for survivors and exits. If $F(x) - G(x) = 0$, the two distributions do not differ, while first order stochastic dominance of F relative to G means that $F(z) - G(z)$ must be less or equal zero for all values of z, with strict inequality for some z. Whether this holds or not is tested non-parametrically by adopting the Kolmogorov-Smirnov test (see Conover 1999, p. 456ff.). The Kolmogorov-Smirnov test indicates that the distribution for survivors first-order stochastically dominates the distribution for exits. These findings are in line with H1.[10]

Our second hypothesis, H2, states that an increase in import penetration lowers the average outputs and mark-ups of surviving domestic firms. Output is measured by sales (in constant prices). From the data we cannot compute the mark-up. However, according to the model output and mark-up should be proportional and hence move in the same direction. Results for H2 are reported in Table 5. For survivors average sales were considerably higher in 2000 compared to 2005 and 2006. The difference in means is statistically significantly different from zero, and positive, according to a t-test at error levels of less than one percent and 2.4 percent, respectively. These findings are in line with H2.

[10] A similar result is reported by Wagner (2009) in a test of a hypothesis derived from a model by Hopenhayn (1992) for the dynamics of industries with heterogeneous firms. Using plant level panel data for Germany Wagner (2009) reports that firms that exited in year t were less productive in t-1 than firms that continued to produce in t.

[Table 5 near here]

The third hypothesis, H3, states that an increase in import penetration raises the average productivity of domestic survivors. Productivity is measured by sales per employee (in constant prices). Results for H3 are reported in Table 6. In line with this hypothesis, the productivity of survivors was higher in 2005 and 2006 than in 2000. The difference, however, was small from an economic point of view and not statistically significant at any conventional level.

[Table 6 near here]

The big picture, then, is that the hypotheses derived from our model for the short run hold up empirically for the German clothing industry during the period 2000 to 2006. The increase in import penetration forced the least efficient domestic firms to exit the market, lowered the average output and raised the average productivity of domestic survivors, although the last effect is small and not statistically significant.

5 Conclusions

In this paper we developed a simple oligopoly model of an industry with heterogeneous firms and exogenous or endogenous market structure. The model yielded predictions regarding the short- and long-run adjustment of the domestic industry to increased import penetration. In line with the theoretical hypotheses for the short run the increase in import penetration in the German clothing industry forced the least efficient domestic firms to exit the market, lowered the average output and raised the average productivity of domestic surviving firms between 2000 and 2006.

Our study illustrates that a simple oligopoly model of an import-competing industry with heterogeneous firms can be used to guide an empirical study that uses firm level data to investigate the short-run consequences of rising import penetration. This kind of analysis can inform policy debates, and can help to produce insights into the consequences of globalization for import competing industries.

An open question is whether the hypotheses derived from our model for the long run hold up empirically, too. Unfortunately, the firm level data that are available to us do not cover a long enough period to tackle this question.

Another open question is whether our results are generally valid over space and time. Further research using firm level data from other countries and other periods are needed to shed light on this question. Research from such replication studies can help to proceed on the thorny road from estimation results to stylized facts.[11]

Appendix

5.1 Expected Output

The expected output of a domestic firm is

$$\widehat{q} \equiv E\left[q(c)\right] = \int_0^{\widetilde{c}} q(c)dF(c) = \frac{1}{2}\int_0^{\widetilde{c}} \left[\widetilde{c} - c\right] dF(c) \tag{17}$$

Evaluating the integral on the right-hand side of (17) by parts, and defining $\phi(c) \equiv [\widetilde{c} - c]$, we have

$$\begin{aligned}
\int_0^{\widetilde{c}} \left[\widetilde{c} - c\right] dF(c) &= \int_0^{\widetilde{c}} \phi(c) f(c) dc \\
&= \left[\phi(\widetilde{c})F(\widetilde{c}) - \phi(0)F(0)\right] - \int_0^{\widetilde{c}} \phi'(c)F(c)dc \\
&= \int_0^{\widetilde{c}} F(c)dc,
\end{aligned}$$

because $\phi(\widetilde{c}) = F(0) = 0$ and $\phi'(c) = -1$.

5.2 Long-run Effects

Total differentiation of (7), (16) yields

$$\begin{bmatrix} 2 + (n-1)F(\widetilde{c}) & \widehat{q}F(\widetilde{c}) \\ -2(n-1)\widehat{q} & -2\widehat{q}^2 \end{bmatrix} \begin{bmatrix} d\widehat{q} \\ d\widehat{n} \end{bmatrix} = \begin{bmatrix} -F(\widetilde{c}) \\ 2\widehat{q} \end{bmatrix} dM.$$

[11] We ask to please inform us about any results of replication studies of this kind.

The Jacobian determinant is $D = -4\widehat{q}^2 < 0$. Using Cramer's rule we can show:

$$\begin{aligned} \frac{d\widehat{q}}{dM} &= 0, \\ \frac{d\widehat{n}}{dM} &= -\frac{1}{\widehat{q}} < 0. \end{aligned}$$

Since $\widetilde{c} = A - (n-1)\widehat{q} - M$, we have

$$\frac{d\widetilde{c}}{dM} = -(\widehat{n}-1)\frac{d\widehat{q}}{dM} - \widehat{q}\frac{d\widehat{n}}{dM} - 1 = 0.$$

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Table 1: The Clothing Industry in Germany – Production and Imports (2000, 2005, 2006)

		Production (1,000 €; constant prices, 2000 = 100)		
WZ	Description	2000	2005	2006
1810	Leather clothes	21505	14018	15824
1821	Workwear	108488	89350	96804
1822	Other outerwear	1848534	1201246	943165
1823	Underwear	952762	521160	519544
1824	Other wearing apparel and accessories	375690	194154	208187
Total		3306976	2019928	1783524
		Imports (1,000 €; constant prices, 2000 = 100)		
WZ	Description	2000	2005	2006
1810	Leather clothes	575635	380549	387379
1821	Workwear	343855	451932	477598
1822	Other outerwear	8388101	8351133	8947524
1823	Underwear	5917061	5715892	6250010
1824	Other wearing apparel and accessories	2350095	2114676	2328617
Total		17574747	17014182	18391128
		Ratio of Imports to Production		
WZ	Description	2000	2005	2006
1810	Leather clothes	26.77	27.15	24.48
1821	Workwear	3.17	5.05	4.93
1822	Other outerwear	4.54	6.95	9.49
1823	Underwear	6.21	10.97	12.03
1824	Other wearing apparel and accessories	6.23	10.89	11.19
Total		5.31	8.42	10.31

Source: Federal Statistical Office; own calculations. WZ refers to the German classification of economic activities

Table 2: The Clothing Industry in Germany – Price index for domestic production and imports (2000 = 100) in 2005 and 2006

		Price index for domestic production (2000 = 100)	
WZ	Description	2005	2006
1810	Leather clothes	102.6	103.0
1821	Workwear	101.7	101.6
1822	Other outerwear	97.5	98.0
1823	Underwear	101.0	102.0
1824	Other wearing apparel and accessories	109.8	111.5

		Price index for imports (2000 = 100)	
WZ	Description	2005	2006
1810	Leather clothes	89.0	88.4
1821	Workwear	75.1	73.8
1822	Other outerwear	95.3	95.8
1823	Underwear	99.2	99.9
1824	Other wearing apparel and accessories	97.4	98.8

		Relation of price index for imports to price index for domestic production (2000 = 1.00)	
WZ	Description	2005	2006
1810	Leather clothes	0.87	0.86
1821	Workwear	0.74	0.73
1822	Other outerwear	0.98	0.98
1823	Underwear	0.98	0.98
1824	Other wearing apparel and accessories	0.89	0.89

Source: Federal Statistical Office; own calculations. WZ refers to the German classification of economic activities

Table 3: The Clothing Industry in Germany – Distribution of size and labor productivity

Size distribution (number of employees) in 2000

WZ	Description	Number of firms	Mean	Standard deviation	p10	p25	p50	p75	p90
18	Clothing	614	108.93	190.21	22.58	29.17	50.17	113.22	231.00
1810	Leather clothes	11	27.98	15.65	x	x	23.33	x	x
1821	Workwear	34	74.01	73.30	24.58	29.25	42.67	104.67	150.17
1822	Other outerwear	318	128.16	197.10	22.75	31.00	61.46	146.25	284.83
1823	Underwear	152	113.45	240.01	22.92	30.88	50.50	98.17	213.50
1824	Other wearing apparel and accessories	93	61.64	75.07	20.00	25.92	36.67	64.00	117.42

Distribution of labor productivity (sales per employee) in 2000

WZ	Description	Number of firms	Mean	Standard deviation	p10	p25	p50	p75	p90
18	Clothing	614	127576.7	151049.5	18661.81	36812.29	87101.82	162053.3	260051.7
1810	Leather clothes	11	109549.0	75917.4	x	x	98150.74	x	x
1821	Workwear	34	117876.2	72741.43	33714.01	61675.3	109592.7	144578.7	251211.4
1822	Other outerwear	318	144435.5	179990.6	17751.88	27311.05	94840.4	191559.9	310930.0
1823	Underwear	152	122084.5	139719.1	18898.97	37931.7	79670.1	155155.9	255593.6
1824	Other wearing apparel and accessories	93	87223.23	53685.02	25837.08	48881.58	77967.28	115658.8	155561.6

Source: Own calculations. WZ refers to the German classification of economic activities. p10 refers to the 10^{th} percentile of the distribution, etc. An x indicates that the figure is confidential.

Table 4: Results of the econometric investigation for H1: The least efficient domestic firms exit the market

Number of firms			Number of employees		
2000	2005	2006	2000	2005	2006
614	310	274	66881	33558	31420

Labor productivity (sales per employee; average) in 2000

Survivors until 2005 (N = 310)	Exits until 2005 (N = 304)	Difference between Survivors and exits	H_0: equal means H_a: difference > 0	Kolmogorov-Smirnov Test H_0: Productivity higher in survivors than in exits
153535	101106	52428	t = 4.370 p = 0.000	p = 0.997

Survivors until 2006 (N = 274)	Exits until 2006 (N = 340)	Difference between Survivors and exits	H_0: equal means H_a: difference > 0	Kolmogorov-Smirnov Test H_0: Productivity higher in survivors than in exits
160247	101248	58999	t = 4.792 p = 0.000	p = 0.997

Note: The t-test does not assume equality of variance in the two groups

Table 5: Results of the econometric investigation for H2: The output of surviving domestic firms in 2005 (2006) is lower than in 2000

Average sales per firm (in constant prices (2000 = 100))

2000 (N = 310)	2005 (N = 310)	Difference between 2000 and 2005	H_0: equal means H_a: difference > 0
2.46e+07	2.15e+07	3076428	t = 2.672 p = 0.004

2000 (N = 274)	2006 (N = 274)	Difference between 2000 and 2006	H_0: equal means H_a: difference > 0
2.59e+07	2.34e+07	2471525	t = 1.985 p = 0.024

Note: The t-test does not assume equality of variance in the two groups

Table 6: Results of the econometric investigation for H3: The average productivity of domestic survivors is higher in 2005 (2006) than in 2000

Average labor productivity (sales per employee; in constant prices (2000 = 100))

2000 (N = 310)	2005 (N = 310)	Difference between 2000 and 2005	H_0: equal means H_a: difference < 0
153535	154410	-875	t = -0.1814 p = 0.4281

2000 (N = 274)	2006 (N = 274)	Difference between 2000 and 2006	H_0: equal means H_a: difference < 0
160247	166261	-6014	t = -1.079 p = 0.141

Note: The t-test does not assume equality of variance in the two groups

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Postfach 2440
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email: brodt@leuphana.de
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