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International trade and retail market performance and structure: Theory and empirical evidence

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ABSTRACT

We use Danish microdata for the period 1999 to 2008 to examine how greater consumer goods imports affect retail market performance and structure. Based on a propensity score matching approach, we estimate that retailers that start to import have 8% greater sales, 6% greater profits, and 2% greater markups in the year of import initiation compared to non-importing retailers. These differences are quite persistent. For instance, we estimate that cumulative sales of import starters are up to 30% higher on average after three years than for comparable non-importers. We also find that imports are associated with a higher exit probability of small retailers and greater local retail market concentration. We argue that the observed adjustments may imply additional gains from trade absent from models lacking a distribution sector.

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1. Introduction

In recent decades advanced economies have experienced a sharp increase in consumer goods imports, leading to an unprecedented degree of import penetration across many consumer goods industries.² Since most of these imports pass through the retail sector, and since retailers themselves have played an active part in the rapid expansion of

consumer good trade, we ask how this growth of consumer goods imports has affected the performance of retailers and the structure of retail markets.³ Specifically, how have greater imports—more precisely the fall in trade costs behind the import growth—affected the sales, markups, and profits of retailers, and what do greater imports imply for the retail industry as a whole, including market concentration, firm exit rates, and the consolidation of retailers into retail chains?

Using Danish microdata for the period 1999 to 2008, we find that sales, profits, and markups of importing retailers exceed those of domestically sourcing firms on average by 20%, 27%, and 3%, respectively, after controlling for firm characteristics. While these results could be solely due to larger and more profitable retailers self-selecting into importing, further estimation based on propensity score matching techniques suggests that these performance differences are at least partly due to importing. Indeed, we estimate that import starters that were similar in observable characteristics to domestically sourcing firms before beginning to import exhibit 8% greater sales, 6% greater profits,

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² For instance, import penetration in the apparel market is around 94% in the United States, 95% in Germany and the UK, 85% in France, 65% in Italy, and 55% in Spain. Import penetration in the US footwear market is at 85% (Gereffi and Frederick, 2010). Average import penetration in textiles, clothing and footwear in the OECD stands at 59% (Nordås, 2008).

³ In the United States, retailers (including firms that engage in both retailing and wholesaling) represent 14% of all US importing firms and account for 9% of the total value of imports (not just consumer goods) (Bernard et al., 2010a). Direct imports by retailers account for 31% of total US imports in textiles and clothing (HS 50–63), and for 34% of total US imports of footwear (HS 64–67) (Gereffi and Frederick, 2010; Bernard et al., 2010b). In Canada the top 5% of importing retailers account for 76% of total Canadian imports of clothing, shoes, jewelry, luggage and leather goods, and for 68% of all Canadian imports of electronics and appliances (Raff and Schmitt, 2016a).

and 2% greater markups in the year of import initiation. The estimated effects turn out to be quite persistent. For instance, after three years, cumulative sales of import starters are on average over 30% higher than for comparable non-importers. Importing may increase the probability of an import starter becoming a chain or opening new shops. We find evidence for such a mechanism occurring two years after import initiation. We also find that an increase in industry-level imports is associated with higher exit probabilities of small retailers and with greater local retail market concentration. By our estimates, a 1% increase in industry-level imports raises the Herfindahl index of local retail market concentration, *ceteris paribus*, by around 0.03%. This is not a small effect, considering that average imports in the estimation sample more than doubled during the sample period and that the Herfindahl index is at a relatively high level initially.

Taken together, our results indicate an economically important role of consumer goods imports for the performance and structure of the retail industry. In particular, they help us explain observed structural changes in retailing, including the growth of big retailers and retail chains and the exit of small retailers.⁴ Our results also imply potentially significant welfare effects from the consolidation of retailing. These effects would come on top of the ones typically associated with international trade, such as gains from greater product variety or production efficiency.

The Danish microdata we use are well suited for our analysis for two reasons. First, developments in consumer goods trade and retailing in Denmark mirror those in other industrialized countries; the Danish data may thus offer a glimpse into economic mechanisms that may operate in a broader set of countries. According to the quantity index published by *Statistics Denmark*, imports of goods for household consumption increased by 75% in real terms between 1999 and 2008, compared to an increase in total real imports of 50%. In nominal terms, consumer goods imports rose by around 85%, with certain types of goods experiencing growth rates well above 100% over this period.⁵ Import shares rose across many consumer goods industries, most strongly in footwear (HS 64–67) from 65% in 1999 to 96% in 2008. Consumer goods thus spearheaded the overall increase in imports from 33% of GDP in 1999 to 51% in 2008.⁶ Retailers in Denmark, as elsewhere, have become major importers of consumer goods. In 2008, retailers in Denmark, more precisely firms that report retailing as their main activity, accounted for around 12% of all firms importing consumer goods and 14% of total consumer goods import values, with retailers' shares of imports being much higher in some of the big consumer goods industries, such as furniture, toys and miscellaneous manufactured articles (33%).

Second, the Danish data contain enough information at the firm level to allow us to deal with several conceptual and empirical challenges that are specific to the study of retail markets. One such challenge consists of identifying the geographic scope of retail markets. Competition among retailers tends to be localized simply because consumers typically do not travel long distances to go shopping (Maican and Orth, 2017). This suggests, among other things, that retail market

concentration should be measured at the local level. In our empirical analysis we use information on municipalities to identify local retail markets, and we compute local market concentration based on the shops in each local market. Another closely related problem stems from the fact that some retailers, typically the bigger ones, are organized as chains operating shops in several local retail markets.⁷ In the data, we are able to identify the shops belonging to each retail firm, and we define retailers with more than one shop as retail chains. This allows us to study the consolidation of retailers into chains and, more precisely, to determine whether greater consumer goods imports have contributed to this consolidation.

The main economic mechanism we want to explore in our analysis builds on economies of scale in direct importing, which imply that only big retailers can afford direct imports. Smaller retailers, if they have access to imports at all, have to rely on more expensive indirect imports via intermediaries.⁸ As a consequence, big retailers benefit more from a fall in trade costs than small retailers, which has consequences for the performance of individual retailers and ultimately for retail market structure and productivity. We develop this mechanism in a theoretical model of the retail industry that extends Raff and Schmitt (2012) by endogenizing the number of shops operated by a retailer and thus introducing the decision of whether to become a chain.⁹ The shop margin arises from fixed costs per shop as in the model of Basker and Van (2010a). In Basker and Van's model, cheaper imports allow a single chain retailer to expand the number of shops, forcing smaller, single-shop competitors to exit. Our main modelling contribution can indeed be interpreted as putting their mechanism of adjustment along the shop margin into an industry equilibrium model of retailing with heterogeneous firms and endogenous market structure, as is in Raff and Schmitt (2012).¹⁰

Our empirical analysis is most closely related to Basker and Van (2010b), who test whether retail industries experiencing an increase in market concentration, measured by sales growth of the four largest firms, are more likely to sell goods exhibiting an increase in imports. Using US import data at the product level, they find that, indeed, product-level imports grow especially fast when these products are disproportionately sold by industries exhibiting high sales growth of the top four firms; this effect is particularly strong for imports from China and other less-developed countries (LDCs). Like Basker and Van, we find a significant correlation between imports and retail market concentration. But since we have access to both firm-level and shop-level data,

⁴ These structural changes are economically important, because retailing is a big sector, accounting for around 10% of employment in many countries, and because these changes have been a major source of retail productivity growth and, more importantly, aggregate productivity growth in industrialized countries since the mid-1990s (see, for instance, Triplett and Bosworth, 2004).

⁵ These goods include, for instance, imports of consumer goods related to animal or vegetable fats (HS15), electrical equipment (HS84–85), transport equipment (HS86–89), and furniture and toys (HS94–98). Consumer goods are defined based on the BEC classification, which can be merged to HS six-digit product codes. Specifically, BEC product codes 112 (food and beverages, primary, mainly for household consumption), 122 (food and beverages, processed, mainly for household consumption), 522 (transport equipment, non-industrial), 61 (consumer goods not elsewhere specified, durable), 62 (consumer goods not elsewhere specified, semi-durable), and 63 (consumer goods not elsewhere specified, non-durable) are considered to be consumer goods.

⁶ As a comparison, in euro area countries this ratio rose from 30% to 39% during that period.

⁷ The consolidation of retailers into chains is an important phenomenon that we observe in Denmark and elsewhere. In Denmark, the number of chains increased from less than 800 in 1999 to more than 1200 in 2008. This is in line with observations in the United States, where large retail chains (with at least 100 establishments) doubled their share of US retail sales from 18.6% in 1967 to 36.9% in 1997 (Jarmin et al., 2009).

⁸ Significant economies of scale in direct importing activities of retailers have recently been documented by Holmes and Singer (2017) for the United States. They show that big retailers like Walmart, Target and Costco, by nature of their large import volumes, face much lower “indivisibility” costs when importing goods via containers than small retailers that typically rely on intermediaries, including freight forwarders to deal with shipping companies, and on logistics firms to manage consolidation of shipments into containers. These “indivisibility” costs consist of the cost of unused container space, the cost associated with consolidation of different shipments into a single container, and the cost associated with distorting the shipment size to fit in a standard container. Economies of scale in direct importing also stem from fixed costs of importing, including the cost of identifying and dealing with suppliers, maintaining overseas buying offices, as well as large investments in logistics, inventory management and information technology. A survey of German, Swiss and Austrian retailers by Zentes et al. (2007) suggests that these costs are very high in practice and only borne by big retailers, whereas small retailers import at most indirectly via wholesalers.

⁹ The literature on the effects of trade on retail markets has recently been surveyed by Raff and Schmitt (2016a).

¹⁰ An alternative theoretical approach is suggested by Eckel (2009). In his paper, retail market concentration is also driven by imports. But it does not come from an increase in the volume of consumer goods trade, but from a rise in the number of varieties available on the world market. As retailers expand their assortment to include more imported varieties, their fixed costs rise and they have to have greater sales, markups and operating profits to cover these fixed costs.

we can examine the differential performance of direct importers and non-importers with respect to sales, markups, profits, the probability to becoming a chain, and the exit probability, and thus go deeper into trying to uncover possible economic mechanisms driving the correlation between imports and retail market concentration. For instance, we can show that the sales growth of large, importing firms, which is taken as the exogenous variable by Basker and Van, can be partly attributed to import activity.

By showing how trade can help explain observed changes in retail market performance and structure, our paper complements studies that have focused on technology adoption as a driver of retail market changes.¹¹ Our paper can further be seen as complementing the study by Holmes and Singer (2017), which examines how retailers respond to greater direct imports of consumer goods by altering the geographic structure of their import distribution.¹²

Finally, given the focus of international trade research on the manufacturing sector and the dearth of studies on the service sector in general and on retailing in particular, we want to point out how our paper compares to the more familiar research on the effects of trade exposure on manufacturing. An obvious difference regarding the effect on firm performance is that retail services are traditionally non-tradable, so that retailers typically do not face import competition and do not export. In fact, we argue that retailers typically even face very little interregional competition. At least in our sample period, retail sales not in stores (i.e. over the internet, by mail order, etc.), where import competition and exports are most likely to arise, are very low, and we exclude them from the analysis. The trade exposure of retailers in our study therefore mostly comes from the goods they import. The performance effects we measure for retailers are therefore best compared to the effects on manufacturers stemming from the import of intermediate goods (see, for instance, the recent studies of De Loecker et al. (2016) and Brandt et al. (2017) on the markup and productivity effects from reductions in input tariffs).

The rest of the paper is organized as follows. In the next section, we present our theoretical framework and derive testable hypotheses about the effect of trade on retail markets. In Section 3, we describe the data, discuss sample selection, and provide descriptive evidence. In Section 4, we outline the empirical approaches for testing each hypothesis and present the corresponding results. Section 5 concludes by discussing what our results imply for social welfare. Proofs and summary statistics are presented in the Appendix. An Online Appendix contains supplementary material, including details on the estimation of markups, the derivation and empirical analysis of additional hypotheses, and further estimation results.

2. Theoretical framework

In this section, we present a simple partial equilibrium model of a retail industry, in which retail firms differ in terms of their productivity and in which the number of retail firms and the number of shops each firm operates across different local retail markets are endogenously determined. We use this model to formulate testable hypotheses about how a reduction in trade costs affects retailer performance and the structure of retail markets.

¹¹ See, for instance, Holmes (2001), Basker et al. (2012), and Lagakos (2016). Foster et al. (2016) provide a recent survey of the literature, looking mostly at technology-driven changes in retailing. Another potential driver of these changes is entry by multinational retailers (see Atkin et al., 2018).

¹² Our paper is also indirectly related to the empirical literature on exchange rate pass-through into retail prices (see, for instance, Antoniadis and Zaniboni, 2016). This literature has recognized that the retail margin (i.e. costs of retailing and retailer markups) is a major factor in explaining why changes in import prices are only incompletely passed through to retail prices. Antoniadis and Zaniboni, in particular, find that pass-through varies systematically by retailer size. We differ from this (short-run-oriented) literature in that we study the effects of imports in the long term, where markups and retail market structure are endogenously determined.

2.1. The model

Consider a country divided into R local retail markets. Each active retail firm has at least one and at most R shops, i.e. no more than one per local retail market. A firm with more than one shop, and hence operating in more than one local retail market, is called a retail chain.

Consumer preferences in each local market follow the 'random preference Hotelling' framework of Innes (2006).¹³ We therefore assume that, in local market $r = 1, \dots, R$, there is a measure L_r of consumers uniformly distributed around a circle of unit circumference. Each consumer visits a shop to purchase one unit of an aggregate consumption good and faces a linear transport cost τ per unit of distance to visit the shop. There are n_r shops located symmetrically on the circle. Preferences are random in the sense that each ordering of the n_r shops among the n_r locations is possible and occurs with the same relative frequency. A simple interpretation of these preferences is that, when choosing where to shop, a consumer chooses only between the two nearest shops, as in a standard address model, but the identity of the two shops depends on an unobserved, random event.¹⁴

We assume, for simplicity, that local markets are symmetric, and therefore drop the subscript identifying the local market. The aggregate demand q_i faced by shop i can then be shown to be linear in prices, where $q_i(p_i) = \frac{L}{n} - \frac{\tau}{n} p_i + \frac{1}{n-1} \frac{\tau}{n} \sum_{h=1, h \neq i}^n p_h$. We make the additional assumption that n is large enough so that demand can be approximated by:

$$q_i(p_i) = \frac{L}{n} - \frac{\tau}{n} p_i + \frac{L}{n} \bar{p}, \quad (1)$$

where \bar{p} is the average local retail price.

Now consider the level of the firm. To enter the market, a firm incurs a sunk cost F_E , which includes the cost of setting up one shop. After entering, each firm learns its marginal retail cost c (or productivity $1/c$), which applies to all the shops it operates. The distribution of c is denoted by $G(c)$ with support on $[0, c_M]$. We let productivity follow a Pareto distribution, so that the cumulative distribution function for c is:

$$G(c) = \left(\frac{c}{c_M} \right)^k, \quad (2)$$

with $k \geq 1$.

Imports are decided at the firm level. Economies of scale in importing arise because direct importing involves a fixed cost F_I , which includes the cost of maintaining overseas buying offices and cooperating with foreign partners to source goods, the cost of information technology needed to manage complex international sourcing operations, etc. Upon entry, each firm has to decide whether to source the aggregate consumption good domestically (which may include imports sourced indirectly through wholesalers) or to rely on direct imports.¹⁵ Purchasing the good domestically is associated with a cost of w per unit. If the firm relies on direct imports, the unit cost of the good is $t < w$, where t also includes transport and other costs associated

¹³ An alternative specification, more familiar to trade economists, would be to assume linear quadratic preferences as in Melitz and Ottaviano (2008). See also Raff and Schmitt (2012) for the use of these preferences. Which preference specification is used makes no difference to our hypotheses. We use the current specification to obtain a better microfoundation for consumer demand so that it becomes easier to discuss the possible welfare consequences of our results.

¹⁴ Each shop therefore competes not just with its neighbors on the circle, but with all other local shops. This assumption is important because it allows us to derive a free-entry equilibrium in which shops have different costs, which would not be feasible in a standard address model.

¹⁵ This assumption is not restrictive, since the aggregate consumption good can be interpreted as a composite good consisting of purely domestic goods and goods that may be either imported directly or sourced domestically. See Raff and Schmitt (2012) for details.

with international trade; for simplicity, we refer to t below as the trade cost.

Another decision taken upon entry at the firm level concerns whether to become a chain and, more precisely, how many shops to operate. We assume that each additional shop beyond the one set up when the firm enters the market involves a fixed cost F_S .

The retail industry is monopolistically competitive. At the local market level, this implies that each shop, respectively firm, takes the number of active shops in the market, n , and the average local retail price, \bar{p} , as given when setting its price. A shop i belonging to a firm with marginal cost c obtains an operating profit of:

$$(p_i - c - x)q_i(p_i), \quad (3)$$

where $x = w$ if the firm relies on domestic sourcing, and $x = t$ if the firm is a direct importer. Using superscript D to indicate domestic sourcing, I to indicate importing, and defining $c_D \equiv \tau/n + \bar{p} - w$, a shop with marginal cost c has the following profit-maximizing prices and sales when goods are sourced domestically or imported, respectively:

$$p^D(c) = c + w + \frac{1}{2}(c_D - c); \quad (4)$$

$$p^I(c) = c + t + \frac{1}{2}(c_D - c + w - t); \quad (5)$$

$$q^D(c) = \frac{L}{2\tau}(c_D - c); \quad (6)$$

$$q^I(c) = \frac{L}{2\tau}(c_D - c + w - t). \quad (7)$$

hence c_D represents the marginal cost at which a shop belonging to a firm sourcing domestically optimally chooses zero sales and thus to be inactive, i.e. $q^D(c_D) = 0$.

A shop with marginal cost c earns an operating profit equal to:

$$\pi^D(c) = \frac{L}{4\tau}(c_D - c)^2, \text{ or} \quad (8)$$

$$\pi^I(c) = \frac{L}{4\tau}(c_D - c + w - t)^2, \quad (9)$$

depending on whether the firm relies on domestic sourcing or importing. Only shops belonging to firms with marginal costs less than or equal to c_D will remain active because only they will be able to cover their marginal cost.

The decisions of whether to import and how many shops to operate are obviously interdependent: a chain, for instance, is able to spread the fixed cost of importing across its shops and thus more likely to import than a single-shop firm. To avoid confronting the reader with a plethora of cases involving different shop-importing combinations, we make several assumptions, described below, to ensure that only firms that are productive enough to import will want to operate more than one shop. As we will show below, this captures the empirically most relevant case.

The firm that is just indifferent between domestic sourcing and direct importing is then a single-shop firm for which $\pi^D(c) = \pi^I(c) - F_I$. This condition defines a critical value of the marginal cost c_I :

$$c_I = c_D + \frac{(w-t)}{2} - \frac{2\tau F_I}{L(w-t)}, \quad (10)$$

such that firms with $c \leq c_I$ prefer importing and firms with $c > c_I$ prefer domestic sourcing. We assume that $c_I < c_D$ so that the least efficient active firms engage in domestic sourcing; sufficient conditions are given in the Appendix.

How many shops will an importing firm operate? Since, by assumption, local markets are symmetric and the fixed cost of each additional shop is constant, the answer is straightforward, namely either a single shop or R shops – one in each local market. In particular, an importing firm is indifferent as to whether to open an additional shop if $\pi^I(c) = F_S$. Denote the marginal cost at which this condition is satisfied by c_S . Since we require that $c_S < c_I$ so that, as already discussed above, only importing firms become chains, the only admissible solution is:

$$c_S = c_D + w - t - 2\sqrt{\frac{\tau F_S}{L}}. \quad (11)$$

Sufficient conditions to ensure $0 < c_S < c_I$ are given in the Appendix.

The three cut-off values of the marginal cost, c_D , c_I and c_S , define four categories of firms. The most productive firms, i.e. those with marginal cost $c \leq c_S$, import directly and operate as chains; firms whose marginal cost is in the interval $c_S < c \leq c_I$ import directly but operate only a single shop; firms in the interval $c_I < c \leq c_D$ are also single-shop firms but do not import directly; and firms with high marginal costs ($c > c_D$) are inactive.

To close the model, consider the entry decision firms face before observing their marginal costs. Firms enter the retail industry until their expected profits are zero:

$$\begin{aligned} & \int_0^{c_S} [R\pi^I(c) - (R-1)F_S - F_I] dG(c) + \int_{c_S}^{c_I} [\pi^I(c) - F_I] dG(c) \\ & + \int_{c_I}^{c_D} \pi^D(c) dG(c) - F_E \\ & = 0. \end{aligned} \quad (12)$$

2.2. Testable hypotheses

In this subsection, we examine the comparative statics of the model with regard to changes in the trade cost t and formulate corresponding hypotheses; all proofs are in the Appendix. We start by checking how the cut-off value c_D changes with t . Applying the implicit function theorem to the zero-profit condition, Eq. (12), allows us to show that $dc_D/dt > 0$. This implies the following hypothesis:

Hypothesis 1. A reduction in the trade cost forces the least efficient firms to become inactive.

The intuition for this effect is straightforward. A reduction in the trade cost, *ceteris paribus*, raises the profits of direct importers whether they are single-shop firms or chains. To hold expected profits at zero, c_D has to decrease so as to lower the probability of being an active firm.

The sign of dc_I/dt can now be obtained from Eq. (10). We find that $dc_I/dt < 0$, which implies that a trade cost reduction induces some firms that were previously not productive enough to afford the associated fixed cost to switch to direct importing. In particular, it is the most productive non-importers that self-select into importing directly. Hence, we may state:

Hypothesis 2. A reduction in the trade cost induces the most productive non-importers to switch to importing directly.

What does a fall in the trade cost imply for firm performance? Holding fixed the number of shops a firm operates, we can show that the sales of direct importers rise, and so do markups because, as can be seen in Eq. (5), importers pass only half of what they save on trade costs on to consumers. In fact, this direct effect on markups dominates the indirect effect stemming from an increase in the price elasticity of demand induced by a lower c_D . Hence the profits per shop of importers rise. Firms that do not import directly experience increased pressure on their markups from the rise in the price elasticity of demand, but obviously do not enjoy any offsetting cost savings. This forces them to cut

their markups and sales, which leads to lower profits.¹⁶ These effects can be summarized as follows:

Hypothesis 3. A reduction in the trade cost (i) raises the sales, markups and profits per shop of firms that engage in direct imports; and (ii) lowers the sales, markups and profits of firms that do not import directly.

Hypothesis 3 thus points to a starkly different performance of importing and non-importing firms following a trade cost reduction. A potential strategy for testing this hypothesis is to focus on firms that switch to direct importing. While **Hypothesis 2** suggests that part of the performance difference between import starters and non-importers is due to self-selection of larger, higher markup, and therefore more profitable firms, into importing, **Hypothesis 3** indicates that import starters should experience an additional boost to their performance caused by their access to cheaper direct imports.

The next hypothesis is associated with the sign of dc_S/dt and thus with the effect of a trade cost reduction on the consolidation of retailers into chains. Since $dc_S/dt = dc_D/dt - 1$, a marginal change in t has two effects on c_S . The direct effect is negative: a reduction in the trade cost raises the profit that a direct importer can earn in each local market and thereby allows some firms to cover the fixed costs associated with operating additional shops and thus becoming a chain that were previously unable to do so; therefore c_S rises. The indirect effect comes from the zero-profit condition and is positive: a reduction in t reduces c_D and thus lowers the probability of being active, which tends to lower c_S . The direct effect dominates so that we may state:

Hypothesis 4. A reduction in the trade cost induces the most productive single-shop firms to add shops and become chains.

Finally, we can examine how a reduction in the trade cost, by changing the marginal-cost cutoffs and the performance of individual firms, affects the aggregate performance of the retail industry and the structure of local retail markets. Market concentration in a setting in which firms differ in their marginal costs, and the shops they operate therefore differ in sales, is negatively related to the number of shops n , but positively related to the coefficient of variation of retail sales, σ_q/\bar{q} . This can be seen when writing the Herfindahl index (H) of local market concentration as follows (see [Waterson, 1984](#)):

$$H = \frac{1 + \sigma_q^2/\bar{q}^2}{n}. \quad (13)$$

The effect of a lower trade cost on the Herfindahl index is therefore generally ambiguous, simply because even if trade leads to a fall in the number of shops, this may be accompanied by a fall in the coefficient of variation of local retail sales.¹⁷ The question of how a lower trade cost affects local market concentration in retailing can therefore only be answered empirically.

3. Data

3.1. Data sources

For our empirical analysis, we use data on retail firms present in Denmark between 1999 and 2008.¹⁸ Specifically, we make use of three data sets available from *Statistics Denmark*. The first data set, *FIRM* (generel firmastatistik), covers the population of firms active in

Denmark and contains information on industry affiliation, number of employees, and other firm characteristics, such as turnover, value added, profits, and fixed and total assets.¹⁹

The second data set, called *UHDI* (udenrigshandel diskretioneret), provides information on individual firms' export and import activities at a detailed product level and by partner country. The data fall into two categories: Intrastat (for trade among EU member states) and Extrastat (for trade with countries outside the EU). Extrastat data come from custom forms and tax authorities and cover nearly all trade, while Intrastat data are self-reported figures by Danish firms that exceed certain export and import thresholds set by the EU.²⁰

The third data set, *IDAS* (IDA arbejdsstede), contains information at the level of the branch which, in the case of retail firms, is usually a shop. The data set includes information about the location of a branch and the individuals working there. We use this information to identify local retail markets and to compute Herfindahl indices for these markets. We also use it to compute the number of shops by retail firm so that we can investigate potential adjustments of retail firms to trade along the shop margin.

Thanks to a unique firm identifier, we can merge the information present in each of the data sets mentioned. Whereas *FIRM* includes the population of active firms and *UHDI* contains information on international trading activities of firms in Denmark subject to rather small reporting thresholds, the data set *IDAS* does not include all firms present in *FIRM*. In the next subsection, we describe in more detail how we constructed the data sets used for the empirical analysis.

3.2. Sample selection

Based on the industry affiliation documented in *FIRM*, we identify all firms that report retailing as their main activity.²¹ *Statistics Denmark* reports the industry affiliation at the six-digit level, where the first four digits correspond to the NACE four-digit classification. Generally, the NACE four-digit level appears most appropriate to define a retail industry.²² However, in case of the sector "other retail sale in specialized stores" (5248), the four-digit classification is too broad, as it masks the large heterogeneity of retailer firms belonging to this industry (e.g. jewelry, sports equipment, toys, bicycles, electronics). Hence, for this industry we use a more detailed industry definition.

We drop a few retail industries from our sample where the economic mechanisms we want to examine are likely to be absent, e.g. because direct importing is rather infrequent, which is the case for NACE rev. 1 three-digit industry 522 (retail sale of food, beverages and tobacco in specialized stores), 525 (retail sale of second-hand goods in stores), 526 (retail sale not in stores), and 527 (repair of personal and household goods), or because the industry is heavily regulated, which is the case for industry 523 (retail sale of pharmaceutical and medical goods, cosmetic and toilet articles).²³ In total, we thus retain 24 retail industries in our analysis.²⁴

¹⁹ We deflate firm-level domestic sales, value added and wages using the consumer price index with 2000 as the base year.

²⁰ For instance, in 2002, the thresholds were DKK 2.5 million for exports and DKK 1.5 million for imports. The thresholds are set each year for imports and exports separately in order to ensure coverage of 95% and 97% for imports and exports, respectively.

²¹ We therefore do not consider firms with main activities in other industries but which potentially have branches engaging in retailing.

²² For instance, the industry retail sale of clothing (four-digit sector 5242) is further broken down into the six-digit sub-industries retail sale of ladies' clothing, retail sale of men's clothing, retail sale of men's and ladies' clothing, and retail sale of baby articles and children's clothing. Hence, at least the former three sub-industries overlap, which makes it difficult, for example, to compute the Herfindahl index.

²³ The number of excluded firms decreases over the sample period from more than 7000 in 1999 to less than 6000 in 2008; their share in total retail firms' imports also decreases during that time from 9% to 7%, while their share in total retail firms' sales remains relatively stable at around 13%.

²⁴ The Online Appendix lists these industries.

¹⁶ These firms are single-shop firms by assumption. But obviously these results would hold at the shop level, even if the firms were chains.

¹⁷ We present hypotheses and corresponding empirical results regarding the effect of a trade cost reduction on average retail productivity and markups (**Hypothesis 5**), on the number of shops in a local market, n (**Hypothesis 6**), and on the mean, \bar{q} , and variance of shop-level sales, σ_q^2 (**Hypothesis 7**) in the Online Appendix.

¹⁸ In order to accommodate a lag structure further described below, we also make use of information for the years 1997 and 1998.

The empirical analysis is conducted at two different levels of observation. At the first level, the firm is the unit of analysis, and we investigate firms' adjustments related to direct importing of consumer goods.²⁵ At the second level, we examine how aggregate indices of retail market structure, most notably the Herfindahl index, respond to consumer goods imports. For this purpose, we require a retail market demarcation that is not only based on industry affiliation, but also on the geographic scope of the market.

We define the geographic scope of a retail market to be a municipality. Foged and Peri (2015, p.12) find that, in Denmark, "municipalities are, even in the long run, rather self-contained labor markets." If workers on average seek employment only within their own municipality, it seems plausible to assume that this is also where they go shopping. But this raises three data-related issues. First, in 2007, a new demarcation of municipalities was introduced in Denmark that reduced the number of municipalities from more than 270 to 98. Most of the old municipalities are linked to only one new municipality. However, for a few old municipality codes, there is no one-to-one correspondence to new codes. We deal with this issue by forming some larger regional groups in order to concord the municipality codes over time. We end up with 85 regions that we use to define local retail markets.

Second, we have to deal with multi-shop firms. While we observe the location, the number of employees and the wage bill at the shop level, information on sales, for example, is only available at the firm level. In the case of multi-shop firms, we therefore need to distribute firm-level sales across shops based on a weighting scheme. Given the information available in IDAS, we use the share of a shop's employment in a firm's total employment as weight.

Third, we face the problem that some active firms present in *FIRM* cannot be merged to *IDAS*, implying that for these firms we do not observe information at the level of the shop. Hence, these firms are excluded from the analysis whenever shop-level information is required, as is the case in the analysis of local retail market structure. This issue concerns in particular the two NACE four-digit industries 5211 (retail sale in non-specialized stores with food, beverages or tobacco predominating) and 5212 (other retail sale in non-specialized stores) for the years 1999 to 2001. We thus exclude these industries during this period from the analysis of local retail market structure. For the remaining industries, we can merge firms that account for around 95% of retail sales in every year. Tables 12 and 13 in the Appendix present summary statistics for variables used in our analysis.

3.3. Descriptive evidence

Table 1 presents a number of aggregate indicators by year for the retailers in our sample. Column (i) indicates that retailers accounted for an important share of firms importing consumer goods and that this share remained relatively constant during the sample period at around 12%.²⁶ Retailers also mattered with respect to the intensive margin of consumer goods imports and this involvement increased over time. As indicated by column (ii), the share of imports by retailers in total consumer goods imports increased from 9.1% in 1999 to 13.8% in 2008. Indeed, for certain product categories, retailers accounted for a much larger share of consumer goods imports.²⁷

²⁵ Note that we clean the data by dropping observations with implausible values for key variables (e.g. negative sales) and by removing outliers in terms of the labor productivity distribution, defined as observations that deviate from median by more than five times the standard deviation. Moreover, we clean dependent variables such as sales, profits or markups by dropping observations if the year-on-year growth rate of the respective variable deviates by more than five times the standard deviation from the median.

²⁶ Over the sample period, consumer goods on average account for almost 80% of total imports of our retail firms.

²⁷ For instance, in 2006, retailers accounted for 23% of imports of wood and articles of wood (HS 44–46), 20% of imports of raw hides and skins, leather and articles thereof (HS 41–43), 33% of imports of furniture, toys, and miscellaneous manufacturing articles (HS 94–96), and 39% of imports of art and antiques (HS 97–99).

Between 1999 and 2008, we observe an increase in average retail sales per firm from DKK 10 million to DKK 11.5 million (column iii). This increase is entirely due to direct importers whose average sales surged by almost 30%, while those of other retailers decreased by more than 15% during that period. At the same time, the share of direct imports of consumer goods in total retail sales more than doubled from 3.5% in 1999 to 7.7% in 2008 (column iv). Moreover, average imports by directly importing retailers rose by more than 60% (column v). This latter development occurred despite a significant increase in the share of directly importing retailers which rose from 7.2% to 11.0% (column vi).²⁸

Finally, in order to get an idea about the degree of retail market concentration and how it has changed over time, the last column of Table 1 presents the development of the aggregate Herfindahl index computed as the sales-weighted average of the indexes in local retail markets.²⁹ The aggregate index remains relatively constant over time at around 0.24.

Table 2 presents additional information about the role of retail chains during the sample period, where a chain is defined as a firm that has more than one shop.³⁰ First of all, we see that the number of chains increased considerably during the sample period (by more than 60%). Moreover, we can observe that these firms are quite distinct since, despite constituting a relatively small group, they account for 64% of total retail turnover in 2008 (up from 56% in 1999). These firms also play a crucial role when it comes to importing; one in four chains imports directly, and, in total, chains account for around 90% of total direct imports by retailers. Furthermore, it is worth noting that there is substantial heterogeneity across chains. While the median chain only has two shops, there is also a small number of chains with well above 100 shops. Indeed, when only focusing on chains with at least ten shops, then these chains alone account for 50% of total retail turnover in 2008.³¹

Table 3 underlines these points by distinguishing retail firms according to their import and chain status. This results in a sorting in terms of average size which is quite plausible also with respect to our theoretical model. In particular, we find that importing chain retailers are by far the largest firms in terms of average sales and number of employees, followed by non-importing chains and importing single-shop firms. Moreover, we observe that average imports by chain retailers that import directly exceed those of single-shop importers by a factor in excess of 30. Similarly, according to these numbers, the probability of a chain store importing amounts to more than 25%, while that of single-shop firms lies below 10%. Overall, these results thus suggest a relationship between firm performance and import activity, which we will further analyze below.

4. Empirical analysis

The hypotheses derived from the theoretical model imply a different performance of importing and non-importing firms in response to lower trade cost that translates into structural change in the industry and, in particular, in local retail markets. In this section, we empirically test the hypotheses. For each hypothesis, we first lay out the empirical approach for taking it to the data, and then present the results. Further note that we use the approach by De Loecker and Warzynski (2012) in order to obtain measures of markups that vary across firms and time; we refer the reader to the Online Appendix for details about the estimation approach and its empirical implementation.

Notice that, since we cannot measure trade cost directly, we test the hypotheses indirectly by assuming that the observed increase in import activity during the sample period, documented in Table 1, is at least in

²⁸ Note that the total number of retail firms remained rather constant over time.

²⁹ The Herfindahl index is computed according to Eq. (13) for local retail markets. Note that retail sectors 5211 and 5212 are excluded from these averages for the reason described in Section 3.2.

³⁰ The information in this table is based on firms that are present both in *FIRM* and *IDAS*.

³¹ Note that a firm with ten shops corresponds to the last decile of the shop distribution across all chains.

Table 1
Retail firms over time.

	i	ii	iii	iv	v	vi	vii
	Share of retail firms in total importing firms	Share of imports by retail firms in total imports	Average sales	Share of imports in sales	Average imports of importing firms	Share of importing firms	Herfindahl index
1999	12.2	9.1	10.0	3.5	4.9	7.2	0.24
2000	11.9	9.2	10.1	4.0	5.6	7.2	0.24
2001	11.9	8.9	10.3	4.0	5.8	7.0	0.25
2002	11.6	7.5	10.6	3.4	4.2	8.7	0.25
2003	12.1	8.6	10.3	4.1	4.5	9.5	0.25
2004	12.4	9.6	10.6	4.4	4.8	9.8	0.25
2005	12.7	10.9	10.7	5.4	5.7	10.2	0.24
2006	12.5	13.5	11.0	7.0	7.5	10.4	0.24
2007	12.6	13.7	11.5	7.7	8.0	11.0	0.24
2008	12.2	13.8	11.5	7.7	8.1	11.0	0.24

Notes: Sales and import values in million DKK in prices from 2000. The Herfindahl index is computed as the weighted average across local retail markets (weights are a market's yearly sales share). Imports refer to consumer goods imports.

Table 2
Retail chains over time.

	i	ii	iii	iv
	No. of chains	Share in retail sales	Share of importers	Share in retail imports
1999	769	55.7	25.7	87.5
2000	822	57.5	23.5	86.9
2001	853	58.1	21.9	87.4
2002	896	63.8	25.6	86.5
2003	917	62.6	25.3	88.3
2004	997	62.1	26.3	88.4
2005	1075	64.4	26.3	89.5
2006	1146	64.1	25.8	90.8
2007	1096	64.2	27.6	91.1
2008	1264	64.1	23.6	92.3

Notes: Table is based on firms present in the data sets *FIRM* and *IDAS*. A chain is defined as a firm with at least two shops. Imports refer to consumer goods imports.

part driven by a trade cost reduction. Throughout the empirical analysis, we focus our attention on imports from countries outside the EU15 for two main reasons. First, a significant trade cost reduction during the time period under investigation likely occurred through enhanced trade integration with respect to these markets; we therefore use “trade cost reduction” and “trade integration” interchangeably.³² Second, by excluding EU15 economies we largely avoid data issues related to reporting thresholds (see section 3.1) and potential biases that could arise from intra-firm trade of multinational retailers headquartered in Sweden or Germany, for example.

4.1. Import activity and firm performance (H2 and H3)

According to Hypothesis 2, a decrease in the trade cost induces larger, higher markup and therefore more profitable retailers to self-select into importing. Moreover, Hypothesis 3 suggests that increased trade integration enhances these performance differences. Specifically, sales, profits, and markups of importing firms should increase, while those of non-importing firms should decrease.

4.1.1. Empirical approach (H2 and H3)

As a first step, we estimate import premia regressions while controlling for other firm-level characteristics. Specifically, we estimate the following model:

$$y_{it} = \beta_0 + \beta_1 DIMP_{it} + \beta_2 x_{i,t-1} + \alpha_{st} + \alpha_i + \varepsilon_{it}, \quad (14)$$

where $DIMP_{it}$ is a dummy variable taking a value of one, if firm i imports

³² Examples of increased trade integration include the EU enlargement towards the East in 2004 and China's accession to the WTO in 2001.

Table 3
Direct imports by chain and single-shop retailers (in 2005).

	i	ii	iii	iv
	Mean domestic sales	Mean employees	Mean imports	No. of firms
Chain - importer	330.4	169.4	33.0	274
Chain - no importer	37.5	22.8	0.0	779
No chain - importer	8.2	4.9	1.1	941
No chain - no importer	6.5	4.0	0.0	8534

Notes: Data refer to retail firms with at least one employee that were active in 2005 and present in the data sets *FIRM* and *IDAS*. Columns i and iii in million DKK. Imports refer to consumer goods imports.

consumer goods from at least one non-EU15 market in year t , and it is zero for firms not importing from these markets³³; y_{it} measures the logarithm of the outcome of interest, namely sales, profits, or markups, while $x_{i,t-1}$ controls for firm size (number of employees)³⁴; α_{st} are sector-year dummies, implying that we are comparing importing and non-importing firms within sector-year pairs. In some specifications, we also include firm fixed effects, α_i , in the regressions so that the coefficient of interest, β_1 , is identified by firms experiencing a change in their import status.

Remember that both Hypothesis 2 and Hypothesis 3 suggest that importing firms perform better than non-importers, implying a positive sign for β_1 . However, the explanations for a positive coefficient differ. According to Hypothesis 2, β_1 should be positive because of self-selection, whereas Hypothesis 3 indicates that performance differences may also be caused by firms' import activities due to access to cheaper products. While regressions based on Eq. (14) therefore provide first insights into differences between importing and non-importing firms, these regressions provide no indication of causality.

We try to address this issue by taking our cue from studies investigating the relationship between exporting/importing and the performance of manufacturing firms.³⁵ To this end, we focus on retail firms that start importing. Specifically, we define a dummy variable, $START_{it}$, that equals one for firms that import in period t , but do not import in periods $t-1$ and $t-2$, while it takes on zero for firms that do not import during all three years. We then investigate the self-selection hypothesis by testing whether import starters perform better than non-importers before the import event occurs. More precisely, we run the following

³³ Hence, the comparison group comprises firms that source domestically only and those that also source from EU15 markets.

³⁴ Note that controlling for the log of the number of employees implies that we restrict the analysis to firms with at least one employee.

³⁵ See, for instance, De Loecker (2007) or the survey by Wagner (2007). More recently, Smeets and Warzynski (2013) present an investigation relying on similar methods that links both exporting and importing to the performance of manufacturing firms.

regression:

$$y_{i,t-1} = \beta_0 + \beta_1 START_{it} + \beta_2 x_{i,t-1} + \alpha_{st} + \varepsilon_{it}. \quad (15)$$

The differences compared to Eq. (14) are that we regress a lagged performance measure ($y_{i,t-1}$) on a dummy variable indicating import starters ($START_{it}$). Hence, β_1 now informs us whether import starters already differ from non-importing firms one period before the import event occurs, as suggested by Hypothesis 2.

Investigating Hypothesis 3, which suggests a causal relationship between importing and retail firm performance, is somewhat more involved. One way to identify this relationship would be to use instruments for firm-level imports. However, off-the-shelf instruments available from the literature turn out to perform unconvincingly in our application.³⁶ We therefore resort to propensity score matching (PSM) techniques. In particular, we try to identify the causal effect by again focusing on import starters and then applying PSM in order to create a control group of firms that do not import but exhibit a statistically similar propensity to start doing so for each import starter.

Notice, though, that using PSM implies a dissonance with the theoretical model. In the model, a firm's productivity draw uniquely determines whether or not it imports. Hence, strictly speaking, the model does not support the existence of a control group of firms with the same observed productivity that do not import. To address this dissonance, we follow Bombardini et al. (2017) by implicitly assuming that firms are heterogeneous also with respect to the fixed costs of importing and that these costs are not perfectly correlated with productivity.³⁷ Aspects other than productivity which could determine a firm's fixed costs of importing may, for instance, be related to its managerial expertise and the competencies of the purchasing and legal departments.³⁸

Keeping this implicit assumption in mind, we let the variable $START_{it}$ thus act as a treatment dummy, and we are interested in the difference between y_i^1 and y_i^0 , where y_i denotes again the performance of firm i , and the superscripts 1 and 0 indicate the firm's treatment status. More formally, we wish to compute the average treatment effect on the treated defined as:

$$E[(y^1 - y^0) | START = 1] = E[(y^1) | START = 1] - E[(y^0) | START = 1]. \quad (16)$$

The fundamental evaluation problem inherent in Eq. (16) stems from the fact that we do not observe the counterfactual outcome $E[(y^0) | START = 1]$, i.e. the expected performance of an import starter had it not switched to importing. A strategy for addressing this problem involves the assumption that, conditional on a set of observable firm-level characteristics that are unaffected by importing, potential outcomes are independent of treatment. The latter is usually referred to as the conditional independence assumption, which implies that selection into treatment is driven by observable covariates. Intuitively, we try to construct a group of comparison firms that are as close as possible to the treated firms in terms of their propensity to start importing. To this end, we follow the insights presented by Rosenbaum and Rubin (1983, 1985) and apply PSM.³⁹

³⁶ We experimented with some potential candidate variables (e.g. a country's world export supply as in Hummels et al., 2014), but the instruments generally turned out to be rather weak. Part of the problem appears to be specific to an analysis of retail firms because these firms significantly increased the number of imported varieties during the period under investigation, while the instruments proposed in the literature usually work for the intensive rather than the extensive margins of trade.

³⁷ See Bombardini et al. (2017) for a more detailed discussion, and Helpman et al. (2017) for an explicit modelling of a firm-specific shock to the fixed cost of exporting.

³⁸ For instance, Meinen et al. (2018) present evidence for the role of managerial expertise in explaining the export success of manufacturing firms in Denmark.

³⁹ Caliendo and Kopeinig (2008) present an overview of propensity score matching techniques.

The first stage of the matching approach involves estimating the probability of starting to import:

$$P(Start_{it} = 1) = \Phi\{z_{i,t-1}\}, \quad (17)$$

where $\Phi(\cdot)$ is the normal cumulative distribution function, indicating that we employ a probit model; $z_{i,t-1}$ contains firm-level control variables lagged by one year, i.e. one period before import initiation. In particular, $z_{i,t-1}$ includes measures of productivity (value added per employee) and size (number of employees and total assets), since both factors are commonly associated with firms engaged in international trade.⁴⁰ Moreover, we condition on lagged sales growth and a firm's wage share in total sales. The former variable is meant to capture firms' cyclical positions, while the latter variable is a rough measure of profitability. Note that we also include a quadratic productivity term to allow for potential nonlinearities. Finally, we add four-digit NACE industry and year dummies to the probit regressions.

The second step of the matching approach involves the search for a control group that is similar to the treated firms according to the propensity score estimated by the probit model. In particular, we apply radius matching with a tight caliper and impose common support to ensure that the balancing property holds.⁴¹ In other words, for each treated firm, we search for a control group that consists of non-importing firms that differ in terms of the propensity score by no more than a pre-specified maximum distance (i.e. a caliper of 0.001).⁴² We can then compute the average treatment effect on the treated (ATT) as:

$$ATT = \frac{1}{N} \sum_i \left(y_i^1 - \sum_{j \in C_i} w_{ij} y_j^0 \right), \quad (18)$$

where N refers to the number of treated firms, C_i to the set of control firms matched to each treated firm $i = 1, \dots, N$, and w_{ij} is a weight such that $w_{ij} = \frac{1}{N_i^c}$ if $j \in C_i$ and zero otherwise, with N_i^c denoting the number of control firms. Below, we compute ATTs for levels of the performance measures indicated by Hypothesis 3. We also consider alternative variable transformations, and investigate the effects at various time horizons. To be precise, besides level effects, we also consider responses of log changes. Importantly, computing an ATT from differences in outcome variables effectively combines propensity score matching with difference-in-differences estimations. Indeed, Smith et al. (2005) deem such a strategy especially appealing. While the approach still relies on the assumption of "selection on observables", taking differences accounts for potential biases related to time-invariant firm characteristics. We thus also consider the change in outcomes computed as the difference between post-treatment and pre-treatment log levels.

Moreover, we compute the treatment effects at various time horizons relative to the treatment year. Assuming that the import event occurs in period $p = 0$, we generate ATTs for the periods $p = -2, \dots, 0, \dots, 3$. Computing ATTs for pre-treatment periods functions as a placebo test. In other words, prior to treatment, we would expect that firms differ neither in terms of the control variables (as confirmed by the balancing tests) nor the outcome variables. Moreover, analyzing the ATTs at various post-treatment periods allows us to investigate the persistence of the effects. We note, though, that this type of analysis implies a more

⁴⁰ Note that the productivity measure is prone to the caveat that, especially in smaller retail firms, the owner (and potentially family members) may be an important part of a firm's workforce without being counted as an employee. This variable therefore tends to overestimate productivity in such instances.

⁴¹ We present information about the balancing property in the Online Appendix. There, we also present results for the first-stage probit regressions.

⁴² We implement the matching algorithm using the Stata program `psmat.ch2` written by Edwin Leuven and Barbara Sianesi. Note that, even though we estimate the probit model pooled across all years, we ensure exact matching by year in the second step of the matching approach.

selected sample, since both treated and untreated firms have to be active for additional periods. As a result, the number of observations decreases with increasing p . Generally, independent of the time horizon considered, matching is always performed at the time a firm starts importing, in line with De Loecker (2007), for example.⁴³

Finally, note that we exploit the double robustness property of the regression adjusted matching estimator. To be precise, we compute ATTs by means of weighted regressions, using sampling weights obtained from the matching approach, while controlling for the covariates included in the first stage probit regression. In this way, we can ensure that the estimator is consistent if either the propensity score equation or the regression equation is correctly specified (see for instance Imbens and Wooldridge, 2009). We cluster the standard errors at the firm-level in these regressions.⁴⁴

4.1.2. Results (H2 and H3)

Table 4 presents the baseline results referring to Eq. (14). Estimating the equation without firm fixed effects (columns i to iii), we find that importing retailers differ significantly from non-importers across all performance measures suggested by Hypothesis 3. In particular, the sales, profits, and markups of directly importing firms exceed those of their non-importing counterparts on average by 20%, 27%, and 3%, respectively (columns i to iii).⁴⁵ Significant differences are also visible when adding firm fixed effects to the regressions (columns iv to vi); i.e. a switch in import status from zero to one appears to be associated with better performance indicators. However, while these results are clearly in line with our theoretical model, we cannot distinguish between the effects related to more productive and therefore larger and more profitable firms self-selecting into importing, as implied by Hypothesis 2, and those that are caused by import activity, as suggested by Hypothesis 3.

As explained above, we investigate the self-selection hypothesis by running regressions in accordance with Eq. (15). The estimation results in Table 5 show that firms beginning to import in year t are indeed already larger and more profitable than non-importing firms in period $t - 1$ (column i to iii). These differences amount to 9%, 5% and 2% for sales, profits, and markups, respectively. Hence, the results clearly support the self-selection mechanism proposed by Hypothesis 2. Moreover, the results presented in Table 5 may also accord with additional performance gains after the import event has occurred since performance differences are even larger in period t (columns iv to vi).

We try to shed some light on the potentially causal effect of importing on retail firm performance by applying a PSM approach, while keeping in mind that PSM, too, is based on a number of assumptions. To the extent that these assumptions are plausibly fulfilled in our context, the results presented in Table 6 indeed suggest that importing significantly impacts sales, profits and, markups of retail firms. According to these estimates, a firm that starts importing enjoys roughly 8% higher sales compared to non-importing firms in the year of import initiation (panel a). This sales premium lasts during the consecutive periods and amounts to 13% after three years. Cumulating these effects over time for firms present in all periods implies sales gains of close to 30% compared to firms sourcing domestically (this effect is highly statistically significant). We also obtain a significant ATT when considering the change in (the log of) sales as an outcome variable. In particular, on impact, the estimated effect of importing amounts to 9 percentage points higher sales growth for import starters. This effect is quite persistent when considering longer time horizons. Three

years after import initiation, the growth in sales relative to pre-treatment exceeds that of non-importers by 11 percentage points.

Moreover, we find a positive impact of import activity on firms' profits which increase by 7% in $p = 0$ and exceed those of non-importing firms by around 12% three years after import initiation. Regarding growth rates, significant effects are estimated which amount to 9 percentage points higher profit growth on impact and as much as 18 percentage points higher profit growth when considering log differences in period $p = 3$. Similarly, we find quite persistent effects on the markups of retailers that start to import. The results in panel c suggest that markups exceed those of non-importing firms by between 2% and 3% in periods $p = 0$ and later. Moreover, markup growth is also affected by around one to two percentage points, even though the statistical significance decreases with longer time horizons.

Finally, we note that the Online Appendix contains information showing that the matching approach is successful in generating samples of treated and untreated firms that are well balanced in terms of covariates. Moreover, results in Table 7 indicate that, after applying the PSM approach, sales, profits, and markups do not differ significantly between the studied treated and untreated firms prior to the import event. This table does not contain placebo results for changes in log sales in $p - 1$, since such a regression is redundant given that we condition on pre-treatment sales growth in the selection model.⁴⁶ Overall, we thus find both evidence for a selection effect and indications that importing has contributed to the observed differences in the performance of importing and non-importing retailers, which is in line with Hypotheses 2 and 3.⁴⁷

4.2. Import activity and consolidation into chains (H4)

Hypothesis 4 states that a reduction in the trade cost induces firms to add shops and thus become a retail chain.

4.2.1. Empirical approach (H4)

We investigate Hypothesis 4 by applying a similar methodology as before. We begin by estimating models as depicted by Eq. (14) for two different outcome variables, namely a dummy variable indicating chain retailers and a dummy variable taking a value of one if a firm opens a new shop. Note that we estimate linear probability models in order to be able to include firm fixed effects. These models indicate whether importing retailers have a higher probability of being a chain and of opening a shop. Moreover, the specification with firm fixed effects relates changes in these probabilities to changes in import status.

In addition, we apply a propensity score matching approach as outlined above in order to gauge the direction of causality. Two things are worth noting here. First, in the case of the chain dummy, we restrict the sample to firms that operated as single-shop firms in $t - 1$ and $t - 2$, i.e. to firms for which the chain dummy equals zero before beginning to import. Hence we investigate whether import initiation changes the probability of becoming a chain (in contrast to the probability of continuing as a chain). Second, when analyzing the probability of opening a new shop, we add the (log of the) number of shops operated in $t - 1$ to the first-stage probit regression. We are thus assessing whether import initiation affects the probability of opening a new shop, comparing firms with a similar number of shops prior to importing.

⁴³ Note that we focus on the first import event of firms in our sample and do not impose any restrictions on import activity in consecutive periods.

⁴⁴ See also Goldbach et al. (2017) for a similar approach in an analysis of the effect of foreign investment on domestic investment.

⁴⁵ Computed e.g. as $19.7 = (\exp(0.18) - 1) \cdot 100$ since the dependent variables are log transformed. As a result, we consider only firms with positive profits in these estimations (around 9% of firms report zero or negative profits).

⁴⁶ Controlling for lagged sales growth in the probit regression (and consequently also when applying the regression adjusted matching estimator) also explains why we obtain the same coefficient when considering the log of sales in $p - 1$ and $p - 2$ as outcome variables.

⁴⁷ In the Online Appendix, we present a series of robustness checks with respect to the matching approach. First, we add lagged (log-) levels of outcome variables to the first stage probit regressions. Second, we employ exact matching by year and NACE four-digit sector. Third, instead of radius matching with a tight caliper, we employ a Gaussian kernel in the matching step. Overall, our results are robust across these checks.

Table 4
Direct importing and firm performance - OLS (H2, H3).

Dependent variable: Log of	i	ii	iii	iv	v	vi
	Sales	Profits	Markup	Sales	Profits	Markup
$DIMP_{it}$	0.180*** (0.012)	0.239*** (0.022)	0.033*** (0.005)	0.110*** (0.010)	0.108*** (0.019)	0.011** (0.005)
$LN(EMPLOYEES_{it-1})$	0.848*** (0.004)	0.557*** (0.008)	−0.002 (0.002)	0.334*** (0.008)	0.188*** (0.012)	0.000 (0.003)
Observations	92,021	79,251	75,372	92,021	79,251	75,372
R-squared	0.749	0.295	0.076	0.881	0.624	0.547
Firm fixed effects	No	No	No	Yes	Yes	Yes
Mean of dependent variable	15.325	12.600	0.149	15.325	12.600	0.149

Notes: Firm-level regressions containing sector-year dummies. Clustered standard errors (at the firm level) in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1. $DIMP_{it}$ is a dummy variable taking on unity if a firm imports consumer goods from outside EU15. $LN(EMPLOYEES_{it-1})$ refers to number of employees.

Table 5
Import starters and firm performance - OLS (H2).

Dependent variable: Log of	i	ii	iii	iv	v	vi
	Lagged (t − 1)			Contemporaneous (t)		
	Sales	Profits	Markup	Sales	Profits	Markup
$START_{it}$	0.084*** (0.013)	0.050* (0.029)	0.021*** (0.007)	0.152*** (0.015)	0.107*** (0.030)	0.029*** (0.007)
$LN(EMPLOYEES_{it-1})$	0.838*** (0.004)	0.515*** (0.008)	−0.007*** (0.002)	0.855*** (0.004)	0.536*** (0.008)	−0.011*** (0.002)
Observations	78,182	57,538	60,731	78,182	57,538	60,731
R-squared	0.827	0.288	0.210	0.738	0.282	0.082
Mean of dependent variable	15.305	12.633	0.191	15.238	12.591	0.146

Notes: Firm-level regressions containing sector-year dummies. Clustered standard errors (at the firm level) in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1. $START_{it}$ is a dummy variable taking on unity if a firm did not import in periods $t - 2$ and $t - 1$ and begins to do so in period t ; it is zero for firms that have not imported during all three periods. Imports refer to consumer goods from outside EU15. $LN(EMPLOYEES_{it-1})$ refers to number of employees.

4.2.2. Results (H4)

The OLS results are presented in Table 8. As expected, we find that importing retailers have a higher probability of being a chain and of opening a new shop. The estimated coefficients imply probability differentials amounting to roughly 6 and 2 percentage points, respectively. The coefficients of interest shrink markedly when adding firm fixed effects, while they remain statistically and economically significant also in these regressions.

In Table 9, we present results from the matching approach in order to analyze the causal relationship. On impact, we do not find a significant increase in the probability of becoming a chain. However, when considering the results in consecutive periods, there is some evidence of an effect two years after import initiation.⁴⁸ The coefficient estimate implies an effect of 1.5 percentage points, which is non-negligible when considering that the unconditional probability of being a chain amounts to only 10% in the overall sample.⁴⁹

When focusing on the probability of opening a new shop, the results are somewhat clearer. Indeed, import starters have a significantly higher probability of increasing the number of shops two years after the import event has occurred. A coefficient estimate close to 2 percentage points again implies a quantitatively meaningful effect, considering that, in the data, the unconditional probability of adding a shop is only 3%. At the same time, we do not find significant differences in the probability of opening a new shop one year before the import event has occurred.⁵⁰ These results therefore suggest that importing has indeed contributed to the consolidation of retailers into chains, which is in line with the theoretical model's prediction.

⁴⁸ Note that the chain (new shop) dummy is equal to one in periods $p = 1$ when a firm becomes a chain (opens a new shop) in period $p = 0$ or $p = 1$. The dummies are coded equivalently for period $p = 2$ and $p = 3$.

⁴⁹ We note though that that p -value associated with this coefficient is relatively high (0.077).

⁵⁰ A placebo regression for the chain dummy is redundant since we restrict the analysis to comparing single-shop firms in the pre-treatment period.

4.3. Import activity and firm exit (H1)

Hypothesis 1 derived from our theoretical model suggests that a trade cost reduction leads to the exit of the least efficient firms.

4.3.1. Empirical approach (H1)

We use a different empirical approach than before to investigate this hypothesis. This is because, in this subsection, we do not only wish to analyze whether less productive or non-importing retailers have a higher exit probability. Instead, we are interested in whether these types of firms have a higher exit probability depending on trade integration. To be precise, we test Hypothesis 1 by relating an indicator of firm-level exit ($exit_{it}$) to industry-level imports. We are thus exploiting industry-level variation in import activity to assess firms' exposure to trade integration. As noted before, this implies the assumption that increased trade integration is partly captured by observed changes in imports. We emphasize that the results presented in this subsection may not reflect a causal relationship, for instance, due to simultaneity issues.

We identify exits in the data by using a variable indicating the resignation date of a firm. The indicator variable $exit_{it}$ equals one if a firm has been active in year $t - 1$ and resigns from the market in year t . The comparison group of continuously active retailers comprises firms that remain in the market during both years. We then estimate the following model:

$$exit_{it} = \beta_0 + \beta_1 DIMP_{it} + \beta_2 DSIZE_{it} + \beta_3 LN(VIMP_{st}) + \beta_4 DIMP_{it} \times LN(VIMP_{st}) + \beta_5 DSIZE_{it} \times LN(VIMP_{st}) + \beta_6 LN(SALES_{st}) + \alpha_s + \alpha_t + \varepsilon_{it}, \quad (19)$$

where $DIMP_{it}$ is a dummy variable indicating a firm's import status; $DSIZE_{it}$ is a categorical variable indicating whether firm i is among the smallest, i.e. least efficient, firms in a given year; $LN(VIMP_{st})$ denotes the value of non-EU15 consumer goods imports of retail firms belonging to sector s in year t ; $DIMP_{it} \times LN(VIMP_{st})$ and $DSIZE_{it} \times LN(VIMP_{st})$ are interaction terms; and $LN(SALES_{st})$ measures total industry-level sales to control for other aggregate developments. Hence Eq. (19) allows us to investigate whether industry-level imports have a differential effect

Table 6

Direct importing and firm performance - matching (H3).

	p	p + 1	p + 2	p + 3
<i>Panel a: Domestic sales</i>				
<i>LN(SALES)</i>	0.077*** (0.013)	0.084*** (0.018)	0.097*** (0.021)	0.122*** (0.026)
Δ <i>LN(SALES)</i>	0.085*** (0.011)	0.092*** (0.017)	0.097*** (0.020)	0.114*** (0.025)
Number of treated	1359	1152	942	762
Observations	69,011	54,814	41,536	31,107
<i>Panel b: Profits</i>				
<i>LN(PROFITS)</i>	0.068*** (0.026)	0.095*** (0.031)	0.089** (0.036)	0.115*** (0.040)
Δ <i>LN(PROFITS)</i>	0.093*** (0.027)	0.120*** (0.033)	0.113*** (0.040)	0.180*** (0.047)
Number of treated	1042	833	645	488
Observations	50,366	37,000	26,762	18,496
<i>Panel c: Markups</i>				
<i>LN(MARKUPS)</i>	0.020*** (0.007)	0.029*** (0.008)	0.028*** (0.009)	0.029*** (0.010)
Δ <i>LN(MARKUPS)</i>	0.012* (0.007)	0.017** (0.008)	0.015 (0.009)	0.020* (0.010)
Number of treated	1080	874	680	522
Observations	52,483	39,005	27,795	19,856

Notes: Clustered standard errors (at the firm level) in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1. Coefficients refer to a dummy variable indicating import initiation from non-EU15 markets (*START_{it}*) obtained from weighted firm-level regressions with weights derived by propensity score matching. Regressions control for covariates included in first-stage probit regression. Δ indicates that changes in the outcome variable are considered. Note that these differences are computed relative to pre-treatment status (i.e. relative to p – 1). p refers to the year of treatment. The Online Appendix presents means of the outcome variables considered in this table.

Table 7

Direct Importing and firm performance - matching (H3) - placebo.

	p – 2	p – 1
<i>Panel a: Domestic Sales</i>		
<i>LN(SALES)</i>	–0.008 (0.008)	–0.008 (0.008)
Number of treated	1359	1359
Observations	69,011	69,011
<i>Panel b: Profits</i>		
<i>LN(PROFITS)</i>	0.004 (0.025)	–0.024 (0.019)
Number of treated	912	1042
Observations	42,491	50,366
Δ <i>LN(PROFITS)</i>		–0.023 (0.027)
Number of treated		912
Observations		42,491
<i>Panel c: Markups</i>		
<i>LN(MARKUPS)</i>	–0.0001 (0.008)	0.008 (0.006)
Number of treated	912	1080
Observations	43,519	52,483
Δ <i>LN(MARKUPS)</i>		0.007 (0.007)
Number of treated		912
Observations		43,519

Notes: Clustered standard errors (at the firm level) in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1. Coefficients refer to a dummy variable indicating import initiation from non-EU15 markets (*START_{it}*) obtained from weighted firm-level regressions with weights derived by propensity score matching. Regressions control for covariates included in first-stage probit regression. Δ indicates that changes in the outcome variable are considered. Note that these differences are computed using the p – 2 samples, while considering the difference in the log of outcomes in p – 1 and p – 2. p refers to the year of treatment.

on the exit probability of importing and non-importing firms or of small and large retailers.

We compute *DSIZE_{it}* based on the size distribution (total assets) of firms in the estimation sample. Specifically, we define firms that belong to 25th percentile of the size distribution as small. Note that we proxy for efficiency using a firm's size rather than productivity because several firms do not report any employees, thus preventing the computation of labor productivity. Since these non-reporting firms tend to be small and exit the market rather frequently, we would lose relevant information if we relied on labor productivity.⁵¹

Finally, note that the industry level *s* here refers to the 24 industries mentioned in section 3.⁵² Since our variable of interest (*LN(VIMP_{st})*) varies over this dimension, we cluster the standard errors at the sector

⁵¹ Numerous empirical studies document that firm size is highly correlated with productivity. Moreover, our theoretical model suggests a direct link between size and productivity. Furthermore, as mentioned in footnote 4.1, a measure of labor productivity may be problematic, especially for smaller retailers, since the variable ignores the work done by firm owners.

⁵² See the Online Appendix for a list of the industries.

Table 8

Direct importing and consolidation into chains - OLS (H4).

Dependent variable	i	ii	iii	iv
	Chain dummy	New-shop dummy	Chain dummy	New-shop dummy
<i>DIMP_{it}</i>	0.058*** (0.008)	0.023*** (0.004)	0.012** (0.005)	0.007* (0.004)
<i>LN(EMPLOYEES_{it-1})</i>	0.140*** (0.003)	0.035*** (0.002)	0.091*** (0.004)	0.005** (0.002)
Observations	88,594	87,851	88,594	87,851
R-squared	0.248	0.059	0.752	0.172
Firm fixed effects	No	No	Yes	Yes
Mean of dependent variable	0.102	0.025	0.102	0.025

Notes: Firm-level regressions containing sector-year dummies. Clustered standard errors (at the firm level) in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1. *DIMP_{it}* is a dummy variable taking on unity if a firm imports consumer goods from outside EU15. *LN(EMPLOYEES_{it-1})* refers to number of employees.

level (Moulton, 1990). Moreover, we also present *p*-values derived from a wild bootstrap procedure (in brackets), given that the number of clusters is relatively small (Cameron et al., 2008).⁵³

4.3.2. Results (H1)

The estimation results in Table 10 first of all show that importing firms have a lower and small firms have a higher probability of exiting the market.⁵⁴ The coefficient of the import dummy suggests a 2.6 percentage point lower exit probability and that of the size dummy a 16.5 percentage point higher exit probability for the respective types of firms. These results thus fit our theoretical model, in which exit occurs at the lower end of the retailer size distribution and thus among retailers that do not import.

The results in column (i) suggest that an increase in industry-level imports is, in general, associated with an increase in the exit probability of non-importing firms (coefficient β_3). However, while the interaction term with a firm's import status has the expected negative coefficient, it is not statistically significant. On the other hand, the results in column (ii) are more in line with Hypothesis 1. In this case, the coefficient for industry-level imports does not suggest a significant relationship with the exit probability of larger retailers. At the same time, the interaction between the size dummy and industry-level imports is positive and significant, which suggests that an increase in aggregate imports is

⁵³ We implement this procedure in Stata using the *cgmwildboot* routine written by Judson Caskey. The null hypothesis is always imposed.

⁵⁴ Note that the import variable *LN(VIMP_{st})* is mean-centered.

Table 9
Direct importing and consolidation into chains - matching (H4).

	$p - 1$	p	$p + 1$	$p + 2$	$p + 3$
CHAIN DUMMY		0.003 (0.004)	0.004 (0.006)	0.014* (0.009)	0.015 (0.011)
Number of treated		1081	887	724	581
Observations		58,260	45,113	33,122	24,398
New shops					
NEW SHOP DUMMY	−0.003 (0.005)	0.007 (0.005)	0.009 (0.007)	0.023** (0.009)	0.017 (0.011)
Number of treated		1291	1326	1094	897
Observations		64,681	66,238	51,537	38,675

Notes: Clustered standard errors (at the firm level) in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Coefficients refer to a dummy variable indicating import initiation from non-EU15 markets ($START_{it}$) obtained from weighted firm-level regressions with weights derived by propensity score matching. Regressions control for covariates included in first-stage probit regression. The Online Appendix presents means of the outcome variables considered in this table.

Table 10
Direct imports and firm exit (H1).

	i	ii	iii
$DIMP_{it}$	−0.026*** (0.003)	−0.026*** (0.003)	−0.026*** (0.003)
$DSIZE_{it}$	0.165*** (0.017)	0.167*** (0.008)	0.167*** (0.008)
$LN(VIMP_{st})$	0.007*** (0.002) [0.018]	0.001 (0.003) [0.776]	0.001 (0.003) [0.810]
$DIMP_{it} \times LN(VIMP_{st})$	−0.001 (0.002) [0.664]		0.001 (0.002) [0.540]
$DSIZE_{it} \times LN(VIMP_{st})$		0.017*** (0.003) [0.016]	0.017*** (0.003) [0.014]
$LN(SALES_{st})$	0.020* (0.011)	0.019* (0.010)	0.019* (0.010)
Observations	119,058	119,058	119,058
R-squared	0.067	0.071	0.071
Mean of dependent variable (exit dummy)	0.086	0.086	0.086

Notes: Firm-level regressions containing sector and year dummies. Parentheses contain standard errors clustered at the sector level; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Square brackets present p-values referring to a wild bootstrap procedure with 1000 replications. $DIMP_{it}$ is a dummy variable taking on unity if a firm imports consumer goods from outside EU15. $DSIZE_{it}$ is a dummy variable taking on unity if a firm belongs to the lower 25th percentile of the size distribution. $VIMP_{st}$ are direct sector-level consumer goods imports from outside EU15. $SALES_{st}$ are sector-level sales.

associated with a higher exit probability of small retailers. This finding is confirmed by the results shown in column (iii), where both interaction terms are included simultaneously. Note that the implied effect is relatively small. Adding together the coefficients of $LN(VIMP_{st})$ and the interaction term, i.e. computing $\beta_3 + \beta_5$, the estimated effects amounts to less than 0.02 percentage points in response to an increase in sector-level imports of 1%. Overall, we conclude that our results are broadly in line with Hypothesis 1.

4.4. Import activity and local-market-level concentration

Finally, we examine how changes in trade costs affect the Herfindahl index of local retail market concentration, where a local market is defined by region r and sector s .⁵⁵ In particular, we estimate the

⁵⁵ Note that some retail firms may operate several shops in a given local market. But shops belonging to the same firm probably do not compete with each other in prices. A similar assumption is made by Holmes (2011) and supported by evidence from Holmes on considerable self-cannibalization among Walmart stores. Treating shops by the same firm as independent shops would thus lead to an underestimation of local market concentration. To obtain a more accurate measure of market concentration, we therefore treat the shops of a given firm in region r and industry s as a single shop. The number of shops in a local market is therefore equal to the number of firms operating a shop or shops in this market.

Table 11
Direct imports and the Herfindahl index.

	i	ii
$LN(VIMP_{st})$	0.032*** (0.009) [0.012]	0.041* (0.021) [0.110]
$LN(SIZE_{rs, t-1})$	−0.076*** (0.016)	−0.045** (0.023)
$LN(WAGE_{rs, t-1})$	0.056*** (0.016)	0.077* (0.040)
Observations	13,735	13,735
R-squared	0.028	0.025
(Weighted) mean of dep. Var.	−1.114	−1.413
Weighted Regression	No	Yes

Notes: Market-level regressions with market fixed effects and year dummies. Parentheses contain standard errors clustered at the sector level; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Square brackets present p-values referring to a wild bootstrap procedure with 1000 replications. $VIMP_{st}$ are direct sector-level consumer goods imports from outside EU15. $ASSETS_{rs, t-1}$ are the sum assets of all firms present in a market. $MEANWAGE_{rs, t-1}$ refers to the average wage in the market. Weights in weighted regressions are based on industry sales shares.

following model:

$$y_{rst} = \beta_0 + \beta_1 LN(VIMP_{st}) + \beta_2 (x_{rs, t-1}) + \alpha_{rs} + \alpha_t + \varepsilon_{it}, \quad (20)$$

where y_{rst} is the market-level Herfindahl index; $LN(VIMP_{st})$ refers to the value of industry-level imports (as before); and $x_{rs, t-1}$ are lagged covariates to control for local retail market characteristics, namely size (measured as the sum of assets of all shops in a market) and the average wage (measured as total wage bill over total employment in a market).⁵⁶ By including local market fixed effects (α_{rs}) in these regressions, we exploit within market variation to estimate the relationship between imports and the outcome of interest. As before, we rely on OLS estimation so that the following results should be interpreted as representing suggestive evidence for the presence of certain relationships in the data without drawing any causal conclusions. Note that we present results from both unweighted and weighted regressions, where weights are based on regional sales shares of each industry. Further note that, as before, we cluster the standard errors at the industry level and also report p-values derived from a wild bootstrap procedure in brackets to account for the relatively small number of clusters.

Table 11 contains the estimation results. We find that a rise in imports is associated with an increase in the Herfindahl index at the local retail market level and thus a rise in local market concentration (column i). The results are broadly similar when using a weighted regression approach (column ii). By these estimates, a 1% increase in industry-level direct imports raises the Herfindahl index of local retail market concentration, ceteris paribus, by between 0.03% and 0.04%. This is not a small effect, especially when considering that average market-level direct imports in the estimation sample more than doubled during the sample period and that, as shown in Table 1, the Herfindahl index is at a high level initially.

5. Conclusions

The paper uses Danish microdata for the period 1999 to 2008 to examine the impact of the rapid growth of consumer goods imports on retail market performance and structure. Our results suggest that larger and more profitable retailers do not only self-select into importing, but that retailers' import activities are responsible for some of the performance differences observed between importing and non-importing firms. In particular, based on a propensity score matching approach, we find that retailers that begin to import may have 8% greater sales, 6% greater profit, and 2% greater markups after beginning to import

⁵⁶ As explained above, we observe certain variables such as sales and total assets only at the firm level. Hence, for a chain retailer we have to distribute these variables across its locations in different regions. We do this on the basis of the employment share of each shop in a chain's total employment. In a second step, we aggregate across shops present in a retail market to obtain variables varying by local retail market and time.

compared to non-importing firms. These differences are quite persistent and also hold for the growth rates of the considered performance measures. For instance, we find that cumulative sales of import starters may be up to 30% higher on average after three years than for comparable non-importers.

Regarding the other stylized facts we emphasized in the introduction, in particular the consolidation of retailers into chains, the exit of small retailers, and greater retail market concentration, we offer several pieces of evidence that link these processes to greater direct imports of consumer goods. First, in our firm-level estimations we find evidence suggesting that import initiation raises the probability of a retailer becoming a chain and adding new shops to its portfolio. We also detect indications for a positive relationship between the probability of exiting the market for small retailers and increases in sector-level direct imports. Moreover, we present evidence for a positive conditional correlation between greater direct imports and higher local retail market concentration as measured by the Herfindahl index.

Taken together, these empirical results provide support for the economic mechanism explored in our theoretical model, namely that performance differences between importers and non-importers as well as structural changes in retailing are, inter alia, driven by direct importing: Due to economies of scale associated with direct importing, only big retailers and retail chains can afford direct imports, which means that they benefit more from trade cost reductions than small retailers that do not have access to these imports. In the Supplementary material we present additional evidence in favor of this mechanism by examining how indirect imports of consumer goods, i.e. imports by wholesalers and other firms outside the retail industry, affect retail markets in Denmark. Almost without exception, our proxy for indirect imports does not exhibit a statistically significant effect on firm exit, on aggregate retail productivity and markups, on the number of retailers, or on the Herfindahl index of retail market concentration.

We conclude that, viewed from a positive perspective, our model provides a plausible mechanism to explain some of the changes in retailing observed in Denmark and other advanced economies. Our paper thus complements the existing literature on retailing that generally attributes observed changes in retailing to technological change.

What do our results imply for social welfare? In our theoretical model, social welfare, W , is approximately equal to:

$$W \approx 2Rn \int_0^{1/2n} (v - \tau x) L dx \quad (21)$$

$$-Rn \left(\int_0^{c_l} [(t + c) q^l(c)] dG(c) + \int_{c_l}^{c_D} [(w + c) q^D(c)] dG(c) \right) \quad (22)$$

$$-Rn_E [G(c_l) F_l + F_E] + (R - 1) n_E G(c_s) [F_l + F_E - F_S], \quad (23)$$

where the number of active shops in a given regional market, n , is related to the number of entrants, n_E , through $n = G(c_D) n_E$, and v is a consumer's reservation price for one unit of the aggregate consumption good. Thus welfare is approximately equal to consumer surplus net of the travel cost paid by consumers to reach the nearest retailer Eq. (21), minus the expected (variable) trade and production costs Eq. (22), minus the sunk cost of entry and the fixed costs of importing and operating shops in additional markets Eq. (23).⁵⁷

Our empirical results indicate that increased consumer goods imports are negatively related to the number of retailers, which may thus imply an increase in travel distances for consumers to reach a shop. As explained by Lagakos (2016), the social costs of greater distance are probably small in an advanced economy like Denmark,

where households tend to own cars and have access to efficient public transport. A greater welfare impact for an advanced economy can be expected to come from lower import prices, as retailers turn to imports instead of domestically sourced goods, and from the trade-induced shift of market share towards the bigger retailers and retail chains that import directly. The sourcing of lower-priced goods from abroad is, of course, a classic gain from trade. The increase in industry productivity stemming from a market share reallocation towards the big and therefore typically more efficient retailers is reminiscent of the effects highlighted in heterogeneous firm models of trade, such as Melitz et al. (2008). But, in the current paper, this productivity gain arises in retailing not in manufacturing, and thus represents an additional gain from trade that is not captured by traditional trade models. In the data we indeed tend to find some evidence for such a gain, namely a positive relationship between labor productivity and industry-level imports, which is, however, estimated somewhat imprecisely.

Another non-traditional gain from trade highlighted by our model consists of the potential cost savings associated with the trade-induced consolidation of shops into chains. These cost savings arise because chains can spread the fixed costs of importing (F_l) and the overhead costs that arise at the firm rather than the shop level ($F_E - F_S$) across their shops. A quantification of these welfare gains is beyond the current paper, but the strong increase in the number of retail chains and the fact that these chains are responsible for the lion's share of import activity in Danish retailing are indicative of substantial gains. That these gains are likely to be big is also suggested by Holmes (2011), who estimates the savings on distribution costs that Walmart realized when expanding the number of its stores, and by Holmes and Singer (2017), who find large savings in import costs for big retail chains like Walmart.

Any future study of the welfare gains from trade-induced changes in retailing would have to take a position on several additional aspects that we have not touched upon in our analysis. First, in many countries, retailing is highly regulated. Regulation, for instance of shop size or location, may limit the extent to which the large, productive retailers in particular can adjust to trade (Eckel, 2009, and Raff and Schmitt, 2012). In the case of Denmark, retailers are subject to a zoning regulation that limits the maximum shop size.⁵⁸ The OECD indicator on the regulation of large outlets suggests that the zoning regulation in Denmark is not among the most restrictive and had been loosened somewhat at the end of our sample period.⁵⁹ But there are other countries, such as Australia, Canada and the United States, that do not systematically impose such regulations and therefore may have experienced bigger retail market adjustments to trade than Denmark. That this may indeed be the case is indicated by Basker and Van (2010b) and Holmes and Singer (2017) who document how Walmart has come to dominate both retailing and consumer goods trade in the United States.

Second, we did not examine changes in the product assortment of retailers, except to note that, over the sample period, Danish retailers substantially expanded the number of product varieties that they import directly. In the case of consumer goods, retailers, of course, play an essential role in determining the number of product varieties that consumers get to choose from, and their decisions regarding the product range are thus likely to have important welfare effects. Several recent theoretical studies explain how retailers expand their product range in response to trade liberalization, but they also show that the welfare effects may not be straightforward. Eckel (2009) explores the possibility that expanding the product range may lead to higher retail prices, thus potentially hurting consumers. He also shows that retailers

⁵⁷ The expression is an upper bound on welfare, since the first term assumes that consumers on average travel 1/4 of the "distance" between any two shops, which would be the case if all retailers charged the same price. However, since prices vary across retailers in our setting, travel costs are strictly greater than shown here.

⁵⁸ From 1997, the zoning law prohibited grocery stores larger than 3000 sq.m (since 2007 larger than 3500 sq.m) in urban areas; in rural areas, the size limit is 1000 sq.m. For non-grocery stores, the zoning regulation implies a size limit of 2000 sq.m, while large cities can grant three exceptions to this rule per year.

⁵⁹ The indicator is based on the following survey question: "If compliance with regulation especially designed for large outlets is required for any type of product, what is the threshold surface limit for these laws or regulations to apply (in m²)?" See Koske et al. (2015) for a comparison of this indicator across OECD countries.

may offer too little product variety compared to the social optimum. Raff and Schmitt (2016b) argue that the product range offered in equilibrium may be too broad. Their model, however, indicates that a consolidation of shops into retail chains would bring product variety closer to the socially optimal level, thus leading to additional gains that are directly related to the increase in the number of chains.

Third, we did not explore the relationship between retailers and manufacturers. As retailers are getting bigger and, as Feenstra and Hamilton (2006) suggest, gain power especially vis-à-vis overseas manufacturers, they may be tempted to use this power to extract greater rents from manufacturers. Raff and Schmitt (2009) examine this issue and show how the exercise of buyer power by retailers may lead to smaller gains from trade than indicated by models in which market power rests with manufacturers.

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Appendix A. Proofs and summary statistics

This Appendix contains proofs for the hypotheses derived from the theoretical model and summary statistics of the main variables.

A.1. Sufficient conditions for $0 < c_S < c_I < c_D$

To ensure that $c_I < c_D$, we assume that:

$$F_I > \frac{L}{4\tau}(w-t)^2. \quad (24)$$

The condition $c_S < c_I$ requires

$$F_S > \frac{L}{\tau} \left(\frac{1}{4}(w-t) + \frac{\tau F_I}{L(w-t)} \right)^2. \quad (25)$$

For $0 < c_S$ it is sufficient to assume that for the most efficient firm, and thus for $c = 0$, it is strictly profitable to become a chain, which requires:

$$F_S < \frac{L}{4\tau}(c_D + w-t)^2. \quad (26)$$

A.2. Proof of Hypothesis 1

Using Eq. (2), Eq. (8), and Eq. (9), the expected zero-profit condition, Eq. (12), can be rewritten as:

$$\int_0^{c_S} \left[\frac{RL}{4\tau}(c_D + w - c - t)^2 - (R-1)F_S - F_I \right] \frac{kc^{k-1}}{c_M^k} dc + \int_{c_S}^{c_I} \left[\frac{L}{4\tau}(c_D + w - c - t)^2 - F_I \right] \frac{kc^{k-1}}{c_M^k} dc + \int_{c_I}^{c_D} \frac{L}{4\tau}(c_D - c)^2 \frac{kc^{k-1}}{c_M^k} dc - F_E = 0.$$

Applying the implicit function theorem and using the Leibniz rule, we obtain:

$$\frac{dc_D}{dt} = \frac{(R-1)c_S^k \left(w-t + c_D - \frac{k}{k+1}c_S \right) + c_I^k \left(w-t + c_D - \frac{k}{k+1}c_I \right)}{(R-1)c_S^k \left(w-t + c_D - \frac{k}{k+1}c_S \right) + (w-t)c_I^k + \frac{c_D^{k+1}}{k+1}} > 0, \quad (27)$$

since $w > t$, and $c_D > \frac{k}{k+1}c_I > \frac{k}{k+1}c_S$ due to $c_D > c_I > c_S$ and $k > 0$.

A.3. Proof of Hypothesis 2

From Eq. (10), we obtain:

$$\frac{dc_I}{dt} = \frac{dc_D}{dt} - \left(\frac{1}{2} + \frac{2\tau F_I}{L(w-t)^2} \right) = \frac{dc_D}{dt} - 1 - \frac{c_D - c_I}{w-t}.$$

Substituting for $\frac{dc_D}{dt}$, we obtain:

$$\frac{dc_l}{dt} = \frac{Num}{Den} < 0,$$

since:

$$Den = (R-1)c_s^k(w-t + c_D - \frac{k}{k+1}c_s) + (w-t)c_l^k + \frac{c_D^{k+1}}{k+1} > 0, \text{ and:}$$

$$\begin{aligned} Num &= (R-1)c_s^k(w-t + c_D - \frac{k}{k+1}c_s) + c_l^k(w-t + c_D - \frac{k}{k+1}c_l) - (1 + \frac{c_D - c_l}{w-t})[(R-1)c_s^k(w-t + c_D - \frac{k}{k+1}c_s) + (w-t)c_l^k + \frac{c_D^{k+1}}{k+1}] \\ &= -\frac{c_D^{k+1} - c_l^{k+1}}{k+1} - \frac{c_D - c_l}{w-t} \frac{c_D^{k+1}}{k+1} - (1 + \frac{c_D - c_l}{w-t})[(R-1)c_s^k(w-t + c_D - \frac{k}{k+1}c_s)] < 0. \end{aligned}$$

A.4. Proof of Hypothesis 3

We first show that $\frac{dc_D}{dt} < 1$. This is true if:

$$c_D^{k+1} + kc_l^{k+1} > (k+1)c_l^k c_D. \quad (28)$$

Note that (Innes, 2006) is satisfied with equality for $c_D = c_l$, and the LS increases faster with c_D than the RHS, which proves $\frac{dc_D}{dt} < 1$. Differentiating Eq. (6) and Eq. (8) with respect to t and using Eq. (27), we obtain:

$$\frac{dq^D}{dt} = \frac{L}{2\tau} \frac{dc_D}{dt} > 0 \text{ and } \frac{d\pi^D}{dt} = \frac{L}{2\tau} (c_D - c) \frac{dc_D}{dt} > 0.$$

Differentiating Eq. (7) and Eq. (9) with respect to t and using $\frac{dc_D}{dt} < 1$, we have:

$$\frac{dq^l}{dt} = \frac{L}{2\tau} \left[\frac{dc_D}{dt} - 1 \right] < 0 \text{ and } \frac{d\pi^l}{dt} = \frac{L}{2\tau} (c_D + w - t - c) \left[\frac{dc_D}{dt} - 1 \right] < 0.$$

The result on markups and profits follows immediately, as markups are proportional to output.

A.5. Summary statistics

Table A.1

Summary statistics -firm-level analyses.

	obs	mean	sd	p10	p25	p50	p75	p90
$LN(SALES_{it})$	92,021	15.33	1.13	14.09	14.62	15.21	15.93	16.76
$LN(PROFITS_{it})$	79,251	12.60	1.13	11.23	12.01	12.66	13.25	13.85
$LN(MARKUP_{it})$	75,372	0.15	0.24	-0.15	-0.01	0.14	0.30	0.46
CHAIN DUMMY	88,594	0.10	0.30					
NEW-SHOP DUMMY	87,851	0.03	0.16					
$LN(EMPLOYEES_{it-1})$	92,021	1.18	1.03	0.00	0.00	1.10	1.79	2.49
$LN(PRODUCTIVITY_{it-1})$	90,900	12.75	0.48	12.23	12.51	12.74	13.03	13.33
DIMP _{it}	92,021	0.09	0.29					
EXIT DUMMY	119,058	0.09	0.28					
$LN(VIMP_{st})$	119,058	18.49	2.25	14.99	16.98	19.09	20.41	20.58

Table A.2

Summary statistics -market-level analyses.

	obs	mean	sd	p10	p25	p50	p75	p90
$LN(HERFINDAHLINDEX_{rst})$	13,735	-1.11	0.86	-2.30	-1.68	-1.06	-0.44	0.00
$LN(ASSETS_{rst-1})$	13,735	16.34	1.59	14.40	15.24	16.22	17.39	18.51
$LN(WAGE_{rst-1})$	13,735	11.53	0.46	10.97	11.27	11.55	11.83	12.08
$LN(VIMP_{st})$	13,735	17.44	2.18	14.60	15.74	17.60	18.95	20.41

Appendix B. Supplementary material

Supplementary material to this article can be found online at <https://doi.org/10.1016/j.jinteco.2018.08.010>.

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