# Imports and the structure of retail markets

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*Abstract.* We construct a model of trade with heterogeneous retailers to examine the effects of trade liberalization on retail market structure, imports and social welfare. We are especially interested in investigating the transmission of lower import prices into consumer prices and the effects of retail market regulation. The paper shows that changes in import prices may have large effects on consumer prices and import volumes when changes in retail market structure are taken into account, and that restrictions on retailing, as they occur in several countries, may significantly alter this transmission mechanism by reducing imports and raising consumer prices. JEL classification: F12, L11

*Importations et structure des marchés de détail.* On construit un modèle de commerce international avec des détaillants hétérogènes pour examiner les effets de la libéralisation du commerce sur la structure du marché de détail, les importations, et le niveau de bien-être social. On est particulièrement intéressé à analyser la transmission de prix plus bas à l'importation vers les prix au consommateur, et les effets de la réglementation du marché de détail. Le mémoire montre que les changements dans les prix à l'importation peuvent avoir des effets importants sur les prix à la consommation et les volumes d'importation quand on prend en compte les changements dans la structure du marché de détail, et que les restrictions sur le commerce de détail, comme il en existe dans plusieurs pays, peuvent modifier le mécanisme de transmission en réduisant les importations et en augmentant les prix au consommateur.

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## 1. Introduction

The purpose of this paper is to show that the retailing sector plays an important role for our understanding of the impact of trade liberalization. To show this, we concentrate our attention on (i) the effects of trade liberalization on the structure and performance of the domestic retailing sector; (ii) how the structure of retail markets affects the transmission of external shocks, such as a reduction in trade barriers, into domestic consumer prices; and (iii) how retail market regulation affects market structure, imports, and consumer prices. To study these issues we build a simple model of international trade with heterogeneous retailers and endogenous mark-ups based on Melitz and Ottaviano (2008).

In our model it is retailers and thus importers that are heterogeneous, not producers and exporters. In fact, we neutralize the effects of trade liberalization on the production side of the economy by holding producer prices fixed. This modelling approach allows us to highlight the effects of trade liberalization on changes in retail market structure and on the consequences for consumers and welfare.

Our approach is motivated by several stylized facts. First, the structure of retail markets has changed dramatically in recent decades. Market concentration has increased markedly, driven by the emergence of large national chains operating large establishments.[1] At the same time there has been considerable entry and exit by firms. In fact, entry and exit rates have been much higher in retailing than in manufacturing (see Jarmin, Klimek, and Miranda 2004). Second, this concentration process has had a significant effect on international trade, as large retailers increasingly import consumer goods from low-wage countries such as China. Basker and Van (2010), for instance, find that over the period 1997 to 2002 U.S. imports from China and other less-developed countries rose especially quickly in retail sectors with the largest consolidation into chains. Wal-Mart alone accounts for 15% of total US imports of consumer goods from China (Basker and Van 2008).[2] This phenomenon is not limited to the United States and is taking place in many retail segments such as electronics, cameras, housewares, toys, clothing, and footwear.[3]

1 Whereas large retail firms (with at least 100 establishments) represented 18.6% of US retail sales in 1967, their share has increased to 36.9% in 1997, and the average size of these establishments is twice as large as it was 40 years ago. Overall, the retail and manufacturing sectors have similar ratios of single to multi-unit firms but multi-unit retailers operate more establishments on average than manufacturers. More significantly, the number of establishments operated by multi-unit retailers increased dramatically between 1977 and 1997, whereas it has decreased in manufacturing (Jarmin, Klimek, and Miranda 2005).

2 Basker and Van (2010) find that between 1997 and 2002 the biggest US retailers had a more than three times higher marginal propensity to import from China than smaller retailers. They argue that the expansion of big retailers accounts for 19% of the growth in US imports of consumer goods from China.

3 For instance, in 2003, the share of imports in Canada was 55% for clothing, 82% for clothing accessories, 86% for footwear, 100% for audio, video, small electrical appliances, toys, and games (Jacobson 2006, table 33). It is precisely in these segments that the market share of large Canadian retailers is the highest (ibid., table 6).

What makes our model useful is that it allows us to address several important policy issues. First, in many consumer-good industries the benefits consumers may reap from trade liberalization depend crucially on how changes in import prices affect retail market structure, since distribution margins (i.e., retail costs and retailer mark-ups) often account for 30% to 50% of the retail prices of consumer goods (Campa and Goldberg 2006). Any change in the cost structure and competition in the retail sector thus has a large impact on retail prices and, more generally, on the gains from trade. By linking the transmission of import prices into consumer prices to a structural model of retail markets, we are able to shed new light on this issue. Specifically, we decompose the degree of transmission of import prices into the average domestic retail price into several distinct effects including changes in distribution margins and in the import share.

Second, many countries, including France, Belgium, Italy, Ireland, Japan, and the UK, regulate retail markets, especially by limiting the size of new retail establishments. For instance, the Large Scale Retail Store Law in Japan had a strong impact on distribution and has caused significant political conflict between Japan and exporter countries, such as the United States (Miyagiwa 1993). France only recently abolished the Loi Raffarin, which also regulated the entry of large retailers, following complaints about the lack of price competition at the retail level (*Economist* 2008). In the United States, on the other hand, there is some evidence that the relatively poor consumers have benefited from the existence of large retailers importing cheap products from developing countries (Broda and Romalis, 2009). By explicitly accounting for retailer heterogeneity, our model allows us to examine how such regulations affect retail market structure, imports, retail prices, and, ultimately, welfare. We show that retail regulations may indeed have strong adverse effects on import volumes, consumer prices, and welfare.

The mechanism at play in our model depends on economies of scale in importing, specifically fixed costs associated with sourcing goods from abroad. In the presence of such fixed costs, reductions in import prices, whether due to lower trade barriers, transport, or communication costs, benefit large retailers disproportionately, because only these retailers can afford to pay the fixed costs associated with importing. And by making large retailers more competitive, lower import prices tend to squeeze out smaller retailers.

The presence of economies of scale in importing is suggested by the fact that large retailers source a rising share of their goods *directly* from abroad, not through domestic sourcing (either by buying domestically produced goods or products imported through independent intermediaries). A recent survey of retailers (Zentes, Hilt, and Domma 2007) indicates that direct importing is indeed mostly done by large retailers, the largest of which operate their own overseas buying offices.[4] It also argues that direct importing is associated with significantly

4 The survey covers 86 retailers in Germany, Austria, and Switzerland (accounting for about 50% of total retail sales). It shows that, in 2006, direct imports by retailers accounted for 26–29% of total sourcing and indirect imports for 35–37%.

lower variable costs, as it allows retailers to bypass additional layers of intermediaries through buying offices that can directly identify the lowest-cost supplier for specific items. The reason why only big retailers choose the direct import channel is, of course, that it is associated with large fixed costs. These include costs of operating buying offices, searching for suppliers, developing products, specifying product standards, training suppliers, and monitoring quality. Evidence from Canadian retailing also suggests that it is the large retailers that carry out the lion's share of direct importing. For example, the largest 5% of the retail establishments (by employment) that engage in direct imports in Clothing, Shoes, Jewelry, Luggage and Leather Goods (NAICS 4481-83) account for 76.3% of the direct sectoral imports from low-cost Asian countries.[5]

Our paper is linked to the literature in the following way. Retail markets have been investigated by Campbell and Hopenhayn (2005), who show that establishments tend to be larger in larger markets. They also suggest that the dispersion of establishment sizes is well approximated by a Pareto distribution. The role of international trade on retailers has been analyzed by Basker and Van (2008), who investigate the effects of trade liberalization on competition between a chain retailer and small single-market retailers. They find that trade liberalization raises the size of the chain retailer, and that the growth of the chain gives an additional boost to imports. There are two main differences between our paper and that of Basker and Van. First, while Basker and Van endogenize the size of the retail chain, specifically the number of stores it operates, and relate it to the intensive margin of imports, we work with a continuous distribution of retailers, which also allows us to capture the extensive margin of imports. Second, whereas the efficiency of the retail chain is exogenously given in Basker and Van, the productivity distribution of retailers is endogenous in our model, allowing us to examine how trade liberalization affects retail efficiency and retail prices.

Other papers examining the interaction between trade liberalization and retail market structure include Raff and Schmitt (2009), who study the effects of trade liberalization on the volume of imports and social welfare in an oligopoly model in which retailers have greater or lesser bargaining power than manufacturers. Eckel (2009) develops a model to examine the effects of trade on retail market structure and especially on product variety and accessibility of retailers. In a setting where retailers have identical costs but are spatially differentiated, he shows that trade liberalization may have ambiguous effects on retail mark-ups and social welfare because it may reduce the number of retailers. By contrast, our model of heterogeneous retailers generates clear predictions regarding the positive effects of trade liberalization. Other related papers include Francois and

5 Other sectors include: Electronics and Appliances (NAICS 4431), where 5% of the largest retailers engaging in direct imports do import 68.2% of the sectoral imports from low-cost Asian countries, and Sporting Goods, Hobby, Musical Instruments, Books, Periodicals, Music (NAICS 4511-12), where these shares are respectively 4% and 67.6% (Statistics Canada, Import Register, Catalogue R007009, 2005).

Wooton (2010), Francois, Manchin, and Norberg (2008), Richardson (2004), and Javorcik, Keller, and Tybout (2008).

The effects of retail market regulations are discussed by Bertrand and Kramarz (2002) for France; Haskel, and Sadun (2009) for the UK; and Schivardi and Viviano (2011) for Italy. These papers, however, are generally not concerned with the effects of regulations on international trade. An exception is Miyagiwa (1993), but his paper does not account for firm heterogeneity.

The paper continues as follows. In section 2, we present the model. The equilibria of the model and comparative static results for marginal changes in trade costs are derived in section 3. In section 4 we use the model to study the effects of retail market regulation. In section 5 we use simulations to assess the impact of trade liberalization on retailer concentration and social welfare. Section 6 concludes, and the appendix contains all the proofs and a discussion of the micro-foundations of the demand system.

## 2. The model

In this section, we adapt Melitz and Ottaviano (2008) to develop a simple model of monopolistic competition with heterogeneous retailers that source the goods they distribute both domestically and abroad. Retailers sell only in their domestic market; that is, their services are non-traded. From the consumer's point of view, the products sold by different retailers are differentiated varieties. This could be because each retailer sells a different product variety or bundle of product varieties, or because the retailers themselves are differentiated in terms of characteristics that consumers value, such as location, amenities, or customer services.[6] In presenting the model we stick to a formulation that admits both interpretations and allows us to focus squarely on retailer heterogeneity and an endogenous market structure in retailing. We discuss in detail in the appendix what additional assumptions we need to impose to make the model consistent with each interpretation.

There is a continuum of retailers indexed by $i \in \Omega$. All consumers share the same utility function:

$$U = \alpha \int_{i\in\Omega} q_i^c di - \frac{1}{2}\beta \int_{i\in\Omega} \left(q_i^c\right)^2 di - \frac{1}{2}\gamma \left(\int_{i\in\Omega} q_i^c di\right)^2 + y, \tag{1}$$

where $q_i^c$ denotes the quantity per capita bought from retailer $i$, and $y$ denotes the consumption of the numeraire good. Parameter $\beta$ describes the degree of substitutability between retailers. If $\beta = 0$, retailers are perfectly substitutable,

6 In Eckel (2009), retailers are located around a circle and are thus spatially differentiated, selling an identical bundle of differentiated products. In Raff and Schmitt (2011), each retailer sells a different bundle of differentiated goods. In both of these papers, however, retailers are equally productive.

and consumers care only about their total consumption level, $Q^c = \int_{i\in\Omega} q_i^c di$. The degree of differentiation between retailers increases with $\beta$.

Assuming that the demand for the numeraire product is positive, the inverse per capita demand faced by each retailer $i$ is

$$p_i = \alpha - \beta q_i^c - \gamma Q^c. \tag{2}$$

If we denote by $L$ the number of consumers and by $N$ the mass of active retailers, the market demand faced by retailer $i$ can be expressed as a function of the average retail price $\bar{p}$:

$$q_i(p_i) \equiv Lq_i^c = \frac{\alpha L}{\gamma N + \beta} - \frac{L}{\beta} p_i + \frac{\gamma N}{\gamma N + \beta} \frac{L}{\beta} \bar{p}, \tag{3}$$

where

$$\bar{p} = \frac{1}{N} \int_{i\in\Omega^*} p_i di$$

and where $\Omega^*$ is the set of active retailers.

Labour, the only factor of production, is inelastically supplied and perfectly mobile between the production and the retailing sectors. Since the numeraire good is produced by a competitive industry under constant returns technology and a unit labour requirement of one, the price of labour in the economy is also equal to one. All costs are therefore expressed in terms of labour requirements.

We assume that retailers first decide whether to enter the market and thus whether to incur the sunk cost $F_E$. Upon entering, each retailer learns about its specific level of marginal retailing cost $c$ or, equivalently, its productivity $1/c$. We assume that the distribution of $c$ is given by $G(c)$ with support on $[0, c_M]$. Since the entry cost is sunk, only entrants able to cover their marginal cost are active in the market. All remaining entrants are inactive, that is, do not buy or sell any goods. Assuming that retail productivity follows a Pareto distribution, we let the cumulative distribution function for $c$ be

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

where $k \geq 1$. When $k = 1$, the distribution is uniform on $[0, c_M]$. As $k$ increases, the distribution shifts toward high marginal costs.

Once a retailer has entered the market, he has to decide whether to source goods domestically or to import them. Imports involve a per unit trade cost $t$ and a fixed cost $F_I$. This fixed cost includes the cost of maintaining buying offices, cooperating with foreign partners to source goods, acquiring information, and so on. Production (domestic or foreign) involves no fixed or sunk cost but foreign production is assumed to be cheaper than domestic production. For simplicity, we normalize the marginal cost of foreign producers to zero and denote the marginal cost of domestic production by $w > t$.

Hence, active retailers that buy domestically maximize

$$(p_i - c - w)q_i(p_i), \tag{4}$$

whereas active retailers relying on imports maximize

$$(p_i - c - t)q_i(p_i) - F_I. \tag{5}$$

Below, we let superscript $D$ indicate domestic sourcing and $I$ indicate imports.

Each retailer takes the mass of active retailers $N$ and average retail price $\bar{p}$ as given when setting its price. Retailer $i$'s profit-maximizing prices when buying from domestic (foreign) sources are, respectively,

$$p_i^D = \frac{1}{2}\left(c + w + \frac{\beta\alpha + \gamma N\bar{p}}{\gamma N + \beta}\right) \quad \text{and} \quad p_i^I = \frac{1}{2}\left(c + t + \frac{\beta\alpha + \gamma N\bar{p}}{\gamma N + \beta}\right).$$

Defining $c_D \equiv (\beta\alpha + \gamma N\bar{p})/(\gamma N + \beta) - w$, we find the equilibrium prices and outputs of a retailer with marginal cost $c$ are

$$p^D(c) = w + \frac{1}{2}[c_D + c] \tag{6}$$

$$p^I(c) = \frac{1}{2}[c_D + w + c + t] \tag{7}$$

$$q^D(c) = \frac{L}{2\beta}(c_D - c) \tag{8}$$

$$q^I(c) = \frac{L}{2\beta}(c_D + w - c - t), \tag{9}$$

and profits are

$$\pi^D(c) = \frac{L}{4\beta}(c_D - c)^2 - F_E \tag{10}$$

$$\pi^I(c) = \frac{L}{4\beta}(c_D + w - c - t)^2 - F_E - F_I. \tag{11}$$

Only retailers with marginal costs less than or equal to $c_D$ will remain active, because only they will be able to cover their marginal cost. Active retailers have to select the source from which to buy their goods. A retailer is indifferent between domestic sourcing and direct imports if $\pi^D(c) = \pi^I(c)$. This condition defines a critical value of the marginal cost $c_I$,

$$c_I = c_D + \frac{(w-t)}{2} - \frac{2\beta F_I}{L(w-t)}, \tag{12}$$

such that firms with $c \leq c_I$ prefer imports and firms with $c > c_I$ domestic sourcing. We assume that $c_I \leq c_D$, so that the least efficient active retailers weakly prefer domestic sourcing. This requires that

$$\frac{L}{4\beta}(w-t)^2 \leq F_I. \tag{13}$$

We also assume that importing is more profitable for the most efficient retailers than domestic sourcing. Thus, at $c = 0$, we require

$$F_I < \frac{L}{4\beta}((w-t)^2 + 2c_D(w-t)). \tag{14}$$

These two assumptions together with the quadratic form of the profit function ensure that the value of $c_I$ solving (12) is unique.

The two cut-off values of the marginal cost, $c_D$ and $c_I$, define three categories of retailers. Retailers whose marginal cost is sufficiently small ($c \leq c_I$) import; retailers whose marginal costs are in the middle range ($c_I < c \leq c_D$) source goods domestically; and retailers with high marginal costs ($c > c_D$) are not active, because they are not able to cover their marginal costs.[7]

Given these cutoffs, we can compute the average retail price of active retailers as

$$\overline{p} = \frac{1}{G(c_D)}\left(\int_0^{c_I} p^I(c)dG(c) + \int_{c_I}^{c_D} p^D(c)dG(c)\right), \tag{15}$$

which, with the Pareto distribution, gives

$$\overline{p} = w + \frac{kc_D}{k+1} + \frac{c_D}{2(k+1)} - \frac{(w-t)}{2}\frac{c_I^k}{c_D^k}. \tag{16}$$

7 The model could easily be expanded by introducing a fourth category of retailers that import goods indirectly through wholesalers. Wholesalers can be thought of as agents that enable importers to reduce the fixed cost of importing by providing intermediation services to a number of retailers. For instance, if indirect importing through wholesales were associated with a lower fixed cost than direct importing but a higher variable cost, then we could think of indirect importers as being situated in terms of their productivity between direct importers and retailers that source goods domestically. The main conclusions of our paper would be unaffected. See Akerman (2010) for a model that explicity considers a role for wholesalers in intermediating trade. See also Bernard et al. (2010) who quantify the role of wholesalers and retailers in US trade, and Blum, Claro, and Horstmann (2009) for a theoretical and empirical study of trade intermediation.

Since the marginal active retailer is just indifferent between buying and not buying, we have $q^D(c_D) = 0$ and $p^D(c_D) = w + c_D$. Using this price in (3), the mass of active retailers can be calculated as

$$N = \frac{\beta(\alpha - w - c_D)}{\gamma(w + c_D - \overline{p})}. \tag{17}$$

The mass of active retailers is related to the mass of entrants into the retail market, $N_E$, by the condition $N = N_E G(c_D)$. In equilibrium the mass of entrants has to be large enough that the expected profit of a retailer is equal to zero:

$$\int_0^{c_I} \pi^I(c)dG(c) + \int_{c_I}^{c_D} \pi^D(c)dG(c) + \int_{c_D}^{c_M} (-F_E)dG(c) = 0. \tag{18}$$

## 3. Equilibrium and comparative statics

In this section we characterize the equilibrium of the model and examine the comparative statics with regard to changes in the trade cost $t$. The endogenous variables of the model are $\overline{p}$, $c_D$, $c_I$ and $N$. The equilibrium values of these variables are given by equations (12), (16), (17), and (18).

Consider first the zero-profit condition (18). The partial derivative of this condition with respect to $c_I$ is zero, since, by definition, $\pi^I(c_I) = \pi^D(c_I)$. Total differentiation of this equation hence yields $dc_D/dt$. We can then derive $dc_I/dt$ from (12) and the marginal change in $\overline{p}$ from (16). We obtain the following comparative static results (see proofs in the appendix):

PROPOSITION 1. *Trade liberalization (i) forces the least efficient retailers to become inactive ($c_D$ decreases); (ii) induces some retailers to switch to buying imports ($c_I$ rises); and (iii) reduces the average consumer price $\overline{p}$.*

The intuition for these effects is as follows. A reduction in the trade cost, ceteris paribus, raises the profits of importers both in absolute terms and relative to those retailers that source their goods domestically. Hence more retailers will turn to imports ($c_I$ rises). To keep the zero-profit condition satisfied ex ante despite the fact that active retailers will ex post earn a larger profit, $c_D$ has to decrease so as to lower the probability of being an active retailer.

Changes in $t$ have a direct effect on $\overline{p}$, as well as indirect effects through changes in the equilibrium values of $c_D$ and $c_I$:

$$\frac{d\overline{p}}{dt} = \frac{1}{2}\frac{c_I^k}{c_D^k} + \frac{k}{k+1}\frac{dc_D}{dt} + \frac{1}{2(k+1)}\frac{dc_D}{dt} + \frac{(w-t)}{2}\frac{c_I^k}{c_D^k}\left(\frac{k}{c_D}\frac{dc_D}{dt} - \frac{k}{c_I}\frac{dc_I}{dt}\right). \tag{19}$$

The first term is the standard pass-through effect: the share of direct cost savings that an importer passes on to consumers (1/2) times the probability that a good is being imported. This effect is clearly less than one and may be very small if the probability that a good is imported (or, equivalently, the share of imports in consumption) is small. This probability depends in a straightforward way on the trade cost. It also depends on the distribution of retailing costs as summarized by parameter $k$. The last three terms in (19) reflect the fact that trade liberalization (i) changes retailing costs and retail markups as the least efficient retailers become inactive, and (ii) increases the likelihood that a good is being sourced from abroad. Specifically, the second term reflects the fact that a reduction in $t$ lowers the expected unit cost of retailing. The third term indicates that a lower $t$ reduces the mark-up of domestically sourced goods. The fourth term shows that trade liberalization, by raising the probability of importing, generates cost savings from importing for a bigger share of consumption.

Since these last three effects are positive, the effect of lower trade costs on consumer prices may be big even if the first term is small. In fact, we can show the following surprising result:

PROPOSITION 2. *The rate at which a reduction in the trade cost decreases the average consumer price may exceed unity if the fixed cost of importing is sufficiently small.*

This result demonstrates that an analysis of the impact of trade liberalization that is limited to the standard effect, that is, the share of cost savings that retailers sourcing goods from abroad pass on to consumers times the import share in the retail sector, may severely underestimate the actual impact. Only if one takes into account key retail market adjustments, including the changes in retail costs and mark-ups spurred by the elimination of inefficient retailers and the increase in foreign sourcing, does one obtain an unbiased estimate of the true impact.

Although these adjustments may not appear like direct impact effects, it is important to keep in mind that they are not limited to the long run either. The analysis can also be conducted in the short run when $N_E$ is fixed. In this case, the effect of $t$ on the short-term equilibrium values of $\overline{p}$, $c_D$ and $c_I$ is qualitatively the same as in the long run.[8] The reason is that the selection effect also works in the short run, as retailers can very quickly add or drop product lines (i.e., become active or inactive) or change their sourcing strategies.

As we just saw, retailers that source their goods from abroad directly pass on only part of the reduction in trade costs to consumers. Their mark-ups, sales and profits hence rise. Retailers that buy their goods domestically, on the other hand, are forced to cut their mark-ups, which leads to lower sales and profits. These effects can be summarized as follows:

8 In the short run, the equilibrium values of $\overline{p}$, $c_D$ and $c_I$ are given by equations (16), (12) and (17), where in the latter equation we substitute for $N$ using $N = N_E G(c_D)$. See www.sfu.ca/~schmitt/paper5_shortrun.pdf for a more detailed analysis.

PROPOSITION 3. *Trade liberalization (i) lowers the sales, mark-ups, and profits of retailers that source domestically; (ii) raises the sales, mark-ups, and profits of retailers that engage in direct imports.*

Firms respond to changes in expected profits by entering or exiting the retail sector. Propositions 1 and 3 indicate that trade liberalization indeed induces changes in expected profits. First, since trade liberalization reduces $c_D$, the likelihood of earning a positive operating profit, $G(c_D)$, falls. Second, the profit earned by an importer rises and, since $c_I$ goes up, so does the probability of being an importer. Third, the profit of a retailer buying goods domestically decreases, but so does the probability of falling into this category.

We can use (17) to derive how the mass of active firms $N$ changes with marginal changes in $t$, keeping in mind that $N$ is related to the equilibrium mass of entrants $N_E$ via the condition $N = N_E G(c_D)$:

$$\frac{dN}{dt} = \frac{\beta}{\gamma(w + c_D - \overline{p})^2}\left(-(\alpha - \overline{p})\frac{dc_D}{dt} + (\alpha - w - c_D)\frac{d\overline{p}}{dt}\right). \tag{20}$$

The first expression in parentheses represents the cost effect: a fall in $t$ reduces the average retail cost and thus implies a higher number of active retailers. The second expression represents the price effect: a decrease in $t$ reduces the average retail price, which drives down the number of active retailers. The sign of $dN/dt$ is therefore generally ambiguous; that is, it depends very much on the characteristics of the retail sector. However, we can prove the following:

PROPOSITION 4. *Trade liberalization reduces the mass of active retailers if the fixed cost of importing is sufficiently small and the market (as measured by $\alpha$) is sufficiently big.*

We will show in section 5 that a reduction in $N$ has important, though not straightforward, implications for retail market concentration and social welfare.

At this juncture, it is useful to relate briefly our assumptions and results to stylized facts and to existing work. Foster, Haltiwanger, and Krizan (2006), in particular, find that there is considerable heterogeneity among retailers, that an establishment's productivity is fairly stable over time, and that the productivity distribution among entrants is similar to that of the incumbents. These findings are consistent not only with our model of heterogeneous retailers but also with the assumption that each retailer has a single productivity draw and that the set of retailers can be represented by a distribution with a stable parameter $k$. Similarly, our proposition 1 is consistent with the finding that it is indeed the least efficient retailers that exit the industry. Finally there is indirect evidence that the results of proposition 3 are important in practice. Basker (2007) argues, for instance, that Wal-Mart, the world's biggest retailer, is a very influential advocate of free trade and runs one of the largest Political Action Committees in the United States.

## 4. Retail market regulation

Heterogeneity among retailers is precisely what is needed to investigate the effects of retail-market regulations that limit the size of retail establishments as traditionally imposed in France, Belgium, Japan, Italy, the UK, and elsewhere. We show that such regulations tend to raise average retail prices and to reduce the impact of trade liberalization.

Examples of the kind of retail-market regulations we have in mind include the Loi Royer (1973) and Loi Raffarin (1996) in France. The Loi Royer created regional zoning boards composed of local store owners, politicians, and consumer representatives to regulate the establishment of retail stores exceeding 1000 to 1500 $m^2$, depending on city size, and the enlargement of existing stores (Bertrand and Kramarz 2002). This law was modified in 1996 by the Loi Raffarin, which extended the authority of these boards to stores with a size exceeding 300 $m^2$ in an attempt to impede entry by hard discounters (Askenazy and Weidenfeld 2007). The intent of these laws was to protect small retailers from the rapid structural change in the retail industry, but its ultimate effect was to impede the establishment of an efficient retail sector, with negative consequences for consumers and employment. In 1975, Belgium enacted legislation to restrict entry of retail establishments exceeding 1000 $m^2$; these restrictions were relaxed in 2004 with the adoption of the so-called 'Ikea Law,' named after the Swedish furniture chain that apparently faced difficulties in establishing large stores in Belgium (Askenazy and Weidenfeld 2007, 51). In Italy the regulation of large retail stores was handed to regional authorities in 1998. Schivardi and Viviano (2010) find significantly lower retail employment and productivity but higher retail profits and prices in regions where the entry of large stores is tightly controlled. Sadun (2008), and Haskel and Sadun (2009) study a 1996 retail-market regulation in the UK, which placed specific entry constraints on stores above 2500 $m^2$. They observe a shift by supermarket chains to smaller stores and a significant negative effect on productivity.

We model these types of regulation by introducing an upper bound on retailer establishment' sales, and thus on their size.[9] Because of retailer heterogeneity, this constraint affects only the most efficient retailers. Let the maximum level of sales allowed under the regulation be denoted by $\hat{q}$. The interesting case to consider is where the marginal retailer that is just constrained in its sales is an importer. All retailers that are more efficient than this marginal retailer are then obviously also constrained, and all constrained retailers charge the same retail price $\hat{p}$, since at $\hat{q}$ their marginal revenue exceeds marginal cost. When we use $\hat{q}$ in (3), this price is given by

$$\hat{p} = c_D + w - \frac{\beta}{L}\hat{q}. \tag{21}$$

9 In our static model, retailer establishment size or capacity is equivalent to sales.

The profit of a constrained retailer hence is

$$\hat{\pi}(c) = \left(c_D + w - \frac{\beta}{L}\hat{q} - c - t\right)\hat{q} - F_E - F_I. \tag{22}$$

The critical value of the marginal cost $\hat{c}$ at which a retailer is just constrained is defined by $\hat{q} \equiv q^I(\hat{c})$. Hence,

$$\hat{c} = c_D + w - t - \frac{2\beta}{L}\hat{q}. \tag{23}$$

At this level of marginal cost we have $\hat{\pi}(\hat{c}) = \pi^I(\hat{c})$ .

Ceteris paribus, a tightening of the constraint raises $\hat{c}$, which implies that the sales constraint hits even less efficient retailers. Of course, a change in $\hat{q}$ also affects the other critical levels of the marginal cost, that is, $c_D$ and $c_I$, together with the other endogenous variables, $\overline{p}$ and $N_E$. The equilibrium values of the endogenous variables when the constraint is binding are given by equations (12), (17), and (23), as well as the new expected-zero-profit condition,

$$\int_0^{\hat{c}} \hat{\pi}(c)dG(c) + \int_{\hat{c}}^{c_I} \pi^I(c)dG(c) + \int_{c_I}^{c_D} \pi^D(c)dG(c) + \int_{c_D}^{c_M} (-F_E)\, dG(c) = 0, \tag{24}$$

and the new equation for the average retail price,

$$\bar{\hat{p}} = \frac{1}{G(c_D)}\left(\int_0^{\hat{c}} \hat{p}dG(c) + \int_{\hat{c}}^{c_I} p^I(c)dG(c) + \int_{c_I}^{c_D} p^D(c)dG(c)\right). \tag{25}$$

To derive the comparative static effects of a marginal change in the constraint $\hat{q}$, consider again the zero-profit condition. Since, by definition, $\hat{\pi}(\hat{c}) = \pi^I(\hat{c})$ and $\pi^I(c_I) = \pi^D(c_I)$, the partial derivatives of (24) with respect to $\hat{c}$ and $c_I$ are zero. We therefore directly obtain from (24) the change in $c_D$ for marginal changes in $\hat{q}$. The respective changes in $\hat{c}$ and $c_I$ then follow directly from (23) and (12). The following proposition presents these comparative-static effects:

PROPOSITION 5. *A tightening of the sales constraint $\widehat{q}$ implies that the marginal active retailer, the marginal constrained retailer, and the marginal importing retailer are less efficient firms (i.e., $c_D$, $\hat{c}$, and $c_I$ rise).*

The first part of the proposition is straightforward. A tighter constraint on the sales of the most efficient retailers raises the residual demand for the unconstrained retailers. This allows retailers that were too inefficient before to remain in business. The surprising result is that a tighter sales constraint raises retailers' propensity to import. The reason for this is that the higher residual demand allows retailers that before were too inefficient to import to source their goods from abroad. This increase at the extensive margin of imports is, of course, offset by a decrease at the intensive margin: a tighter constraint reduces the import volume of efficient retailers.

To determine the effect of a tighter constraint on the average retail price, we simplify (25) to obtain

$$\bar{p} = w + \frac{kc_D}{k+1} + \frac{c_D}{2(k+1)} - \frac{(w-t)}{2}\frac{c_I^k}{c_D^k} + \frac{\hat{c}}{2(1+k)}\frac{\hat{c}^k}{c_D^k}. \tag{26}$$

The first four terms of this equation are the same as in (16). The fifth term is an additional term, reflecting the direct effect of the output constraint. It represents the extra expected mark-up of a constrained firm times the probability that a firm is constrained conditional on its cost being less than $c_D$.

The change in the average retail price induced by a tighter constraint comes from changes in the cut-off values $\hat{c}$, $c_D$, and $c_I$. A tighter $\hat{q}$ raises all three cut-off values. This has the following implications. An increase in $\hat{c}$ means that a larger fraction of retailers becomes constrained and thus has higher prices than without the constraint. The increase in $c_D$ also raises $\bar{p}$, since at the margin less efficient retailers remain active in the market. The rise in $c_I$ works against the first two effects. Retailers are more likely to source goods from abroad, which is associated with lower variable costs than sourcing goods domestically. One would expect that the first two effects dominate the last one, so that a tightening of the sales constraint raises the average retail price. Formally, we can show that it is indeed the case if either $(w-t)$ is big and/or $F_I$ is small, so that the retailers switching to importing have a relatively high unit retailing cost compared with the rest of the industry and thus have only a small market share.

We formally state these sufficient conditions in the following proposition:

PROPOSITION 6. *A tightening of the sales constraint* $\widehat{q}$ *raises the average retail price* $\bar{p}$ *if* $(w-t)$ *is sufficiently big and/or* $F_I$ *is sufficiently small.*

Retail-market regulation also affects the transmission of changes in import into consumer prices. Since, from (21), $\widehat{p} = c_D + w - (\beta/L)\widehat{q}$, the prices of constrained retailers are not affected at all by the import price, even though we assumed that these retailers do in fact import their goods. The reason for this is that the sales of these firms are below the level at which marginal revenue equals marginal cost, so that small changes in marginal cost have no effect on sales or prices.

In the extreme case where the constraint is so restrictive that it affects all importing firms, trade liberalization has no impact whatsoever on the average retail price even if the import share in the total consumption basket of households is large. Thus, even if retail-market regulation induces a larger mass of retailers to source from abroad, its impact on the most efficient retailers makes the average retail price less sensitive to variations in import prices, at least if the constraint is sufficiently tight (i.e., for $\widehat{q}$ sufficiently close to $q^I(c_I)$). This result can be summarized as follows:

PROPOSITION 7. *Retail-market regulation reduces the pass-through of lower trade costs into the average retail price if the output constraint is sufficiently tight.*

## 5. Retail market concentration and welfare

In section 4, we argued that the number of active retailers may decrease with trade liberalization. Even if the number of active retailers rises, concentration in retailing could still increase because of the impact of lower trade costs on the size dispersion of retailers. But then would social welfare rise or fall? The same question also arises in connection with retail-market regulation, since it is often a goal of this regulation to lower, or at least to keep low, the degree of market concentration in retailing.

To investigate these issues, we use simulations. In the context of the present model, the Herfindahl index, $H$, is an ideal measure of market concentration. This is because this index takes into account the entire size distribution of the retailing sector and thus both the mass of active retailers as well as the dispersion of retailer size. Indeed, the Herfindahl index, defined as the sum of the squares of all retailers' market shares, can be rewritten as

$$H = \frac{\sigma_q^2/\bar{q}^2 + 1}{N}, \tag{27}$$

where $\bar{q}$ denotes average sales of active retailers and $\sigma_q^2$ is the variance of retail sales (see Waterson 1984). This formulation of $H$ reveals the separate effects on concentration stemming from the mass of active retailers and from the impact of retailers' size dispersion. Thus, in a market with heterogeneous retailers, market concentration as measured by the Herfindahl index is negatively related to the mass of active retailers, $N$, and positively related to the coefficient of variation of retail sales, $\sigma_q/\bar{q}$. Since $0 \leq H \leq 1$, industry concentration is high if a few big retailers account for a large fraction of sales.

Social welfare in the current model is best captured by the following indirect utility function:

$$U = I + \frac{1}{2}\left(\gamma + \frac{\beta}{N}\right)^{-1}(\alpha - \bar{p})^2 + \frac{1}{2}\frac{N}{\beta}\sigma_p^2, \tag{28}$$

where $\sigma_p^2$ denotes the variance of retail prices. Welfare is obviously decreasing in $\bar{p}$ and increasing in $N$ and $\sigma_p^2$ (see Melitz and Ottaviano 2008).

It is often presumed that a decrease in $H$ corresponds to an increase in $U$. This presumption rests on the idea that a decrease in $H$ is associated with an increase in competition and thus with a smaller social deadweight loss. It is easy to see that such a simple one-to-one relationship between $H$ and $U$ does not necessarily exist in the present model with heterogeneous retailers following a shock such as trade liberalization. This is the case because there is no simple negative relationship between $\overline{p}$ and $\overline{q}$ when $N$ varies and because $\sigma_q^2$ and/or $\sigma_p^2$ can rise with trade liberalization. Thus, unless trade liberalization changes the mass of retailers in a way that clearly dominates its effects on the size variation of retailers, it is quite possible that social welfare may increase, even if trade liberalization increases retail market concentration. Clearly, retailer heterogeneity plays a key role in this seemingly contradictory message regarding the Herfindahl index and social welfare.

We illustrate these possibilities in figures 1a and 1b. In the first figure, both welfare (measured by $U$ net of income $I$) and $H$ monotonically rise with trade liberalization. Welfare increases despite a *decrease* in the number of active retailers, $N$.[10] This occurs because the average price, $\overline{p}$, falls considerably as the trade barrier comes down due to the different effects captured by (19). Two forces explain why $H$ rises with trade liberalization: the decrease in the number of active retailers and an increase in the variance of sales, $\sigma_q^2$.

Figure 1b illustrates the more standard case where trade liberalization monotonically raises welfare and lowers the Herfindahl index. Trade liberalization still leads to a decrease in the average retail price but, unlike the previous case, it raises the mass of active retailers. Although $H$ falls with trade liberalization, its decrease is small as trade liberalization raises retailer size dispersion. Clearly, in the present model, the Herfindahl index is not a reliable indicator of the social welfare impact of trade liberalization. More important for our purpose, the simulations show that welfare rises with trade liberalization even if retail market concentration increases.

Consider now the effects of market regulation restricting the size of the most efficient retailers. Using the case illustrated by figure 1b, we assume that the maximum sales volume allowed by regulation, $\widehat{q}$, corresponds to 75% of the unconstrained free-trade sales of the most efficient retailer (i.e., with $c = 0$).[11] Such a constraint affects more than just the most efficient retailers but it does so with a smaller relative impact, since less efficient retailers are smaller. Indeed, retailers with a volume of sales less than $\widehat{q}$ are not affected at all. Table 1 shows the percentage changes with respect to the benchmark case without regulation for different levels of the trade cost.

The regulation has striking effects on both the level of the variables and the impact of trade liberalization. It significantly increases the number of active retailers, $N$, and decreases $H$ relative to the benchmark case. In this sense, the introduction of the regulation achieves its goal. Consumers, however, are hurt,

10 And despite a decrease in $\sigma_p^2$. The underlying parameters in the figures are $L = 5$, $F_I = .1$, $w = .25$, $c_M = 5$, $\alpha = 1.75$, $\beta = .9$, $\gamma = .6$, and $k = 1$.

11 In the above example, this corresponds to a maximum sales volume allowed by regulation equal to $\widehat{q} = 1.83$.

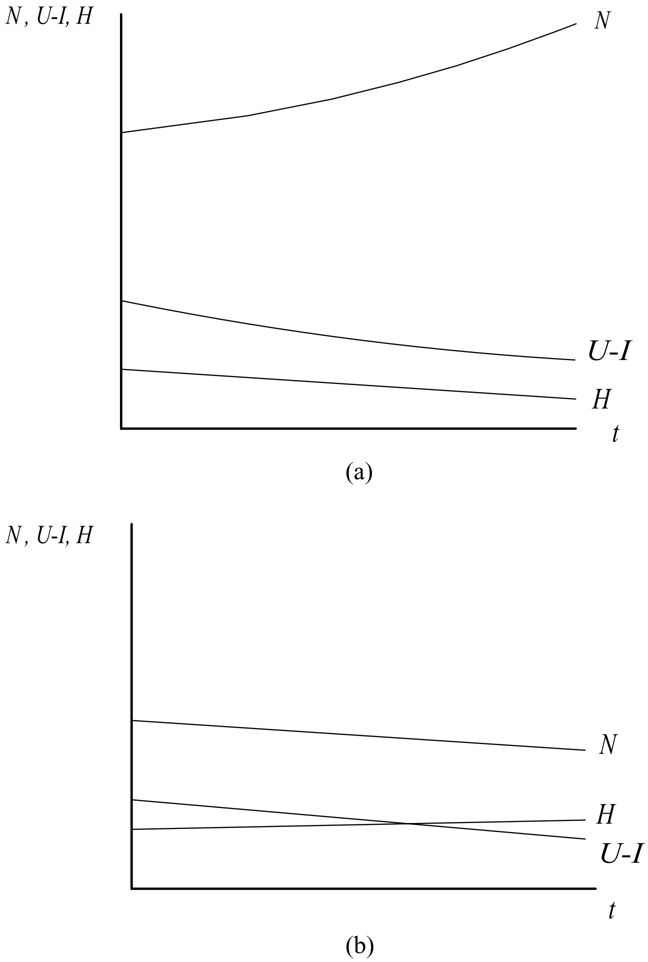


FIGURE 1 (a) $F_E = .02$ (b) $F_E = .1$

TABLE 1
Impact of regulation

| $t$ | $\bar{\bar{p}}$ | $\bar{\bar{q}}$ | $N$ | $H$ | $U - I$ |
|---|---|---|---|---|---|
| 0 | +11% | −16% | +14% | −28% | −14% |
| 0.05 | +9% | −16% | +13% | −22% | −15% |
| 0.1 | +8% | −16% | +13% | −19% | −16% |
| 0.15 | +7% | −15% | +12% | −17% | −17% |
| 0.2 | +6% | −15% | +11% | −16% | −17% |

since they face higher average prices and lower social welfare than in the benchmark case. Regulation also affects the impact of trade liberalization. Even if it still leads to lower prices and a greater average volume of sales, the impact of freer trade is very much muted, since the average retail price decreases to a much smaller extent and the average quantity sold by retailers increases much less than without the regulation. Despite its impact on concentration and on the number of retailers, the overall impact of the regulation is a smaller increase in social welfare through trade liberalization than in the absence of such a regulation.

## 6. Conclusions

Our paper has two important messages. The first one is that the impact of trade liberalization depends very much on the structure of the retailing sector and how this sector adjusts to trade liberalization. To show this, we used a simple model where there is no adjustment on the production side, the traditional source of adjustment to trade liberalization, so that we could focus our attention solely on the structure of the retailing industry with heterogeneous retailers. Because buying foreign products involves a fixed cost, only the most efficient retailers source goods from abroad. Trade liberalization then shifts retail sales, mark-ups, and profits toward big retailers that engage in direct imports at the expense of small ones that source domestically only. This tends to raise the variance of retail sales and may lead to higher retail market concentration, as measured by the Herfindahl index. The model provides not only clear predictions concerning the sensitivity of retail prices to variations in import prices, but it also tells us the source of these adjustments. Whether adjustments are due to retailers switching the sourcing of their purchases, or because the mass of them is affected, the model suggests that retailer heterogeneity plays an important role in explaining how much consumers benefit from trade liberalization. The importance of the retailing sector for our understanding of trade liberalization can also be seen when we analyze the impact of regulation. Restrictions on the size of retailers can be viewed as neutralizing part of the endogenous response of the retailing sector to external shocks such as trade liberalization. We show that such a restriction both impacts the level of key indicators, such as average retail prices and social welfare, but also mutes the effect of trade liberalization in a way that is detrimental to consumers.

The second message is that, although stylized, the model helps us to understand how freer trade may have affected differently some countries. In some countries, including France and Japan, there is a tradition of protecting small local retailers by placing barriers on the expansion and particularly on the size of large retailers, whereas such restrictions typically do not exist in countries such as the United States or Canada. Not surprisingly, restrictions on the volume of sales affect first and foremost the efficient retailers. We show that this allows inefficient retailers to remain active and makes the average retail price higher than it would otherwise be. Interestingly, this makes the incentives to source products from abroad stronger for less efficient retailers, not weaker. We also show that it makes the retail price level less sensitive to changes in the price of imported products. With higher average retail prices and a lower sensitivity of retail prices to foreign shocks, it should not be surprising if French consumers feel that their 'pouvoir d'achat' (purchasing power) has suffered compared with that of consumers elsewhere in Europe (*Economist* 2008).

The contrast with the United States is striking. Broda and Romalis (2009) show that because the composition of the consumption basket of poor US households is different from that of rich households and because the price index of the poor's consumption basket has declined relative to that of the rich, the impact of the rise in income inequality has been significantly smaller than first feared. It seems fairly clear that this would not have been possible without the instrumental role played by large retailers importing a large volume of products from low-cost Asian countries.

These two examples underline well the significant impact of the retailing sector in a more integrated world. Simply put, in the United States, the large retailers seem to allow poor consumers to keep up with the Joneses, whereas in France consumers feel cheated by the retailers and do not perceive much benefit from globalization. Of course much more needs to be done to understand the role and the impact of the retailing sector in today's world. This is left for future research.

## Appendix

### *A.1. Forms of retailer differentiation*

There are two basic reasons why consumers may view retailers as being differentiated: (i) retailers have different characteristics (location, amenities) that consumers value, or (ii) retailers sell different goods or bundles of goods. We discuss separately how each interpretation fits with our model.

i) *Differentiated retailers*. Assume that goods are perfect substitutes, produced by a perfectly competitive manufacturing sector and that $N$ active retailers are symmetrically located around a circle of circumference $C$ around which a mass $L$ of consumers is uniformly distributed. Each consumer demands one unit and faces a linear transport cost $\tau$ per unit of distance to visit a retailer. Assume next a standard address model where consumers choose between two stores depending on their location. Because competition is localized, this model is not suited to deal with firm heterogeneity (see von Ungern-Sternberg 1991). One difficulty is that, when retailers have different marginal costs, a Nash equilibrium in prices depends on how retailers are placed on the circle (since each price depends on the marginal costs of the two neighbours, there is no one-to-one mapping between a retailer's marginal cost and its equilibrium price). This makes it difficult to deal with entry and exit. If, say, a shock to demand forces retailers to close down, it is not obvious which ones will exit: high-cost retailers or lower cost ones that just happen to face tough competition from even lower-cost neighbours. The only way to have a tractable address model with cost heterogeneity is to have a non-standard specification where each retailer competes with all the other retailers.

One such model is Innes (2006)'s 'random preference Hotelling' specification. Preferences are random because each ordering of the $N$ active retailers among the $N$ locations is possible and happens with the same relative frequency. A simple interpretation of these preferences is that when a consumer goes shopping, she still chooses between only two retailers, but the identity of the two stores depends on an unobserved, random event. Innes shows that the aggregate demand function faced by retailer $i$ is linear in prices such that $q_i(p_i) = L/N - (L/C\tau)p_i + L/(C\tau(N-1))\Sigma_{h=1,h\neq i}^{N} p_h$. This demand converges to the same demand arising from the quadratic utility function as $N$ rises; for large enough $N$, this demand is approximately equal to

$$q_i(p_i) = \frac{L}{N} - \frac{L}{C\tau}p_i + \frac{L}{C\tau}\bar{p}. \tag{A1}$$

It can be shown that our results hold with (A1). Hence, for large enough $N$, our linear demand functions may be interpreted as arising from an address model in which each consumer visits only one retailer. See von Ungern-Sternberg (1991), Chen and Riordan (2007), and Braid (1998) for other non-standard address models leading to linear aggregate demand functions at least over certain price ranges.

ii) *Product differentiation*. This interpretation is compatible with our model if we assume that the prices are fixed at $w$ for domestic varieties and at $t$ (including the trade cost) for imported varieties. There are several ways to justify this. One way is to assume that each variety is produced under constant returns to scale either by a perfectly competitive industry (as in Eaton and Kortum 2002), or by two or more homogeneous firms competing in Betrand fashion (as in Bernard et al. 2003). In both instances, price is equal to marginal cost. Another way is to assume a large number of potential manufacturers, each producing a differentiated variety under increasing returns to scale, for instance, with a fixed cost, $\alpha$, and a constant marginal cost $w$ at home and $t$ (including the trade cost) abroad. Assuming further that each retailer carries one good and makes a take-it-or-leave-it offer to a manufacturer specifying a two-part tariff that combines a fixed payment to the manufacturer and a wholesale price per unit, it can be shown (see Raff and Schmitt 2011 for a more general setting) that the optimal two-part tariff involves a fixed payment of $\alpha$ to the manufacturer combined with a wholesale price of $w$ at home and $t$ (including the trade cost) abroad. Once the retailer's market entry cost is redefined as

$\tilde{F}_E \equiv F_E + \alpha$, the entire remaining analysis and results, as presented in the paper, hold.

*A.2. Proof of proposition 1*

Using the Pareto distribution, (18) can be rewritten as

$$\frac{c_D^{k+2}}{(k+1)(k+2)} + (w-t)c_I^k\left(\frac{w-t}{2} + c_D - \frac{kc_I}{k+1}\right) - \frac{2\beta}{L}\left(c_M^k F_E + F_I c_I^k\right) = 0. \tag{A2}$$

Total differentiation of (A2) yields

$$\frac{dc_D}{dt} = \frac{c_I^k\left(c_D + w - t - \dfrac{kc_I}{k+1}\right)}{\dfrac{c_D^{k+1}}{(k+1)} + (w-t)c_I^k} > 0, \tag{A3}$$

since $c_D^{k+1}/(k+1) + (w-t)c_I^k = 2c_D^k(w + c_D - \overline{p}) > 0$ and $w - t + c_D - kc_I/(k+1) > 0$, owing to $w > t$, $c_D > c_I$ and $k < 1 + k$.

From (12) we obtain

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

Substituting for $dc_D/dt$, we have

$$\frac{dc_I}{dt} = \frac{1}{\dfrac{c_D^{k+1}}{(k+1)} + (w-t)c_I^k}\left[-\left(\frac{1}{2} + \frac{2\beta F_I}{L(w-t)^2}\right)\left(\frac{c_D^{1+k}}{1+k} + (w-t)c_I^k\right) + c_I^k\left(c_D + w - t - \frac{kc_I}{1+k}\right)\right].$$

Using $2\beta F_I/(L(w-t)^2) = (1/(w-t))(c_D - c_I + (w-t)/2)$ (from (12)) in the above expression and simplifying, we get

$$\frac{dc_I}{dt} = \frac{1}{2c_D^k(w + c_D - \overline{p})}\left\{-\frac{c_D^{1+k}}{1+k}\left[1 + \frac{c_D - c_I}{w-t}\right] + \frac{c_I^{1+k}}{1+k}\right\} < 0. \tag{A4}$$

Note that $dc_I/dt < 0$ provided $c_D^{1+k}(w - t + c_D - c_I) > (w-t)c_I^{1+k}$, which holds, since $w > t$ and $c_D > c_I$.

By using (16), it is easy to check that

$$\frac{d\bar{p}}{dt} = \left(\frac{1+2k}{2+2k}\right)\frac{dc_D}{dt} + \frac{1}{2}\frac{c_I^k}{c_D^k} + \frac{k(w-t)}{2}\frac{c_I^k}{c_D^k}\left[\frac{1}{c_D}\frac{dc_D}{dt} - \frac{1}{c_I}\frac{dc_I}{dt}\right] > 0, \qquad \text{(A5)}$$

since all the terms on the RHS are positive.

*A.3. Proof of proposition 2*

Consider the minimum value of $F_I$ consistent with (13). In this case, $c_D = c_I$, $dc_I/dt = 0$, and $dc_D/dt = 1$. Using this in (19) yields

$$\frac{d\bar{p}}{dt} = \frac{4k+3}{2k+1} + \frac{k(w-t)}{2c_D} > 1.$$

By continuity, $d\bar{p}/dt > 1$ for $F_I$ sufficiently close to its minimum value.

*A.4. Proof of proposition 3*

By differentiating (8) and (10) with respect to $t$ and using (A3), it is easy to check that, for retailers sourcing domestically,

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

Next, we show that $dc_D/dt < 1$. By rewriting and manipulating (A3),

$$\frac{dc_D}{dt} = \frac{(1+k)(w-t) + c_D + k(c_D - c_I)}{(1+k)(w-t) + \dfrac{c_D^{1+k}}{c_I^k}}. \qquad \text{(A6)}$$

Thus, $dc_D/dt < 1$ if $c_D + k(c_D - c_I) < c_D^{1+k}/c_I^k$ or if $1 + k(1 - \frac{c_I}{c_D}) < c_D^k/c_I^k$. When $k = 1$, this inequality reduces to $(c_D - c_I)^2 > 0$, and when $k > 1$, the RHS of the above inequality increases faster than the LHS. Since $0 < dc_D/dt < 1$, it is easy to check that, for retailers selling imported goods,

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

The result on mark-ups follows immediately, as mark-ups are proportional to output.

*A.5. Proof of proposition 4*

After substituting for $\overline{p}$ and $d\overline{p}/dt$ in (20), we have

$$sign\left\{\frac{dN}{dt}\right\} = sign\left\{\left(\frac{w-\alpha}{2+2k}\right)\frac{dc_D}{dt} + \left(\frac{w-t}{2}\right)\frac{c_I^k}{c_D^k}\left(\frac{k(\alpha-w-c_D)}{c_D}-1\right)\frac{dc_D}{dt}\right.$$
$$\left. + \frac{(\alpha-w-c_D)}{2}\frac{c_I^k}{c_D^k} - \frac{k(\alpha-w-c_D)}{c_I}\frac{c_I^k}{c_D^k}\left(\frac{w-t}{2}\right)\frac{dc_I}{dt}\right\}.$$

For $F_I$ equal to its lower bound (see (13)), we have $c_D = c_I$, $dc_I/dt = 0$, and $dc_D/dt = 1$. Therefore,

$$sign\left\{\frac{dN}{dt}\right\} = sign\left\{\frac{w-\alpha}{2+2k} + \frac{w-t}{2}\left(\frac{k(\alpha-w-c_D)}{c_D}-1\right) + \frac{(\alpha-w-c_D)}{2}\right\}.$$

Further simplification yields $sign\{dN/dt\} = sign\{k(\alpha - w - c_D) - c_D\}$. Since in equilibrium $dc_D/d\alpha = 0$ from (A2), $sign\{N/dt\} > 0$ if $\alpha$ is sufficiently big.

*A.6. Proof of proposition 5*

Using the Pareto distribution in (24) and totally differentiating the resulting equation gives

$$\frac{dc_D}{d\hat{q}} = -\frac{2\beta\hat{c}^{k+1}}{L\left(\frac{c_D^{k+1}}{(k+1)} + (w-t)c_I^k\right)} < 0. \tag{A7}$$

From (23) and (12) we can then compute

$$\frac{d\hat{c}}{d\hat{q}} = \frac{dc_D}{d\hat{q}} - \frac{2\beta}{L} < 0 \tag{A8}$$

$$\frac{dc_I}{d\hat{q}} = \frac{dc_D}{d\hat{q}} < 0. \tag{A9}$$

*A.7. Proof of proposition 6*

Using (A8) and (A9), we find the derivative of (26) is

$$\frac{d\overline{p}}{d\hat{q}} = \frac{1+2k}{2(1+k)}\frac{dc_D}{d\hat{q}} - \frac{k(w-t)(c_D-c_I)}{2}\frac{c_I^{k-1}}{c_D^{k+1}}\frac{dc_D}{d\hat{q}}$$
$$+ \frac{1}{2(1+k)}\frac{\hat{c}^k}{c_D^k}\frac{(c_D(1+k)-k\hat{c})}{c_D}\frac{dc_D}{d\hat{q}} - \frac{\beta}{L}\frac{\hat{c}^k}{c_D^k}.$$

Since $dc_D/d\hat{q} < 0$ and $c_D(1+k) - k\hat{c} > 0$, we have $d\overline{p}/d\hat{q} < 0$ if the second term is sufficiently small. Using (12), we can write the second term as

$$\frac{k(w-t)(c_D-c_I)}{2}\frac{c_I^{k-1}}{c_D^{k+1}}\frac{dc_D}{d\hat{q}} = \left(\frac{\beta F_I}{L} - \frac{(w-t)^2}{4}\right)\frac{kc_I^{k-1}}{c_D^{k+1}}\frac{dc_D}{d\hat{q}}. \tag{A10}$$

Hence, $d\overline{p}/d\hat{q} < 0$, provided that $F_I$ is small and/or $(w-t)$ is big enough.

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