How Barriers to International Trade Affect TFP*

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Abstract

We ask how barriers to international trade affect TFP in a small open economy with monopolistic elements in the import–competing industries. We analyze the two standard trade barriers: a binding quota and a tariff that does not completely shut down international trade. We find that both trade barriers lead to too much production of the import-competing sectors, if they produce at all. This is the standard mis–allocation effect. We also find the new effect that under a quota the import-competing sectors produce inefficiently what they produce, whereas under a tariff they produce efficiently what they produce. This suggests that empirical studies on openness and TFP ought to distinguish between quotas and tariffs. We discuss the supporting evidence for our finding from the empirical studies that do so.

Keywords: Monopoly Rights; TFP; Quota; Tariff.
JEL classification: EO0; EO4.

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1 Introduction

There are big cross-country differences in the level of per-capita income. For example, the Penn World Tables report that the average per-capita income in the richest ten percent countries is about thirty times bigger than in the poorest ten percent countries [Heston et al. (2002)]. Growth accounting exercises typically find that differences in total factor productivity (TFP henceforth) account for a significant part of these cross-country income differences.\(^1\) This raises the question why rich countries have higher TFP than poor countries.

There is empirical evidence that openness fosters the catch up of per-capita GDP and TFP.\(^2\) The measures of openness typically used in the literature have many dimensions including the size of barriers to international trade, the size of the black-market premium over the official exchange rate, the importance of government monopoly in exporting and importing industries, and the share of the trade volume in total GDP. In this paper, we explore the importance of one dimension, namely barriers to international trade. Such barriers fall into two broad categories: non-tariff barriers, which we call quotas, and tariff barriers. Quotas are quantity restrictions on imports and tariffs are taxes on imports.

We develop a theoretical model in which quotas and tariffs can adversely affect TFP. We only consider the interesting cases of a quota that binds and a tariff that does not completely shut down international trade. The key feature of our model is that monopoly rights over the use of technologies in the import-competing industries allow industry insiders to extract rents by blocking efficient technologies and work practices. There is ample evidence of blocking activity in both developing and developed countries.\(^3\)

We find that a quota has the usual misallocation effect of distorting the efficient allocation of the factors of production, which implies that the import-competing industries

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\(^1\)Examples are Caselli et al. (1996), Klenow and Rodriguez-Clare (1997), Prescott (1998), Hall and Jones (1999), and Caselli and Coleman (2003).

\(^2\)On openness and per-capita GDP see e.g. Dollar and Wolff (1993), Sachs and Warner (1995), and Wacziarg and Welch (2003); on openness and TFP see e.g. Alcalá and Ciccone (2003) and Parente and Prescott (2004).

\(^3\)Parente and Prescott (2000) offer a review of the evidence.
produce too much. This decreases TFP. In our model economy with monopoly rights, a quota has the additional effect that the import–competing industries produce *inefficiently* what they produce. This decreases TFP further. In contrast, we find that a tariff causes lower distortions than a quota. In particular, if the import–competing sectors produce, then a tariff has the usual misallocation effect of distorting the efficient allocation of the factors of production. However, under a tariff the import–competing industries produce *efficiently* what they produce. Thus, a tariff may decrease TFP only because it can distort the efficient allocation of the factors of production.

In sum, we find that there is an important difference between the ways in which different trade barriers affect TFP when there are monopoly rights in the import-competing industries: under a quota the import–competing industries produce inefficiently what they produce whereas under a tariff the import–competing industries produce efficiently what they produce. Our results generalize those of Holmes and Schmitz (1995), who showed that monopoly rights are effective in a closed economy and ineffective in an open economy. These two cases correspond to a zero quota and a zero tariff in our model.

Our findings suggest that distinguishing between quotas and tariffs is important for understanding the effects of trade barriers on TFP and income. The empirical studies that do not lump quotas and tariffs together but disaggregate the standard openness measures tend to find supportive evidence for our findings. For example, Baily (1993) and Baily and Gersbach (1995) studied the services and manufacturing industries of Germany, Japan, and the USA and found that TFP is negatively correlated with quotas and uncorrelated with tariffs. Muendler (2002) studied Brazilian manufacturers after Brazil’s trade liberalization 1986–98 and found that reductions in quotas had a much larger effect on TFP than reduction in tariffs. Lee (1996) and Kim (2000) reported similar evidence from the Korean manufactures 1963–88.

We organize the rest of the paper as follows. In Sections 2 and 3, we lay out the economic environment and define the equilibrium. In Section 4, we characterize the equilibria under binding quotas and tariffs, derive the different implications for TFP, and
confront them with the empirical evidence. In Section 5, we conclude.

2 Environment

We develop a small open economy model with monopoly rights in the import-competing sectors that combines elements of Holmes and Schmitz (1995) and Parente and Prescott (1999). Since here we are not interested in quantitative issues, we use the simplest environment in which we can make our point analytically. Consequently there is only one period and labor is the only production factor.

There is an “agricultural” good \( a \) and there are many differentiated “manufactured” goods \( m_i, \ i \in [0,1] \). We use the names agricultural good and manufactured good for concreteness, but do not mean them literally.

Each individual is endowed with one unit of productive time and it may be endowed with membership in an insider group. In particular, for each \( i \in [0,1] \) there is an interval of length \( \lambda_0 \in (0,1) \) of identical insiders of type \( i \). Individuals that are not insiders are outsiders and all outsiders are identical. Therefore, we have a rectangle of measure \( 1 - \lambda \) of outsiders. The implications of being an insider or outsider will become clear when we introduce the technologies. We will use the subscript \( \iota \in \{0,1\} \) to indicate whether an individual is an insider or an outsider.

All individuals have identical preferences represented by the utility function:

\[
( a^{\sigma-1} + \int_0^1 m_i^{\sigma-1} di )^{\frac{\sigma}{\sigma-1}}.
\]

We assume that the demand for the differentiated goods is inelastic, that is, \( \sigma \in (0,1) \).

The technology in the agricultural sector is described by:

\[
A \leq N_a,
\]

where \( A \) is the production and \( N_a \) is the labor allocated to the agricultural sector. In
each manufacturing industry, there are three technologies described by:

\[ M_{ik} \leq \pi_{ik} N_{ik}, \quad k \in \{0, 1, 2\}. \]

\( M_{ik} \) and \( N_{ik} \) are the production and the labor when the \( k \)-th technology is used. The \( \pi_{ik} \)'s are the same for all manufacturing sectors: \( \pi_{ik} = \pi_k \) for all \( i \in [0, 1] \). We order them such that \( 1 = \pi_0 < \pi_1 < \pi_2 \). Any individual can use the \( \pi_0 \) technology. In contrast the insiders of the \( i \)-th manufacturing industry have the monopoly right over the use of the \( \pi_1 \) technology in this industry. This means that they are the only ones who can use it and that as a group they can decide how productively they want to operate it. Any group of individuals that pays a cost \( c \) can use the \( \pi_2 \) technology. In other words, \( c \) is the cost of breaking the monopoly.

The agents decide sequentially in a three–stage game. In the first stage, the insiders of each manufacturing industry choose whether to leave or to stay in the insider group. Leaving is voluntary and insiders who leave can work anywhere else. If all insiders of the \( i \)-th manufacturing industry leave the group, then it dissolves and every individual can use the \( \pi_2 \) technology in this industry without paying the fixed cost \( c \). Afterwards, production and consumption take place and the game ends. If some insiders of the \( i \)-th manufacturing industry stay in the group, then these insiders are committed to work in this industry and the game continues. The insiders also decide whether to accept new members. We assume that they accept new members to achieve the largest group size \( \lambda_i \in [0, 1] \) for which their utility is at its maximum.

In the second stage, the outsiders decide whether or not to pay the entry costs. If a group of outsiders enters, its members are the only individuals that can produce with the \( \pi_2 \) technology. This group then chooses the price of the \( i \)-th manufactured good and the insider group chooses how efficiently it wants to operate the \( \pi_1 \) technology. The outsider group produces the total demand minus the production of the \( i \)-th group, \( \pi_i \lambda_i \), minus the imports of the \( i \)-th good. Afterwards, production and consumption take place and the
game ends. If no group of outsiders enters the game continues.\textsuperscript{4}

In the third stage the $i$-th group chooses $\pi_i \in [0, \pi_1]$. This is the efficiency with which its members operate the $\pi_1$ technology. In the real world, it varies depending on working arrangements and rules such as sick days, holidays, etc.\textsuperscript{5} The outsiders decide whether or not to produce with the $\pi_0$ technology. Afterwards, production and consumption take place and the game ends.

There are markets for the agricultural good, for all manufactured goods, and for all types of labor. All final goods are tradable in the world market. The economy is small and open in that it takes the relative final goods prices in the world market as given. Labor is immobile, so it is not traded in the world market. We use the agricultural good in the world market as the numeraire and denote the remaining relative prices by $p_a, p_{mi}^*$, $p_{mi}$ for $i \in [0, 1]$, $w_o$, and $w_i$. The relative price with a superscript $*$ is from the world market and the relative prices without a superscript are from the domestic market.

3 Equilibrium Definition

We will only consider equilibria with free trade of the agricultural good, which implies that $p_a = 1$ in equilibrium.

We start with what happens after the strategic choices in the different stages. Profit maximization then implies that the wages equal the marginal products. This means that $w_o = 1$, for example. Each individual takes prices and wages as given and maximizes its utility function subject to its budget constraint. Using $w_o = 1$, this problem can be written as:

\[
\max_{a_i, \{m_{ij}\}_{j=0}^1} \left( a_i \sigma^{-1} + \int_0^1 m_{ij} \sigma^{-1} dj \right)^{\frac{\sigma}{\sigma - 1}} \text{ s.t. } a_i + \int_0^1 p_{mj} m_{ij} dj = w_i. \tag{1}
\]

\textsuperscript{4}Note that as Parente and Prescott (1999) we assume that there are insider and outsiders groups but we do not model how they form or they survive. We leave addressing these important questions for future research.

\textsuperscript{5}See Holmes and Schmitz (2001a,b) and Schmitz (2001) for further discussion.
The solution to (1) implies the individual demand functions:

\[ a_i = \frac{1}{1 + \int_0^1 p_{mj}^{1-\sigma} dj} w_i, \]  
\[ m_{i} p_{mi} = \frac{p_{mi}^{1-\sigma}}{1 + \int_0^1 p_{mj}^{1-\sigma} dj} w_i. \]  

(2a)  

(2b)

The market-clearing conditions are:

\[ \left(1 - \int_0^1 \lambda_i di\right) a_o + \int_0^1 \lambda_i a_i di = A + A^*, \]  
\[ \left(1 - \int_0^1 \lambda_j di\right) m_{jo} + \int_0^1 \lambda_j m_{ji} di = M_{j0} + M_{j1} + M_{j2} + M_j^*, \quad j \in [0, 1], \]  
\[ N_{i1} = \lambda_i, \quad i \in [0, 1], \]  
\[ N_a + \int_0^1 N_{j0} + N_{j2} dj = 1 - \int_0^1 \lambda_i di. \]  

(3a)  

(3b)  

(3c)  

(3d)

The quantities with a superscript * are net imports. The first two market-clearing conditions say that the sums of the demands for the final goods (left-hand sides) equal their domestic productions plus net imports (right-hand sides). The third market-clearing condition says that for each manufactured industry the demand for insider labor equal the group size (recall that the group members are committed to work in their manufactured industries). The fourth market-clearing condition says that the sum of the demands for outsider labor by the agricultural sector and by the manufacturing industries equal the outsiders’ total time endowments. Note that, in principle, each of the three technologies may be used, thus \( M_{j0} + M_{j1} + M_{j2} \) and \( N_{j0} + N_{j2} \) show up in the market clearing conditions (3b) and (3d).

We continue with stage 3. If the outsiders enter in this stage, profit maximization implies that they earn their marginal product \( p_{mi} \pi_0 = p_{mi} \). They enter if and only if this marginal product is at least as large as the outsider wage \( w_o = 1 \). Since some outsiders must work in agriculture we have that \( p_{mi} \leq 1 \) in equilibrium. The members of the \( i \)-th insider group also earn their marginal products, \( w_i = p_{mi} \pi_i \). The group chooses
\( \pi_i \in [0, \pi_1] \) so as to maximize the utility of its representative member subject to its group size given, to \( w_i = p_{mi} \pi_i \), and to the total demand for this manufactured good. Using that in our model economy maximizing utility is equivalent to maximizing the wage, we can write this problem as:

\[
\max_{\pi_i} p_{mi} \pi_i \\
\text{s.t. } p_{mi} = \left[ \frac{1 - \int_0^1 \lambda_jdj + \int_0^1 \lambda_j w_j dj}{(\lambda_i \pi_i + M_i^*) \left( 1 + \int_0^1 p_{mj} 1^{1-\sigma} dj \right)} \right]^\frac{1}{\sigma} \frac{1 - \int_0^1 \lambda_jdj + \int_0^1 \lambda_j w_j dj}{(\lambda_i \pi_i + M_i^*) \left( 1 + \int_0^1 p_{mj} 1^{1-\sigma} dj \right)} \leq 1,
\]

\[
p_{mi} = 1 \text{ if } \frac{1 - \int_0^1 \lambda_jdj + \int_0^1 \lambda_j w_j dj}{(\lambda_i \pi_i + M_i^*) \left( 1 + \int_0^1 p_{mj} 1^{1-\sigma} dj \right)} > 1.
\]

The ratio in the constraint follows by adding the individual demands for \( m_i \) to the total demand and then solving for the relative price \( p_{mi} \). In the first subcase, \( \pi_i \) is such that there is excess supply if the relative price equals one. Thus, the relative price is smaller than one and only the insider group members produce. In the second subcase, \( \pi_i \) is such that if the relative price equals one, then there is more demand than the insider group members can produce. Thus, the relative price equals one and some outsiders produce as well.

We continue with stage 2. If a group of outsiders pays to enter the \( i \)-th manufacturing industry, then it chooses the price of the \( i \)-th manufactured good so as to maximize profits subject to its members being the only ones that produce with the \( \pi_2 \) technology and subject to the demand for their production. Given this price, the insider group maximizes the utility of its members by choosing \( \pi_i = \pi_1 \) and producing as much as possible, \( \lambda_i \pi_1 \). The demand for the entrants’ production equals the total demand minus the insider group’s production minus the imports so it solves:

\[
\max_{p_{mi}} \left( p_{mi} - \frac{1}{\pi_2} \right) \left[ \frac{1 - \int_0^1 \lambda_jdj + \int_0^1 \lambda_j w_j dj}{p_{mi}^{\sigma} \left( 1 + \int_0^1 p_{mj} 1^{1-\sigma} dj \right)} - (\lambda_i \pi_1 + M_i^*) \right].
\]

The group enters if and only if the maximum profit exceeds the entry costs \( c \).
We finish with stage 1 of the game. The insiders stay in the insider groups if and only if their wage in units of the agricultural good exceeds the wage they could earn in agriculture: \( w_o = 1 < p_{mi} \pi_i \). They accept new members if their initial size falls short of the minimum \( \lambda_i \) that deters entry in stage 2 or if their maximum production in stage 3 is smaller than total demand at \( p_{mi} = 1 \):

\[
\lambda_i \pi_1 < \frac{1 - \int_0^1 \lambda_j dj + \int_0^1 \lambda_j w_j dj}{1 + \int_0^1 p_{mj}^{1-\sigma} dj} - M_i^*.
\]

We want the domestic economy to have a comparative advantage in the production of the agricultural good. This is required for it to import the manufactured goods under free trade. Otherwise we cannot talk about a quota \( Q \) or a tariff \( \tau \) on the imports of the manufactured good. We ensure this by the following assumption:

**Assumption 1** The relative world market price of all \( M_i \) is given by \( p_m^* \in (0, 1/\pi_2) \).

In other words the world market price in the absence of barrier to trade is lower than the domestic price when the economy is closed, irrespective of which technologies it uses in the manufacturing sector. For simplicity, we assume that the government collects and consumes the revenues that accrue from the trade barriers, \((p - p^*)Q \) and \( \tau M^* \). None of our results would change if, instead, the government rebated them to the individuals in a lump–sum fashion. Note that the government has no other role in our model.

We will restrict attention to symmetric subgame–perfect equilibria where all insiders behave identically, all outsiders behave identically, and all groups behave identically. Thus, we will drop the index \( i \) except when distinguishing the representative insider from the representative outsider. We start with the equilibrium definition when there is a quota on the imports of manufactured goods. The quota restricts the quantity of goods that can be imported: \( M^* \leq Q \). We only consider binding quotas, under which \( M^* = Q \) and \( p_m \) is determined domestically.

**Definition 1 (Equilibrium under a Binding Quota)** Let \( Q \geq 0 \) be given. A symmetric, subgame–perfect equilibrium under a binding quota are prices \((p_a, p_m, w_o, w_i)\), an
allocation \((A, N_a, M_0, N_0, M_1, N_1, M_2, N_2, a_o, a_i, m_o, m_i)\), net imports \((A^*, M^*)\), and group choices \((\lambda, \pi)\) such that:

(i) the quota binds, \(Q = M^*\);
(ii) \(p_a = 1\);
(iii) wages equal marginal products, \(w_o = 1\) and \(w_i = p_m \pi\);
(iv) \(\lambda\) and \(\pi\) solve the problems of the representative insider group at stages 1 and 3;
(v) \(M_2 = \pi_2 N_2\) and \(M_0 = N_0\) solve the entry problems at stages 2 and 3, respectively;
(vi) \((a_i, m_i)\) solves the problem of the representative agent of type \(i\), \(i \in \{o, i\}\);
(vii) markets clear.

We continue with the equilibrium definition when there is a tariff on the imports of manufactured goods. If the tariff is not large, then the manufactured goods are imported and \(p_m = (1 + \tau)p_m^*\) is given to the domestic economy. If the tariff is large, it shuts down trade and the domestic economy behaves like a closed economy with a zero quota. \(p_m < (1 + \tau)p_m^*\) is then determined in the domestic economy.

**Definition 2 (Equilibrium under a Tariff)** Let \(\tau \geq 0\) and \(p_m^* > 0\) be given. A symmetric, subgame–perfect equilibrium under a tariff are prices \((p_a, p_m, w_o, w_i)\), allocations \((A, N_a, M_0, N_0, M_1, N_1, M_2, N_2, a_o, a_i, m_o, m_i)\), net imports \((A^*, M^*)\), and group choices \((\lambda, \pi)\) such that:

(i) \(p_m = (1 + \tau)p_m^*\) or \(A^* = M^* = 0\) and \(p_m\) is determined domestically;
(ii)–(vii) as in Definition 1.

### 4 Equilibrium

#### 4.1 Quota

We first characterize the equilibrium under a binding quota. The relative prices are then determined by the domestic supply and demand. Consequently the representative insider group can manipulate the relative price of its output. It does so by producing
the manufactured good inefficiently, which decreases total production and increases its relative price. Since the demand for manufactured goods is assumed to be inelastic, the increase in the relative price is larger than the decrease in the marginal product of labor. The net effect is that income increases. Thus the group stays together and produces with the inefficient $\pi_1$ technology. The next proposition formalizes this intuitive argument.

**Proposition 1 (Equilibrium Under a Quota)** Suppose Assumption 1 holds and there is a quota $Q \in [0, 1/2)$ on the imports of manufactured goods. If

\[
\lambda_0 \leq \frac{2}{1 + \pi_1} \left( \frac{1}{2} - Q \right),
\]

(7a)

\[
c > 2^{-\frac{1}{2} \sigma (1 - \sigma) \frac{1 + \pi_1}{\sigma} \left( \left( \frac{1}{2} - Q \right) \pi_1 + Q \right)^{\frac{1}{1 - \sigma}}},
\]

(7b)

then there is a unique equilibrium in which the quota binds.

In this equilibrium the domestic economy produces all final goods; $\lambda \geq \lambda_0$ and $\pi \leq \pi_1$ are such that only the insiders produce the manufactured goods.

**Proof.** See the Appendix.

We now analyze TFP. We define TFP as the empirical growth literature: it is the residual that would result if aggregate output evaluated at ppp–adjusted international prices was produced from aggregate labor. Since all goods of our model are traded in the world market and since our economy is small, the ppp–adjusted international prices equal the world market prices. Moreover, since aggregate labor equals one, we have:

\[
A + p_m^* M = TFP \cdot 1 = TFP.
\]

(8)

Note that in our model with labor as the only input factor TFP equals labor productivity.

Since we assumed that the domestic economy has a comparative advantage in producing the agricultural good, the maximum TFP of 1 obtains when it only produces the agricultural good. If it also produces the manufactured good, then TFP is smaller than 1. The next proposition specifies when which case happens.
Proposition 2 (TFP Under a Quota) Suppose Assumption 1 holds and there is a quota $Q \in [0, 1/2]$ on the imports of manufactured goods. If the parameters satisfy conditions (7), then:

$TFP < 1$; $TFP$ increases when $Q$ increases.

Proof. See the Appendix.

4.2 Tariff

We continue by characterizing the equilibrium under a tariff. In the interesting case in which the tariff does not completely shut down international trade the domestic economy imports the manufactured goods and the relative prices of manufactured goods are given by the world market price times one plus the tariff. In this case the representative insider group cannot manipulate the relative price of its output, so the best it can do is to maximize the marginal product of its members. To achieve this it has to dissolve so that its members can work in agriculture or use the $\pi_2$ technology. As a result, manufactured goods are produced with the most productive technology, if they are produced at all. The next proposition formalizes this intuitive argument and specifies under which conditions manufactured goods are imported and under which conditions they are produced.

Proposition 3 (Equilibrium Under a Tariff) Suppose Assumption 1 holds and there is a tariff on the imports of manufactured goods.

(i) If $\tau \in [0, (1 - p^*_m \pi_2)/(p^*_m \pi_2))$, then there is a unique equilibrium.

In this equilibrium the insider groups dissolve; the domestic economy produces only the agricultural good and imports its whole consumption of manufactured goods.

(ii) If $\tau = (1 - p^*_m \pi_2)/(p^*_m \pi_2)$, then there is continuum of equilibria.

In all equilibria the insider groups dissolve; the allocation of labor between agriculture and manufacturing is indeterminate.

In almost all equilibria the domestic economy produces all final goods; it uses the $\pi_2$ technology to produce the manufactured goods; it exports agricultural goods and imports
manufactured goods.\(^6\)

(iii) If \(\tau \in ((1 - p_m^* \pi_2)/(p_m^* \pi_2), \infty)\) and conditions (7) hold for \(Q = 0\), then the equilibrium is as under a zero quota (closed economy).

**Proof.** See the Appendix.

The equilibrium with a positive tariff has the same qualitative properties as the equilibrium with a zero tariff, except for relatively large tariffs. The reason why relative large tariffs change things is that they increase the relative price of manufactured goods, so the economy may start producing manufactured goods. In particular, in case (ii) the tariff is such that all individuals are indifferent between producing and not producing manufactured goods. An equilibrium in which manufactured goods are imported then still exists. In contrast, in case (iii) the tariff is such that all individuals strictly prefer to produce manufactured goods. An equilibrium in which manufactured goods are imported no longer exists, because the domestic economy cannot produce only manufactured goods and at the same time import them. The equilibrium then is as with a zero quota, which corresponds to a closed economy.

We now turn to analyze TFP under a tariff. The next proposition specifies what happens in the different cases.

**Proposition 4 (TFP Under a Tariff)** Suppose Assumption 1 is satisfied and there is a tariff on the imports of manufactured goods.

(i) If \(\tau \in [0, (1 - p_m^* \pi_2)/(p_m^* \pi_2))\), then:

\[ TFP = 1; \text{ a reduction in } \tau \text{ does not affect } TFP. \]

(ii) If \(\tau = (1 - p_m^* \pi_2)/(p_m^* \pi_2)\), then in almost all equilibria:

\[ TFP < 1; \text{ a reduction in } \tau \text{ increases } TFP. \]

(iii) If \(\tau \in ((1 - p_m^* \pi_2)/(p_m^* \pi_2), \infty)\) and conditions (7) hold for \(Q = 0\), then:

\[ TFP < 1; \text{ a reduction in } \tau \text{ such that } \tau \text{ remains in case (iii) does not affect } TFP. \]

Note that as long as the tariff does not shut down international trade, TFP is smaller under the tariff than under free trade if and only if \(\tau = (1 - p_m^* \pi_2)/(p_m^* \pi_2)\). This is

\(^6\)Almost all means except for a measure–zero set.
\(^7\)Almost all means except for a measure–zero set.
the usual misallocation effect: a tariff distorts the efficient allocation of the factors of production, so the import–competing industries produce too much. The reason that this effect shows up only for one value of the tariff is that our production function is linear in labor, so the manufactured goods are not produced if the tariff is below this value. Ferreira and Trejos (2001) use a neoclassical production function with capital and labor and show that TFP for all tariff values is lower than under free trade.

4.3 Evidence

In sum, we find that when there are monopoly rights in the import-competing industries binding quotas and tariffs affect TFP in very different ways: (i) under a quota the import–competing industries use inefficient technologies and they may operate them inefficiently; under a tariff that does not shut down international trade completely the import–competing industries use efficient technologies and they operate them efficiently, if they produce at all; (ii) an increase in the quota has a quantitatively larger effect on TFP than an equivalent decrease in the tariff for a large range of tariff values.\(^8\)

Baily (1993) and Baily and Gersbach (1995) provide supportive evidence for finding (i). They study the services and manufacturing industries of Germany, Japan, and the USA and find strong positive correlations between the level of TFP and the degree to which domestic firms are exposed to the competition with the international productivity leaders. The key factor determining exposure is quotas (which they call non-tariff barriers), whereas tariffs are not important. Muendler (2002) provides supportive evidence for finding (ii). He studies a sample of medium–sized to large Brazilian manufacturers before, during, and after Brazil’s trade liberalization 1986–98. Using market penetration as a proxy for quotas, Muendler finds that an increase in quotas had a much larger effect on TFP than an equivalent decrease in tariffs. Lee (1996) and Kim (2000) also provide supportive evidence for prediction (ii). They study the Korean manufacturing industries

\(^8\)Note that these differences between quotas and tariffs are reminiscent of Bhagwati’s (1965) result that the two are not equivalent when there monopoly power in the goods market. However, we need monopoly power in the labor market for our result. The reason is that a monopolist in the \(i\)-th manufacturing industry could increase the relative price directly, so there would be no incentive to produce inefficiently.
during 1963–83 and 1966–88, respectively. Using coverage ratios (the percentage of imported goods with quantity restrictions) as a rough measure of quotas, they find that quotas had a statistically significant negative effect on TFP growth, whereas tariffs had an insignificant and quantitatively much smaller negative effect. While these effects are on growth rates the accumulated growth rate effects translate into level effects.

There are many other studies that document that TFP or labor productivity increased after trade liberalizations; examples include Ferreira and Rossi (2003) and Hay (2001) for Brazil, Pavcnik (2002) for Chile, and Tybout and Westbrook (1995) for Mexico. However, these studies do not distinguish between the effects of quotas and tariffs. Thus, while they do not contradict our findings they are also consistent with alternative explanations. For example, even with perfect competition in the labor market, trade liberalizations should increase TFP because they reduce the misallocation effects of trade barriers.

The Korean evidence is also consistent with the alternative assumption that the monopoly power is in the goods market. In independent work, Traca (2001) shows for an endogenous growth model with a monopolist in the import–competing industry that a binding quota reduces research and development activities whereas a tariff does not affect them. Consequently, a more restrictive quota implies lower growth rates of productivity and output along the balanced growth path, whereas differences in a tariff do not affect these growth rates. There are two ways to distinguish between his and our result. First, one needs to identify whether trade liberalizations have short–run or long–run growth effects. Wacziarg and Welch (2003) report that most of the evidence points to short–run growth effects. This suggests using a theory of adoption like our’s. Second, one needs to identify whether TFP in low– and middle–income countries is mainly determined by research and development or by the adoption of technologies that research and development activities of the industrial leaders have developed. Coe et al. (1997) report that “almost the entire R&D activity in the world economy is concentrated in the industrial countries”. This too suggests using a theory of adoption like our’s for countries that are not industrialized.
5 Conclusion

We have asked how barriers to international trade affect TFP in a small open economy with monopoly rights in the import-competing industries. We have analyzed the two standard trade barriers: a binding quota and a tariff that does not completely shut down international trade. We have found that the main difference between the two is that under a quota the import-competing industries produce inefficiently what they produce, whereas under a tariff the import-competing industries produce efficiently what they produce.

Most empirical studies on openness and productivity lump tariffs and quotas together with several other dimensions of openness. The results of these studies are often not robust [Rodriguez and Rodrik (2000)]. Our findings suggest one possible reason: different dimensions of openness may well have very different effects on TFP. We have reviewed the few empirical studies that do distinguish between quotas and tariff and found that they report supporting evidence for this hypothesis.

References


