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Abstract

Article VI of the GATT allows counter measures if goods are sold on a foreign market at a price below average production plus transportation costs. The present article analyzes Article VI based on a simple game theoretic model with two countries and economies of scale in the production of one homogeneous good. It is shown that multiple equilibria exist under the WTO rule for some parameter values which do not exist without the rule. In some equilibria the incumbent serves the entire market even if the entrant can produce at lower costs. The model supports the criticism of the anti-dumping rule as an instrument of protection by industrialized countries against competition from developing countries.

JEL: F13, F12, L13

Keywords: WTO/GATT Article VI

1   Introduction

The World Trade Organization (WTO) set up rules that allow governments to protect domestic producers from foreign competition if the competitor sells goods on the domestic market below a "fair price" according to WTO rules. This rule is intended to protect against unfair competition and predation that may harm local industry.

Article VI has recently been the subject of public criticism. In *The Economist* it is argued that "this right [to protect against goods that are sold below cost] is often misused as a tool of naked protection, particularly by America"[1]. This criticism is shared by many economists. Nobel laureate Joseph E. Stiglitz on several occasions has pointed out that anti-dumping legislation has mainly been used as a means of protecting producers in industrialized countries from competition by producers in emerging economies.[2] Bhagwati (1988, p. 48) considers the data on anti-dumping cases and draws the conclusion that "... the dramatic rise of such unfair trade cases is itself prima facie evidence of their use for harassment of successful foreign suppliers". Kenen (2000, p. 231) observes in his textbook "The rule against dumping has thus become a popular route for domestic firms to obtain protection against import competition". In the present article we provide a simple game theoretic argument in order to support this view. We argue for a different definition of costs if efficiency and fairness are the aims of the WTO.[3]

Article VI of the General Agreement on Tariffs and Trade (GATT)[4] states that a country may use anti-dumping measures if a "product is ... introduced

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[1] "Seeds sown for future growth", The Economist, 15th of November 2001.

[2] Stiglitz (2000, p. 439) writes "Nowhere is this hypocrisy greater than in the invocation of anti-dumping and countervailing duties". He also reports an episode where the U.S. government was threatening to invoke dumping duties on Russia's exports of aluminium, where both parties knew that Russia was not dumping.

[3] We side again with Stiglitz (1997), who comes to a similar conclusion, arguing for the use of marginal as opposed to average cost if fair trade and measures against predatory pricing are the policy concern.

[4] All legal texts can be downloaded from the WTO-webpages: http://www.wto.org .

into the commerce of an importing country at less than its normal value". The GATT provides two alternative definitions of the normal value. First, if the product is sold on the exporting country's market too, then the normal price is "the comparable price, in the ordinary course of trade for the like product when destined for consumption in the exporting country". Second, if the product is not considered to be sold on the exporting country's market, the final act of the Uruguay Round, the Agreement on Implementation of Article VI (1994) defines the normal price in the "ordinary course of trade" as at least the price covering "per unit (fixed and variable) costs plus administrative, selling and general costs". Hence a normal price is a price that is equal to, or higher than the price on the exporting country's market, or the average costs plus - in both cases - expenses for transportation and administration.

Our argument is based on the second (average cost) definition. The literature also states the average cost definition as the one predominantly used in anti-dumping cases (see for example Stiglitz, 1997). In footnotes we refer to the first definition and show that the results are equivalent. For our argument the average cost definition is the less distorting one because an entrant can use home market prices to finance part of the transportation costs. If in our model an inefficiency arises under the average cost definition it will also arise under the stricter home market price definition.

We present a simple game theoretic model of international trade. Two firms display economies of scale in the production of one homogeneous good. Firms are located in different countries. Each country exhibits inelastic demand for the good. Firms compete in prices. Without the application of the anti-dumping rule, economies of scale in production imply that production is concentrated in one of the countries, given transportation costs are not too large. In equilibrium, both markets are served by the globally more efficient producer. For some non-empty parameter ranges equilibrium prices violate Article VI. If the anti-dumping rule restricts the set of actions (prices) available to players (firms) then a different equilibrium set results. In particular

for some parameter values one country produces always if the rule is not applied. However if the rule is enforced the same parameter values yield equilibria where either one or the other country produces and sells on the global market. In these "both may produce" equilibria it is possible that the less efficient producer sells on both markets.

The argument stated so far is based on a simultaneous move (normal form) game. Most industries are characterized by incumbents, usually located in industrialized countries, and entrants, usually located in emerging economies. To accommodate for this sequential structure, we study the game with a sequence of moves, with the incumbent moving first. To capture a first mover advantage we apply subgame perfection as a selection criterion among existing Nash equilibria. Of the "both may produce" equilibria of the normal form game under the anti-dumping rule, only those are subgame perfect where the incumbent serves the global market. The entrant can only serve the global market if his efficiency advantage is large enough, such that in the normal form game only equilibria exist where the entrant produces. Article VI forces him to cover fully the transportation costs by the revenue from sales in the foreign market.

In contrast to Brander and Spencer (1985) or Bagwell and Staiger (1997) this paper does not consider strategic trade policy by governments. Bagwell and Staiger use a related model to study the competition of firms displaying economies of scale in production and the effect of export subsidies by governments. In contrast to the results of Brander and Spencer, Bagwell and Staiger show that such subsidies can be efficiency enhancing. In their model, not allowing for subsidies reduces efficiency because the contest of two countries in granting such subsidies results in the more efficient producer winning the entire market. Subsidies, as considered by both contributions provide a rationale for the WTO's anti-dumping rule. We want to emphasize the presumingly unwanted effects of the formulation of the rule.

The article proceeds by stating the model in section 2. Section 3 derives results. Section 4 draws some conclusions.

2 The Model

The model considers one period only. Two firms are located in two different countries, one industrialized (or incumbent) and one emerging (or entrant) country. The countries are denoted by I and E respectively. Both firms use technologies exhibiting economies of scale to produce a homogenous good. In each country the industry is represented by one (potential) firm. The two firms compete in prices (Bertrand), in a contestable market fashion. In a related multi period game this rules out that an entrant can be deterred from becoming active in any future period by an action chosen by the incumbent today.

Demand in each country is price inelastic and given by x^E and x^I.[5] We assume markets to be segmented, i.e. firms can price discriminate between markets. Denote by $X = x^E + x^I$ the total (global) demand for the good.

The production technologies are described by per-unit or average costs. These per-unit costs differ for countries and exhibit economies of scale, where $c^i(x)$, $i \in \{I; E\}$ represents per-unit (average) costs of the firm in country i.

In order to model economies of scale in production we assume that $c^i(x)$ is a function with the properties $\partial c^i/\partial x < 0$ and $c^i(0) = 0$, where x is the quantity produced. For the simple case of constant marginal costs this is $c^i(x) = F^i/x + \tilde{c}^i$ for $x > 0$ and $c^i(x = 0) = 0$, where F^i for instance captures differences in setup and labor force training costs in both countries and $\tilde{c}^i$ denotes marginal costs - which might include differences in variable resource costs or labor costs. Fixed costs are only incurred if production takes place. An example of constant marginal costs is provided to illustrate parameter ranges where multiple equilibria exist.

Finally transaction costs of selling one unit of the good in the other country are constant and equal to t. They are independent of the direction of trade. t represents transportation as well as administrative and adaptation

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[5]The assumption of inelastic demand simplifies greatly the calculations. It does not affect the basic argument that Article VI restricts the strategy set of the firms and thus can alter the equilibrium set of the game.

costs.

We assume price competition. Total demand in each country is allocated to the producer with the lower per unit price. The price charged in each market will be the lowest price that the high cost producer can offer without making negative profits.[6] In the literature this type of competition is also referred to as a contestable market game (as introduced by Baumol, Panzar and Willig, 1982). The actions available to players are the prices p_i^j, where the lower index i denotes the country of the producer, and the upper index j denotes the market where the good is sold.

Let $p_1 \preceq p_2$ ($\succeq$) denote that $p_1 \leq p_2$ ($p_1 \geq p_2$) and for $p_1 = p_2$ producer 1 (2) is able to choose a lower price without making a loss. The table below states the market outcomes resulting from the strategies (prices) chosen by E, I.

Table 1 : Market situations

	$p_E^I \succeq p_I^I$	$p_E^I \preceq p_I^I$
$p_E^E \succeq p_I^E$	(1) only I produces	(3) cross hauling only
$p_E^E \preceq p_I^E$	(2) no trade	(4) only E produces

In case (1) E does not enter the market, the payoffs are 0 for E and $(p_I^E - t - c^I(X))x^E + (p_I^I - c^E(X))x^I$ for I. Case (2) describes a situation where each firm serves its home market only, payoffs are $(p_E^E - c^E(x^E))x^E$ and $(p_I^I - c^I(x^I))x^I$ for E, I respectively. In case (3) both firms serve the other market only, payoffs are $(p_E^I - t - c^E(x^I))x^I$ and $(p_E^I - t - c^I(x^E))x^E$ for E, I respectively. Note, that this can never be an equilibrium because, due to the economies of scale, competing for the global market is always more profitable than competing for the foreign market only. Case (4) describes a situation, where E serves the global market and gets a payoff of $(p_E^E - c^E(X))x^E + (p_E^I - t - c^E(X))x^I$ whereas I gets 0.

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[6]cf. Tirole (1988) on Bertrand competition with asymmetric costs or limit pricing.

In the equilibria specified below it will be stated which country produces for given parameters. As a consequence of the assumption of inelastic demand the equilibrium may not be unique in prices. Multiple equilibria with respect to prices exist whenever one firm produces for both markets and the most competitive option of the (non producing) competitor is to produce for both markets. In equilibrium, the competitors offer the same prices but the producing firm generates a positive profit whereas the competitor's profit at these prices is zero. For all prices in the equilibrium set the profits of both firms are the same. To be specific, consider one equilibrium with prices p^I and p^E and with country I producing. If the E producer is at these prices indifferent between entering the global market (both markets) and not entering at all then prices $p^I + \Delta^I$ and $p^E - \Delta^E$ with $\Delta^E = \frac{x^I}{x^E}\Delta^I$ are also equilibrium prices as long as $p^E - \Delta^E \leq c^E(x^E)$. The latter inequality ensures that the producer in E cannot compete by serving the home market only.

In order to analyze Article VI, we model the anti-dumping rule by a restriction on the action set of players: The action sets are restricted with respect to the pricing on the foreign market such that $p_I^E \geq c^I(X) + t$ and $p_E^I \geq c^E(X) + t$.[7] In equilibrium each country cannot reduce any of its prices without making a loss. When the anti-dumping rule is applied, prices are not allowed to violate the restriction.

We first consider a simultaneous move (normal form) game. In this basic setup we search for Nash equilibria. We subsequently extend the analysis and analyze a game with sequential moves where the incumbent moves first followed by the entrant. In this extension we use subgame perfection as the equilibrium concept.

3 Results

In this section we first state the results with and without the Article VI restriction. At the end of the section two diagrams summarize and illustrate

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[7]Or $p_C^F \geq p_C^C + t$ as the constraint for the alternative definition.

the intuition behind the results.

In what follows, we denote by the index C the producing country and by the index F the competing country (from the perspective of the producing country the foreign country).

If the action set is unrestricted, producers are free to choose their pair of prices. In our model without anti-dumping policies there exist only equilibria where the more efficient producer sells on both markets, given t is not too large. Production takes place exclusively in either E or in I.

Proposition 1 *Without anti-dumping policies there exist only equilibria where the producer with the lowest overall costs ($min\{Xc^E(X)+tx^I, Xc^I(X)+tx^E\}$) serves the global market.*

Proof. We stated above that the equilibrium is not unique in prices. Given the multiplicity of equilibria in prices, we prove the equilibrium for one set of prices. The other equilibria can be derived from the above mentioned argument. Consider the equilibrium where $p_C^F = c^F(x^F)$ and $p_C^C = \frac{X}{x^C}c^F(X) - \frac{x^F}{x^C}c^F(x^F) + t$. The latter price results from the zero profit condition for F on the global market given p_C^F. These prices generate a profit of $x^F(p_C^F - c^C(X)) + x^C(p_C^C - c^C(X)) = x^F(c^F(x^F) - c^C(X) - t)) + Xc^F(X) - x^Fc^F(x^F) + tx^C - x^Cc^C(X) = -Xc^C(X) - x^Ft + Xc^F(X) + x^Ct > 0$ given $Xc^F(X) + tx^C > Xc^C(X) + tx^F$. Hence if C has the lower overall costs then in any Nash equilibrium C is the actual producer. C is able to reduce prices slightly further without making a loss. ∎

The proposition states that one country always produces and this country is the one with the lower overall costs for serving the global market. The overall costs consist of total production costs and the transportation costs to the foreign country. However, note that for some parameter values the producing firm sells below "the price in the ordinary course of trade". The producing firm has to do this in equilibrium to keep the competitor indifferent between entering the global market and not entering at all. The prices charged on the foreign market show a discount on average (plus transaction)

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costs. But, prices show no discount on marginal costs, which are lower due to economies of scale. Marginal costs are the important benchmark if predatory pricing and efficiency in general are the objectives. Selling below average plus transportation costs can be efficient and profitable for the actual producer. In models of spatial price discrimination such behavior is frequently observed and is referred to as base point pricing (see for example Haddock (1982)) .

Let us now turn to the effects of the anti-dumping rule. Only prices on the foreign market that fulfill the WTO restriction: $p_C^F \geq c^C(X) + t$ can be chosen.[8] It needs to be stressed, that the WTO restriction reduces the action sets of players, which implies that the most competitive offer of one player may not be an element of his action set.

First, we characterize a situation that might have been the aim of Article VI, the protection of (small) domestic industries against (large) international competitors, which may not be more efficient overall. The following proposition describes a situation where both firms produce.

Proposition 2 *Given the anti-dumping rule only an equilibrium without trade exists, where both countries produce for their home market, if and only if* $c^I(X) + t \geq c^E(x^E)$ *and* $c^E(X) + t \geq c^I(x^I)$.

Proof. If both conditions hold then each producer can underbid the best price the competitor can offer under the Article VI restriction when he produces for his home market only. ∎

Under the conditions stated, Article VI generates equilibria with efficient production whenever $\min\{Xc^I(X)+x^E t, Xc^E(X)+x^I t\} > x^E c^E(x^E)+ x^I c^I(x^I)$. If the opposite holds then the WTO rule is welfare decreasing. Without the anti-dumping rule Proposition 1 states that the producer with the lower overall costs will serve the global market.

The next proposition characterizes equilibria where production is concentrated in one country and the anti-dumping rule has to be observed.

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[8]The alternative constraint $p_C^F \geq p_C^C + t$ is equivalent if the constraint is binding. Combining $p_C^F = p_C^C + t$ with the no loss requirement in equilibrium ($p_C^F x^F + p_C^C x^C \geq Xc(X) + tx^F$) yields the same restriction as the one given in the text.

Proposition 3 *Given the anti-dumping rule only equilibria exist where the industrialized [emerging] country only produces if $c^I(X)+t < c^E(X)$ [$c^E(X)+t < c^I(X)$].*

Proof. If one of the inequalities hold then the producer with the lower costs can underbid the competitor in both countries and can do so with prices that fulfill the WTO restriction. ∎

Again, due to the assumption of inelastic demand, prices in equilibrium are not unique . Prices have the same structure as stated above. In any case, under the conditions stated in Proposition 3 it is possible for the producer to offer prices above per unit costs of production plus transportation costs avoiding the possibility of anti-dumping measures.

The interesting cases are the remaining range of cost parameters. For these parameters, in the existing equilibria either E or I produces. This multiplicity only arises if selling below average plus transportation costs, is ruled out due to anti-dumping legislation.

Proposition 4 *Given the anti-dumping rule there exist equilibria where either production takes place in I only or it takes place in E only if and only if $\max\{c^I(X), c^E(X)\} < \min\{c^I(X), c^E(X)\} + t$ and $\max\{c^I(X), c^E(X)\} + t < \min\{c^I(x^I), c^E(x^E)\}$.*

Proof. Consider the following equilibrium $p^F = p_C^F = c^F(x^F)$ and $p^C = p_C^C = c^F(X) + t$. At these prices F cannot reduce prices further without violating the WTO restriction or generating a loss. Under the conditions stated in the proposition C generates a profit of $x^F(c^F(x^F) - c^C(X) - t) + x^C(c^F(X) + t - c^C(X))$. This profit is greater than zero given that both cost differences are positive. Under the conditions stated in the proposition this holds for $C = I$ and $C = E$. The first condition ensures that the case stated in the previous proposition does not apply. The second condition ensures that the lowest costs $(c^C(X))$ of both countries allows each firm to underbid the best price the other firm can offer when producing for its home market only $(c^F(x^F))$. The opposite case was described in Proposition 2 . ∎

To reconsider the alternative definition of dumping, note that the assumption stated in the proposition also guarantees that the proposed equilibrium prices fulfill the foreign price definition[9].

We now consider the game with sequential moves. First I sets prices and then E. In the previous proposition we characterized parameter ranges such that in equilibrium only I or only E produces. Subgame perfection selects among the multiple equilibria of the game. The fact that the firm producing makes a positive profit, implies:

Proposition 5 *In all subgame perfect equilibria for the parameters characterized in Proposition 4 only I produces.*

Proof. The WTO restriction does not allow the second mover to underbid the first mover on his home market. Given that the producing firm generates a profit implies that I in equilibrium sets the prices $p^E = c^E(x^E)$ and $p^I = c^E(X) + t$ and serves the global market. ■

This result shows that the WTO rule favors incumbents. Given that the cut off value given in Proposition 1 is contained in the interval described by Proposition 4 it follows that the WTO rule can lead to an incumbent from one (industrialized) country serving the global market, even if production is globally more efficient if it takes place in the other (emerging) country. These considerations are illustrated by the following two figures.

Figure 1 is based on an example of fixed plus constant marginal costs. We assume that the I country has an advantage due to lower fixed costs ($F^E > F^I$) whereas E has an advantage in variable costs ($w = c^I - c^E > 0$ for example due to per unit wage differences). We additionally assume that $\frac{F^I}{x^I} + w > \frac{F^E}{X} + t$ to ensure that both countries are able to obey the WTO rule and underbid a competitor producing for his home market only. In figure 1 the firm which produces in the absence of an anti-dumping rule is represented

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[9]The alternative definition of dumping implies the following has to hold in equilibrium: $p^F = c^F(x^F) \geq c^F(X) + t = p^C$. For both countries the second assumption stated in the proposition guarantees that $c^C(x^C) > c^C(X) + t$, hence equilibrium prices always guarantee that the alternative definition is fulfilled too.
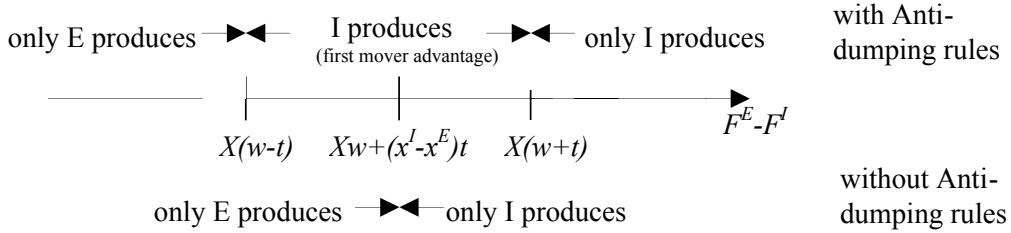
only E produces ►◄ I produces ►◄ only I produces — with Anti-dumping rules
(first mover advantage)

$X(w{-}t)$ $Xw+(x^I{-}x^E)t$ $X(w{+}t)$ $F^E{-}F^I$

only E produces ►◄ only I produces — without Anti-dumping rules

Figure 1: Who serves the global market in the case of fixed plus constant marginal costs $(c^E(x) = \frac{F^E}{x}, c^I(x) = \frac{F^I}{x} + w)$?

below the line. If the anti-dumping rule applies a region around the point where total costs, covering production and transportation costs, are equal for both producers exists. In this region there exist Nash equilibria of the normal form game where either only I or only E produces. In the subgame perfect equilibria of the game with sequential moves, I as the firm moving first, serves the global market. In this case, it is possible that in equilibrium the less efficient producer can sell on both markets, due to the anti-dumping rule and economies of scale in production.

The next example does not rely on a simple cost structure. Figure 2 illustrates a case where the entrant in a situation without an anti-dumping rule serves the global market at foreign prices below the normal value because his overall costs are lowest $(c^E(X) + \frac{x^I}{X}t < c^I(X) + \frac{x^E}{X}t)$. At the same time multiple equilibria exist when the anti-dumping rule applies because the incumbent can set prices below $c^E(X) + t$ such that the entrant cannot use his most competitive offer. Due to the production technologies and the home market effect the incumbent needs not to violate Article VI. In this case $c^I(X)$ may be larger than $c^E(X)$ and it is still possible that equilibria in the simultaneous move game where either I or E produces exist. In a sequential move game, producer I simply reduces his home market price to obey the anti-dumping rule on the foreign market.

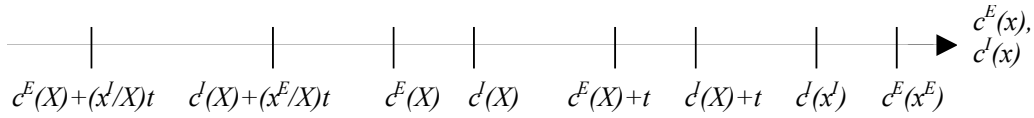To exploit the comparative statics of the equilibrium we observe the fol-

$c^E(X)+(x^I/X)t \quad c^I(X)+(x^E/X)t \qquad c^E(X) \quad c^I(X) \qquad c^E(X)+t \quad c^I(X)+t \qquad c^I(x^I) \quad c^E(x^E)$

$c^E(x),$
$c^I(x)$

Figure 2: A generalized example where the anti-dumping rule leads to the less efficient producer serving the global market.

lowing. The smaller t is compared to the extent of economies of scale, the more likely it is that trade takes place. From an entrant's point of view (if he is located in the economy with the smaller demand), this has two positive effects. On the one hand the home market effect (favoring the economy with the larger demand) becomes less strong without anti-dumping policies. On the other hand the range of parameter values increases where an entrant can underbid the incumbent without violating anti-dumping rules. However the home market effect alone does not yield the same result. The inefficiency results from the use of an average cost instead of a marginal cost definition in the formulation of the anti-dumping rule. A larger home market reduces the average cost bias, it does not make it disappear.

The disadvantage due to the anti-dumping rule may be relatively small, especially if the home market of the emerging economy is small. But, in markets where cost differences in production are small, this small effect may turn the weights towards an incumbent. Furthermore, not all emerging economies have homemarkets that are small, examples being Poland or South Africa. In such cases the effect of the anti-dumping legislation can be quite strong.

4 Conclusion

In this article, we highlighted in a simple model of international trade the protection of incumbents by the WTO's anti-dumping rule. Incumbent firms of industries that show economies of scale in production are usually located in industrialized countries. The anti-dumping rule hence protects industri-

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alized economies from competition by emerging economies. In the model presented, the rule makes emerging countries, usually already in a disadvantageous position due to a smaller home market even worse off.

Anti-dumping measures have to be declared to the WTO. Looking at WTO data on anti-dumping measures initiated or in action reveals that it is mainly industrialized that countries use this instrument. Anti-dumping rules are more often applied by developed than by developing WTO member countries. The European Union (160) and the United States of America (185) have especially high numbers of anti-dumping actions in force (only India has a similar number of actions in place). In general, the developed members of the WTO have on average close to forty measures in place whereas the developing and transition members have an average below thirty. Only thirty percent of all measures in force are against producers from developed countries whereas developing and transition countries carry the burden of the remaining 70%.[10]

Another empirical observation supports the view that Article VI is used as a protection device for domestic firms in developed countries against competition from abroad. Thurow (1985) shows that 18 out of 20 top Fortune 5000 firms in the United States could be accused of dumping if the anti-dumping laws were applied domestically.

So, why do countries not oppose more strongly against Article VI? One explanation could be that in the lobbying process entrants are usually not present or have little power. In this case governments are influenced more by incumbents. If few incumbents exist in emerging economies as well they will lobby for the adoption of Article VI. The government, influenced by lobbying, will accept the agreement even though it puts the emerging economy at a disadvantage. Stiglitz (2000) reports that developing countries too, learned to use Article VI to protect local industries..

The discussions of the Doha round and the Cancun Ministerial Conference

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[10]The data can be found on the WTO's webpages: www.wto.org. The presented data is as of the end of 2002.

reveal that more countries realize negative effects of some WTO rules. And certainly there are more complains and failures than the one discussed in this article.

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