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What makes countries initiate WTO disputes on food-related issues?

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Abstract

This paper analyses relevant determinants for the probability to initiate a dispute on policy measures under the World Trade Organization (WTO) dispute settlement system. The empirical analysis differs from existing assessments by focusing on agri-food related disputes and provides a more in-depth analysis of specific country and sectoral characteristics not considered in previous studies. Contrary to recent analyses of overall trade disputes, the results show that some determinants such as legal capacity and monetary means are not statistically significant. Own protectionist behaviour, endured protectionism, and the duration of WTO membership, however, could be identified as relevant determinants with the expected direction of impact.

Keywords: WTO dispute, agri-food sector, binary choice model.
JEL-classification: C12, C13, F13

1 Introduction

The dispute settlement system of the World Trade Organization (WTO) was set into force as a part of the WTO Agreement on January 1, 1995. It is the device for the resolution of conflicts arising between Members over the interpretation of their commitments under the regime of the organization. Dispute settlement must be self-enforcing, i.e. from the consultation to the potential compliance phase all actions are driven by Members. Referred to as the "central pillar of the multilateral trading system" (WTO, 2007a) the design of the WTO dispute settlement system is central to the debate on institutional reforms of the WTO and has also been under negotiation at the current WTO Doha round of negotiations. A major desire is to make the settlement system more effective and to allow for the appropriate consideration of developing countries' demands. Reform proposals span a wide field from tightening time frames regarding panel proceedings over more effectively dealing with compliance and compensation procedures to assistance for developing countries ensuring their equality of opportunity (PETERSMANN, 2003). However, the understanding of the factors that drive the system is required for targeted improvement.

The question addressed in this paper is, therefore, which Members' characteristics explain their activity as complainants in WTO food-related trade disputes. Compared to previous empirical studies, this investigation provides an in-depth

analysis of food-related disputes and considers new potential determinants that may supplement the understanding of what drives the use of the dispute settlement system. The empirical investigation is based on a dispute distribution model developed and employed by HORN ET AL. (1999).

This paper is organised as follows: After a short description of the WTO dispute settlement's features and the food-related caseload of the investigation period, a survey on existing empirical studies is provided. The model specification, including a discussion of considered determinants, is described in the next chapter. Statistical implementation and estimation results are subsequently presented before concluding.

2 Facts and figures on WTO dispute settlement

All Members are provided with equal right to seek adjudication through the WTO dispute settlement system. Acceptable reasons for filing a complaint are a trading partner's measures that nullify the benefits or impair the attainment of any objective of one or more of the WTO Agreements. The system's rules and procedures generally are administered by the General Council, i.e. the plenary meeting of the WTO at the level of governmental officials, which turns itself into the Dispute Settlement Body when adjudicating trade disputes. Dispute settlement procedures are stricter under the WTO compared to those in force under its predecessor GATT 1947. This is due to the elimination of blocking or delaying tactics through the adoption of time limits for all stages of adjudication, the implementation of standard terms of reference for panels, and an improved mechanism for enforcement of compliance with panel rulings (HOEKMAN AND KOSTEKI 2001). This is in particular owing to the implementation of the so called 'negative consensus', which means that a panel is established, a panel report adopted, or the complainant authorized to trade related retaliation unless the DSB decides by consensus to reject.[1]

In the area of food-related disputes, 147 cases have been initiated over the period from January 1, 1995 to June 30, 2006.[2] Regarding country participation the figures on current and previous food-related WTO disputes reveal that the majority of cases are related to the economically advanced countries. Table 1 shows the participation pattern by development classification of the UNITED NATIONS

[1] The 'Understanding on Rules and Procedures Governing the Settlement of Disputes' is laid down in Annex 2 of the 'Marrakech Agreement Establishing the World Trade Organization' from April 15, 1994.

[2] These 147 cases refer to nine different Agreements related to issues on food, see footnote 7.

(2008) for the period January 1, 1995 to June 30, 2006.[3] The Members of the European Communities are not separately captured in the statistic, thus reducing the number of WTO Members to 134 instead of 149[4].

Table 1. Food-related dispute initiations by development classification until June 30, 2006

Group	No. of Members	Share in membership	No. of Disputes	Share in disputes
Developed	31	0,23	97	0,66
Developing	71	0,53	50	0,34
Least Developed	32	0,24	0	0
Total	134		147	

Source: Own compilation based on WTO (2007b) and UNITED NATIONS (2008)

Representing 23% of the WTO membership, the group of developed countries are the most active users with 66% of all initiated food-related disputes. 34% of all disputes are initiated by the large group of developing countries. The group of Least Developed Countries[5] accounts for about 24% of WTO Members, but they did not use the system at all for food related issues. This is remarkable since food-sector related exports generally represents a substantial share in their export structure.

As there exists no established principle for the assignment of the developed or developing status in the United Nations system, a pattern which more precisely defines the economic status refers to the World Bank classification of income levels[6]. Table 2 depicts the initiation pattern related to per capita income groups.

[3] The developing status according to the WTO is based on members' self-declaration and not on verified economic attributes.

[4] The European Communities comprised 15 Members until April 30, 2004. Disputes of its 10 new Members from May 1, 2004 on are captured separately and not assigned to the EC in Table 1.

[5] 32 of currently 150 WTO members are classified as Least Developed Countries. The identification of their status by the United Nations is dependent on the following economic criteria: (1) a low per capita income criterion, (2) a human resource weakness criterion and (3) an economic vulnerability criterion (United Nations, 2007).

[6] Per capita income classification according to The World Bank (2008): Low income: $875 or less, Lower Middle Income: $876-3465, Upper Middle Income: $3466-10,725, High Income: >$10,726.

Table 2. Food-related dispute initiations by per capita income classes until June 30, 2006

Per capita income class	No. of Members	Share in membership	No. of Disputes	Share in disputes
High income	43	0,32	5	0,03
Upper middle income	36	0,27	31	0,21
Lower middle income	30	0,22	20	0,14
Low income	25	0,19	91	0,62
Total	134		147	

Source: Own compilation based on WTO (2007b) and THE WORLD BANK (2008)

High income Members initiated 62% of all food-related disputes. Members of the Upper middle and Lower middle income groups account for about 25% of all initiated disputes, whereas Members of the Low income group are almost completely absent. The United States and the European Union dominate the High income group, followed by Canada, Australia and New Zealand. Brazil, Chile, Ecuador, Philippines and Thailand in the Middle income groups, and India in the Low income group are examples for comparatively actice users of the system.

As is evident from the brief description above, the WTO dispute settlement system's rules themselves do not discriminate between Members and offer equal opportunities for dispute initiation. Therefore, it is of some interest to investigate what are the major determinants for observing this pattern of dispute initiation across countries and whether other than the most prominent attribute "income" may influence a Member's decision to file a complaint.

3 Empirical analyses on general dispute initiation

A few empirical assessments on the WTO initiation of disputes exist considering various determinants, agreements referred to, and roles in a dispute (complainant, defendant, co-complainant and interested party). Table 3 depicts their investigation period, dispute coverage, main issue of analysis and the models used. Table 4 comprises the detected influences of determinants under previous investigations.

HORN ET AL. (1999) mark the first empirical investigation by using a binomial dispute distribution model. According to their analysis the dispute initation pattern is to a large extent reflected by the pattern of export diversity and value. GDP did not reveal a significant influence, but a country's legal capacity shows a slight positive influence on its probability to complain. BESSON AND MEHDI (2004) find empirical evidence that legal capacity matters with respect to a country's likelihood to win disputes. This supports the conclusion of BUSCH AND REINHARDT (2003) that early settlements of developing countries, i.e. in the consultation stage or in the Panel stage before a ruling, are missing due to the lack of legal capacity.

Table 3. Survey on investigation period, dispute coverage, main issue and used model of previous empirical studies

Empirical study	Investigation period and dispute coverage	Main issue of analysis	Used model
Horn et al. (1999)	WTO disputes; 1995-1998; 155 complaints; all agreements	Determinants for the initiation of complaints	Binomial dispute distribution model
Holmes et al. (2003)	WTO disputes; 1995-2002; 279 complaints; all agreements	Involvement in complaints (both sides) and success in disputes	Descriptive statistics
Bown (2004a)	GATT & WTO disputes; 1973-1998; 174 complaints; all agreements	Determinants for compliance after trade disputes	Linear regression
Bown (2004b)	GATT & WTO disputes; 1992-2003; complaints against U.S. trade remedies	Initiation of complaints against U.S. trade remedies	Probit model
Besson and Mehdi (2004)	WTO disputes; 1995-2002; 40 complaints of developing against developed countries	Success in disputes: Developing against developed countries	Probit model
Bown (2005)	WTO disputes; 1995-2000; 54 complaints; complaints against import protection on MFN-basis	Engagement as Co-Complainant or interested third party	Ordered multinomial logit model

Source: Own compilation

The self-enforcing nature of the dispute settlement system has been the starting point for BOWN (2004a, 2004b and 2005): A focus lies on costs of running a dispute and a country's retaliation power to finally enforce compliance by penalty tariffs on imports of the condemned party. BAGWELL AND STAIGER (2000) and DAM (1970) state that the retaliation threat always has been a central component of the GATT system. The success of this power is linked to the countries' relevance as trade partner and there exists also theoretical support that the retaliation threat is not uniformly distributed over Members and that imbalances relating to trade volume and market size shows influence on their force under trade disputes. BOWN (2002) demonstrates that a country's capacity to influence its terms-of-trade determines the credibility of its retaliation threat which is confirmed as well by JOHNSON (1953) and KENNAN AND RIEZMAN (1988).

BOWN (2005) concentrates on the question whether to join complaints as co-complainant or interested party and demonstrated a positive impact of the capac-

ity to absorb legal costs on both decisions. Additionally, he identifies a positive effect of a Member's retaliatory capacity in terms of its relevance as trading partner and a negative impact of countries' dependencies on bilateral development aid. BOWN (2004c) shows that the threat of retaliation is significant for determining whether a government chooses to abide by its international obligations. BOWN (2004b) demonstrates that the successful economic resolution to disputes is influenced by the threat of retaliation by the complainant. In respect of developing countries success in disputes BESSON AND MEHDI (2004) discover empirical support for the influence of their trade retaliation power.

Market access and exporting interests are expected to be relevant for the decision on initiation or participation and there exists empirical substantiation for this. BOWN (2005) provides support for the positive impact of a country's volume of exports at stake in its decision to attend disputes as co-complainant or interested third party and BOWN (2004d) demonstrates its positive influence on the likelihood to complain against United States (U.S.) imposed trade remedies. In the broader sense there is evidence for the relevance of trade volume or share respectively. HOLMES, ROLLO AND YOUNG (2003) reach the conclusion that a Member's trade volume determines its likelihood to file complaints on the basis of simple descriptive statistics. This supports the findings of HORN ET AL. (1999) that trade volume and export diversity are closely correlated.

BOWN (2004a) finds only limited confirmation that international obligations affect a country's decision to fulfil its commitments whereas BOWN (2005) finds empirical evidence on the positive influence of a Member's international economic relationships – measured by its engagement in preferential trade agreements – on its decision to formally engage in a dispute as co-complainant or interested third party. On the topic of success in disputes, the results of BESSON AND MEHDI (2004) suggest that international economic relationships show influence on a Member's likelihood to win and they conclude that the reliance on bilateral assistance has a negative impact on the success. Further, they discuss the impact of military power and find confirmation for the negative influence that military powerful defendants have on the performance of developing countries in dispute.

Table 4. Survey on findings of previous empirical studies

		Influence on the likelihood to			
Determinant	Empirical study	Initiate disputes	Partake in initiated disputes	Win a dispute	Reach compli-ance after ruling
Export diver-sity	Horn et al. (1999)	**+**			
Exporting interest	Bown (2005)		**+**		
Export volume	Holmes et al. (2003)	**+**			
Gross Domes-tic Product	Bown (2005)		**+**		
	Horn et al. (1999)	**0**			
Political econ-omy relation-ship with re-spondent	Bown (2004b)				**0**
	Bown (2005)		**+**		
	Besson and Me-hdi (2004)			**–**	
Reliance on bilateral assis-tance	Besson and Me-hdi (2004)			**–**	
	Bown (2005)		**–**		
Legal capacity	Horn et al. (1999)	**+**			
	Besson and Me-hdi (2004)			**+**	
Military power	Bown (2004b)				**+**
	Besson and Me-hdi (2004)			**+**	
Retaliatory capacity	Bown (2004d)	**+**			
	Bown (2005)		**+**		
	Besson and Me-hdi (2004)			**0**	

+ positive influence; - negative influence; 0 no influence
Source: Own compilation

4 Assessing relevance of determinants

4.1 A binomial dispute initiation model

This analysis is based on the model first presented by HORN ET AL. (1999): The initiation decision is described through a binary choice model in which the Member's probability to complain against another Member is *dependent* on a set of the complainant's traits or the characteristics of its specific environment. The implicated conditional probability function for this binary choice situation is the Bernoulli distribution

$$\begin{aligned} f\left(y_{ij}\left|\mathbf{x}_i,\boldsymbol{\beta}\right.\right) &= \pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)^{y_{ij}}\left[1-\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)\right]^{1-y_{ij}} \\ &= \begin{cases} \pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right) & \text{for } y_{ij}=1, \\ 1-\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right) & \text{for } y_{ij}=0. \end{cases} \end{aligned} \tag{1}$$

where y_{ij} is the binary dependent variable which takes 1 for a complaint and 0 for no complaint, $\boldsymbol{\beta}$ denotes the vector of K coefficients, i and j indicate the complainant and the defendant respectively. The set of K influences is merged in vector $\mathbf{x}_i$. Function $\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)$ calculates the individual probability to complain for a prospective complainant i which can be represented by any cumulative probability distribution function. Here, we use the widely employed conditional logistic distribution,

$$\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right) = \frac{\exp\left(\mathbf{x}_i\boldsymbol{\beta}\right)}{1+\exp\left(\mathbf{x}_i\boldsymbol{\beta}\right)}, \tag{2}$$

which would result in the well-known Logit model when applied to single trials.

The proceeding for the assessment of determinants is the reproduction of the observed sample of dispute initiation over the period from January 1, 1995 to June 30, 2006 based on a dispute distribution function which yields probabilities for positive integers, i.e. the number of a Member's initiated disputes. Assuming that the probability for a litigation decision $\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)$ is constant from one trial to the next and that successive trials are independent, Member $i's$ probability for c_i complaints in n_i trials against all other WTO Members is then specified through the Binomial distribution

$$f\left(c_i\left|\mathbf{x}_i,\boldsymbol{\beta},n_i\right.\right) = \binom{n_i}{c_i}\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)^{c_i}\left[1-\pi_i\left(\mathbf{x}_i\boldsymbol{\beta}\right)\right]^{n_i-c_i}, \tag{3}$$

where $c_i = \sum_j y_{ij}$. The expected number of Member $i's$ complaints against allother WTO Members is then given by the expected value of the Binomial distribution,

$$E(c_i) = n_i \pi_i (\mathbf{x}_i \boldsymbol{\beta}), \tag{4}$$

which is strictly proportional to the number of independent Bernoulli trials n_i.

The applied method is maximum likelihood estimation. Assuming that the data drawn from this Binomial distribution is independent and identically distributed with unknown parameter $\boldsymbol{\beta}$, the likelihood function, i.e. the joint probability density of observing the given sample of complaints $(c_1, c_2, ..., c_m)$ is specified by

$$L(\boldsymbol{\beta} | c_i, \mathbf{x}_i, n_i) = \prod_{i=1}^{m} \binom{n_i}{c_i} \pi_i (\mathbf{x}_i \boldsymbol{\beta})^{c_i} \left[1 - \pi_i (\mathbf{x}_i \boldsymbol{\beta})\right]^{n_i - c_i}. \tag{5}$$

Starting from the logarithmic likelihood function

$$\ln L(\boldsymbol{\beta} | c_i, \mathbf{x}_i, n_i) = \sum_{i=1}^{m} \left[\ln \binom{n_i}{c_i} + c_i \ln\left[\pi_i (\mathbf{x}_i \boldsymbol{\beta})\right] + (n_i - c_i) \ln\left[1 - \pi_i (\mathbf{x}_i \boldsymbol{\beta})\right] \right] \tag{6}$$

the first order conditions for a maximum are

$$\frac{\partial \ln L(\boldsymbol{\beta} | \cdot)}{\partial \boldsymbol{\beta}} = \sum_{i=1}^{m} \left[\frac{c_i - (n_i - c_i) \exp(\mathbf{x}_i \boldsymbol{\beta})}{\left[1 + \exp(\mathbf{x}_i \boldsymbol{\beta})\right]} \right] = 0 \quad . \tag{7}$$

Restricting the vector of determinants to a constant, the probability to complain reduces to $\pi_i (\mathbf{x}_i \boldsymbol{\beta}) = \pi$ for all Members i and can be determined analytically by solving the first derivative of equation (6) with respect to π leading to $\pi = \frac{\sum_i c_i}{\sum_i n_i}$. Hence, for the restricted model, the maximum likelihood estimator of the probability to initiate a dispute is simply the number of observed complaints over the total number of independent Bernoulli trials.

The definition of the number of independent Bernoulli trials requires information about the exact number of infringements that each Member faces, as the aforementioned binary choice model refers to the litigation decision when WTO obligations are violated. For the reason that we have no a priori information about

the existence of inconsistent trade measures – their existence can merely be assured after a positive Dispute Settlement Body or Appellate Body ruling – the analysis is based on an assumption about their distribution. For HORN ET AL. (1999) the number of independent Bernoulli trials is dependent on a country's export diversification, i.e. its number of different exported goods over all products and trading partners under the regime of the WTO. Each counted bilateral export flow is considered as one trial. They worked on the assumption that "disputable trade measures" (DTM) are uniformly distributed over all bilateral export flows. The problem of this approach is that the determinants for the occurrence of disputes cannot be separately identified from the impacts on the existence of DTM, leading to an "export diversity bias", i.e. an increase in disputes with increasing export diversity. This problem already was a central criticism of HOLMES, ROLLO AND YOUNG (2003).

Following the approach of HORN ET AL. (1999) we try to mitigate the problem of missing information about the distribution of infringements by incorporating two new indicators: Endured Protectionism by Trade Partner and Own Imposed Protectionism. In addition to this information on the likelihood of DTM in export flows, the attempt of HORN ET AL. (1999) to select the relevant export flows is slightly modified by taking empirical instead of parameterized values for average induced litigation costs into account.

4.2 Determinants considered

Deviating from existing studies, this paper focuses specifically on agricultural and food-related disputes in order to develop an in-depth analysis of determinants relevant in this sector and to additionally introduce new potential determinants. The set of determinants or countries' traits already used in prior studies is reflected by agricultural trade flows characterising the export diversity, a country's wealth and its legal capacity. Due to limited data availability for some determinants under investigation the Members sample is limited to 53 while maintaining the distribution over income classes.

Disputes data

Dispute initiations were collected that affected products of the food sector.[7] The investigation covers the period from January 1, 1995, to June 30, 2006. Each ini-

[7] Agricultural and food related issues comprise initiated disputes which were raised under the following agreements: Agreement on Agriculture, Agreement on Sanitary and Phytosanitary Regulations, Agreement on Technical Barriers to Trade, Agreement on Safeguards, General Agreement on Tariffs and Trade, Agreement on Subsidies and Countervailing Measures, Agreement on Trade Related Investment Measures, Anti-Dumping-Agreement and the Agreement on Import Licensing Procedures.

tiation is counted once to avoid double counting, thus omitting re-uptakes of disputes that occur when the consultation period of 12 months is exceeded. For jointly filed initiations, each participant is assigned one dispute. When one Member simultaneously requests for consultations on the same subject but with different defendants each one is counted on its own. Since the European Communities (EC) is a single customs union with a harmonised trade policy and common tariffs all disputes initiated by its Members are assigned to the EC. On the other hand, when disputes are initiated against several EC Members there is only one dispute assigned, including all defendants. The number of disputes for each Member is related to the whole investigation period,

$$y_i^* = \frac{y_i^o}{t_i} \cdot T \,, \tag{8}$$

where y_i^* is the time-corrected number of disputes of Member i, y_i^o assigns Member $i's$ observed disputes over its WTO membership time t_i and T stands for the investigation period. This proceeding is self-evident, since the number of filed disputes ought to be linked to a Member's membership time in the WTO. By this means the time-bias is taken care of.

Export diversity

Here we adopt the approach first presented by HORN ET AL. (1999). Strictly speaking, export diversification is not an explanatory variable, but an intrinsic component of the underlying binomial dispute distribution model as the total number of trials depends on the number of export flows. They found empirical support for the dependency of a Member's activity as complainant from its export diversity, i.e. its number of different exported goods over all trading partners. The underlying principle lies in the expectation of an increased probability to encounter infringements if a Member's export diversity increases. This is self-evident if we assume infringements to be uniformly distributed over all markets, products and trading partners. Hence, we expect the number of disputes to be positively related to Members' amount of different bilateral export flows. The export diversification factor's explanatory contribution content is just confirmable by excluding all other variables as the expected number of complaints is proportional to the number of a country's export flows. Export flows come from EUROCARE (2006) available on an aggregation level comparable to the HS[8]-4-level.

Induced costs of litigation

[8] Harmonized Commodity Description and Coding System of the World Customs Organization (WCO)

HORN ET AL. (1999) were the first analysing the litigation costs involved and demonstrated their relevance. Their approach is followed through the implementation of a threshold for counting a Member's bilateral export flows, thus excluding flows under a certain value not being worth to fight for. According to calculations of NORDSTRÖM (2005), average costs for dispute settlement proceedings range from $128K to $706K, dependent on the degree of its complexity and the per hour rate of engaged lawyers. Hence, the analysis is conducted for four different litigation cost levels, i.e. excluding all flows below the respective threshold: $0 when no threshold is applied, $300K for low costs, $500K for medium costs and $700K for high litigation costs. The impact of the adopted cost-thresholds is shown for the restricted model, i.e. to the exclusion of all explanatory variables, thus comparing different cost thresholds with respect to the corresponding model's prediction quality.

Endured protectionism by trade partner

This is to our knowledge the first empirical effort to incorporate information about the distribution of WTO-inconsistent trade barriers to reduce the lack of information about the existence of actual infringements which is the precondition to each dispute. It is assumed that the more protective the trade policy of a country's trading partners is, the higher the probability that it faces disputable trade barriers. Hence, we expect the number of initiated disputes to be positively related to a country's faced trade restrictiveness. For this purpose the Market Access Overall Trade Restrictiveness Index (MA-OTRI) provided by Kee, Nicita and Olarreaga (2006) is used. It compromises a tariff equivalent of all barriers that exporters of the respective country face on average.

Own protectionist behaviour

Another hypothesis is that the number of its filed disputes is negatively related to a country's tendency towards protectionism. The rationale behind this is the assumption that a more protective Member faces also a greater likelihood to become "victim" of an accusation. We presume a more protective country to pursue a defensive and peaceful strategy to not provoke to be challenged itself. On the other hand we hypothesize that more protective countries have a lower propensity to fight for market liberalisation. For this purpose the Overall Trade Restrictiveness Index (OTRI) by KEE, NICITA AND OLARREAGA (2006) is used as a measure for a country's inclination to restrictive policies. It is a tariff equivalent for all trade barriers which the respective country imposes in average upon the rest of the world. Consequently, it provides the mirror image of the aforementioned MAOTRI indicator, measuring the trade restrictiveness from the potential complainant's perspective.

Relevance of the agricultural sector

Independent from a country's contact to a trading partner we expect the overall importance of the agricultural sector having a positive influence on initiating a case: the higher the overall economic relevance, the more sensitive a country may be regarding violations. To quantify the sector's importance the agricultural share of a Member's GDP is employed. This rather crude indicator is used due to missing data on the value of the countries' food industry. An improved measure should comprise information on the relevance of a Member's whole agri-food sector. The data is drawn from the UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (2002 and 2003).

Capacity to absorb legal costs/wealth

The capacity to absorb legal costs is supposed to be essential for the accomplishment of disputes as explicit compensation for litigation costs is not intended by the system. Even though the expected gains from removing the trade barrier exceed the induced litigation costs, this potential payoff lies ahead and is uncertain. For this reason each potential complainant must anticipate substantial costs that are involved by prosecution and, if applicable, also by enforcement of compliance. It is assumed that the number of complaints is positively related to a Member's capacity to absorb legal costs. As proxy for such financial means we use a country's GDP, provided by the UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (2002 and 2003).

Legal capacity

One argument often raised to explain the limited access of the system to developing and low income countries is their lack of human and legal capacity (see e.g. WHALLEY, 1996). HORN ET AL. (1999) found empirical evidence on the matter of a country's legal capacity in respect of initiating disputes. We hypothesise that the larger a country's endowment with skilled legal personnel, the higher its capability to challenge arguable trade measures of its trading partners and we expect the number of bilateral complaints to be positively linked. The respective determinant should comprise the whole extent of a country's trade administration, i.e. its budget, its staff's size and quality. Since there is no differentiated information on Members' legal capability we use, like HORN ET AL. (1999), their delegation size at Geneva as proxy. The respective information comes from the UNITED NATIONS (2004).

Influence of private actors and governmental efficiency

The influence of private pressure groups on the government is relevant as only the government may finally enter a dispute but can be persuaded by private actors in doing so. This power may differ among countries depending on the national framework for organizing private lobby activities and on their respective relevance. It is increasingly seen as especially relevant for developing countries in determining the use of the settlement system (SHAFFER, 2003a; BOWN AND

HOEKMAN, 2005). SHAFFER (2003a) and SHAFFER (2003b) demonstrate the relevance of private-public partnerships for the initiation and prosecution of trade disputes at the WTO and BESSON AND MEHDI (2004) argue that domestic variables should be incorporated to handle the potential sources of distortion of the dispute settlement procedure.

To our knowledge this is the first empirical attempt to capture some aspects of the aforementioned interaction between the public and the private sector regarding dispute initiation. For this purpose two domestic variables are included which are provided by KAUFMANN (2004): (i) the Corporate Legal Corruption Component (CLCC), measuring legal dimensions of undue political influence by the private sector and (ii) the Judicial/Legal Effectiveness Integrity Index (JLEI), assessing the effectiveness and integrity of the legal and judicial system. The greater the influence of lobbyists, e.g. by legal political finance or by the voice of interests of powerful firms, the more successful the private sector is supposed to be in achieving its export interests. Accordingly, the number of challenged disputes should be positively correlated to the amount of undue influence, aggregated in the CLCC variable. It is hypothesized, that the higher the efficiency and integrity of the legal and judicial system of a country, the higher its ability to identify illegal trade measures and to pursue a legal action. Hence, the probability for litigation is presumed to be positively dependent on the JLEI variable.

Membership time

The time of membership may be negatively related to the costs of filing a dispute as learning occurs. Hence, we suspect a Member's experience through its membership in the WTO to be positively related to its number of filed disputes. An index is created over the time since the inception of the organization until June 30, 2006, relating each Member's membership time to the whole observation period. The associated data is from WTO (2007c).

The following table provides a survey on all explanatory variables with their respective data source and expected impact on the initiation of disputes.

Table 5. Survey on explanatory variables, data and expected sign

Explanatory variables	Data	Source	Expected sign
Export diversity*	Census of different export flows on HS-4 level	EuroCARE (2006)	(+)
Capacity to absorb legal costs/wealth*	Per capita Gross Domestic Product	UNCTAD - Statistical Yearbook (2002, 2003)	+
Legal capacity*	Size of permanent delegation at Geneva	United Nations (2004)	+

Explanatory variables	Data	Source	Expected sign
Influence of private actors	Measure of legal dimensions of undue political influence by the private sector	Kaufmann (2004): Corporate Legal Corruption Component (CLCC)	+
Governmental efficiency	Measure of effectiveness and integrity of the legal and judicial system	Kaufmann (2004): Legal and Judicial Effectiveness and Integrity Index (LJEI)	+
Relevance of the agricultural sector	Percentage share of GDP produced in agriculture	UNCTAD - Statistical Yearbook (2002, 2003)	+
Endured protectionism by trade partner	Average endured tariff equivalent	Kee, Nicita, Olarreaga (2006): Overall Trade Restrictiveness Index (OTRI)	+
Own imposed protectionism	Average imposed tariff equivalent	Kee, Nicita, Olarreaga (2006): Market Access Overall Trade Restrictiveness Index (MA-OTRI)	–
WTO membership time	Index based on a member's percentage membership share over investigation period	World Trade Organization (2007c)	+

* *Influencing factors already integrated in previous empirical investigations*
Source: Own compilation

5 Statistical Implementation and Results

For the restricted model, the probability to complain is identical for all Members and its estimate only dependent on the number of all observed disputes and of the sum of bilateral export flows between all trading partners. Hence, improved model prediction is merely owing to changes in the distribution of export flows over Members by weighing the relevant exports flows, i.e. introducing thresholds for accounting only export flows beyond a certain value. The average number of export flows declines from 5530 in case of no threshold to 65 when the highest threshold of $700K is used. The fit of the model is measured by two different indicators: the fraction of exact predictions and the mean absolute deviation (MAD) between observed and predicted disputes

$$MAD = \frac{1}{m}\sum \left| c_i - \hat{c}_i \right|, \tag{9}$$

where c_i denotes the number of observed and $\hat{c}_i$ the number of predicted disputes of Member i and m assigns the sample size.

Both indicators prove that the thresholds regarding the incorporation of export flows is important as raising the threshold increases the fit of the model. This result supports the findigs of HORN ET AL. (1999) that the pattern of dispute initiation is to a large extent reflected by differences in Members' diversity and value of trade. Table 6 comprises the results for the restricted model. The threshold of $300K has no substantial influences on the results compared to no threshold. Using the middle threshold of $500K, the MAD decreases by 30% to 1.67 compared to 2.38 for the model without threshold. The fraction of exact predictions increases from 23% to 43%. When the highest threshold is applied, the MAD decreases further by 38% to 1.04 while the fraction of exact predictions slightly increases to 49%.

Table 6. Results for the restricted model subject to different thresholds for export flows

			Number of bilateral export flows			Mean of absolute deviations	Fraction of exact predictions
Threshold			min	max	avg		
$0	BETA 0	-7,7127					
	PROB	0,0004	127	115000	5530	2,38	23%
$300K	BETA 0	-7,3363					
	PROB	0,0007	94	79400	3796	2,32	25%
$500K	BETA 0	-4,9581					
	PROB	0,0070	16	6210	354	1,67	43%
$700K	BETA 0	-3,2228					
	PROB	0,0383	1	750	65	1,04	49%

Source: Own compilation.

For the unrestricted model the Akaike information criterion is utilized to select the relevant variables. Based on this, the incorporation of additional variables is traded off against the increased fit of the model. By incorporating additional explanatory variables the goodness of fit is improved regardless of the number of free parameters in the data generating process. The indicator penalizes increasing complexity thus mitigating the danger of over-fitting. It is then sought after the model specification showing the lowest information criterion value. The proceeding is stepwise: Starting from the restricted model, one additional variable is included and corresponding information criterion calculated. In the next step the variable that yielded the lowest value is retained and the additions of the remaining variables are assessed one by one. Additional variables are included as long as they reduce the information criterion. For the final model, standard errors of the

coefficients are derived using the bootstrap methods. The quality of the unrestricted model is further on validated by a likelihood ratio test. In this process the logarithmic likelihood function value of the unconstrained ML estimator $\hat{\boldsymbol{\beta}}$, is compared with the likelihood function value of the constrained ML estimator $\tilde{\boldsymbol{\beta}}$, which is obtained by maximizing the logarithmic likelihood function subject to the linear restrictions $\widetilde{\beta_k} = 0 \forall k \neq 0$. The LR test statistic is computed as

$$LR = 2\left[\ln L\left(\hat{\boldsymbol{\beta}} | c_i, \mathbf{x}_i, n_i\right) - \ln L\left(\tilde{\boldsymbol{\beta}} | c_i, n_i\right)\right]., \qquad (10)$$

which has a Chi-squared distribution with degrees of freedom equal to the number of imposed restrictions.[9]

According to this proceeding only four of the considered determinants are retained in the final model: (1) Endured protectionism, (2) Own imposed protectionism, (3) Influence of pressure groups and (4) WTO membership time result in a sufficient increase in the goodness of fit for no threshold and the thresholds \$300K. For the application of the \$500K threshold the variable Influence of pressure groups and for the highest threshold of \$700K both Influence of pressure groups and Own imposed protectionism are discarded in the selection process. Table 7 comprises the results for the selected specifications of the unrestricted model subject to different thresholds for export flows. The standard errors are given in brackets behind the respetive coefficients. All included variables show the hypothesized sign and except for the variable Influence of pressure groups, their influence is proven to be statistically significant. The variables' joint significant influence is verified by an asymptotic significance test based on the bootstrapped sampling distribution of the estimator (see EFRON AND TIBSHIRANI, 1993). Compared to the restricted model, the fraction of correct predictions are slighly higher for all thresholds. The mean absolute deviation between observed and predicted complaints decreases as well. This is mainly due to improved model behaviour for Members with a large number of observed disputes, predominantly for the EC and the U.S. Both measures show that the model amendment is much higher for the \$300K threshold and the specification without threshold.

[9] Estimation, selection of variables, the likelihood ratio test and the bootstrap re-sampling and testing procedure are implemented in GAMS (General Algebraic Modeling System), see BROOKE, A., KENDRICK, D., MEERAUS, A. AND R. RAMAN (1998): GAMS – A User's Guide, GAMS Development Corporation, Washington, DC. The standard errors of the coefficients are calculated for 2000 re-sampling iterations.

Table 7. Results for unrestricted specification selections subject to different thresholds for export flows

	Thresholds							
Explanatory variables	$0		$300K		$500K		$700K	
BETA 0	-9.373		-9.363		-9.583		-6.585	
Endured protectionism by trade partner	**2.113	(-1.27)	**2.394	(1.30)	***2.934	(1.08)	**1.730	(0.98)
Own imposed protectionism	***-2.030	(0.87)	***-2.465	(0.92)	*-1.903	(1.20)	not included	
Influence of pressure groups	0.525	(0.67)	0.655	(0.69)	not included		not included	
WTO membership time	*1.424	(0.91)	**1.707	(0.98)	***4.312	(1.64)	*2.811	(2.12)
Mean of absolute deviations		1,66		1.45		0.98		0.94
Fraction of exact predictions		34%		36%		51%		55%
Level of significance for likelihood ratio test on model specification		1%		1%		1%		10%

** significant at the 10% level*
*** significant at the 5% level*
**** significant at the 1% level*
Source: Own compilation.

The probability to complain per export flow covers a wide range: For the specification without threshold the highest probability is 4 times, for the highest threshold it is 26 times the lowest probability. However, Member's activity in dispute initiation cannot be inferred from its probability to complain without considering the number of its export flows: Being one of the two most active users of the system, the probability to complain for the EC falls into the lower third whereas the probability of Australia, Canada and the U.S. belong to the highest for all thresholds. For the $500K threshold the probability of the U.S. constitutes 2.76 times the EC's probability. Corresponding to their reciprocal ratio with respect to their bilateral export flows (1: 2.25) this results in 32 predicted disputes for the U.S. (but 34 actually observed) and 26 for the EC (only 24 actually observed).

The likelihood ratio test proves a significant amendment of the model based on the incorporation of the addressed determinants. For the first three thresholds the concerned variables' contribution could be substantiated at a 1% level, for the highest threshold at a 10% level of significance.

The findings of HORN ET AL. (1999) on a significant influence of legal capacity could not be supported in our analysis of food related disputes. This may be explained by the fact that legal capacity increasingly becomes an internationally tradable good such that each Member can purchase legal expertise, provided that

it has sufficient financial resources. The Advisory Centre on WTO Law (ACWL)[10] lists eleven law firms and four individuals on its 'Roster of External Legal Counsel'. On the other hand, the findings of BOWN (2005) with respect to the influence of monetary means is not confirmed by our results either. Therefore, it seems more likely that legal capacity and monetary means are more relevant determinants for the overall number of dispute initiations but simply less important for the variation of probabilities across countries for the smaller food sector.

The indicators on Governmental efficiency and Relevance of the agricultural sector did also not survive the variable selection process The latter might simply be a insufficient proxy for the relevance of a Member's agri-food-industry. Variables are not discarded due to multicollinearity, since the pairwise coefficient of correlation between selected and unselected variables is at most 0.34 for Legal capacity and WTO membership time.

6 Conclusions

This paper presented an analysis of the determinants for initiating WTO disputes related to the agri-food sector. Apart from this new sectoral focus, the analysis extended the literature with a more in-depth analysis of potentially relevant determinants. The empirical model representing the number of initiated disputes by country as a sequence of Bernoulli trials – with probabilities modelled by a logistic distribution – was applied to 53 WTO Member countries.

The results show that some of the determinants relevant in previous dispute studies such as legal capacity and monetary means could not be confirmed as statistically relevant in the context of the agri-food sector. It could be shown that increasing own protectionist attitude lowers the probability to complain and the level of protection faced by a country leads to an increase as both variables prove to be statistically significant determinants of dispute initiation in the agri-food sector. At the same time, the duration of WTO membership clearly contributes to a larger likelihood to initiate a WTO dispute. Though selected for two of four possible model specifications with its expected sign, the Influence of private pressure groups does not turn out to show a significant influence. Further research should focus on the improvement of data quality to validate or disprove the findings on insignificant influences of some variables, for example the importance of the agri-food sector for the country considered. A generalisation of the model allowing to simultaneously incorporate characteristics of the defendant country

[10] The ACWL is a WTO institution supporting developing countries with general legal advice on WTO matters and was established in 2001 at Geneva. Its "Roster of External Legal Counsel" is available at: http:// www.acwl.ch/e/tools/news_detailsphoto_e.aspx?id=3c188583-5884-4a1d-ae02-e65b14370cc9, 15-04-2008.

would also be very useful. Currently, the implied assumption that probabilities to be a defendant is equal across all countries could only be partially mitigated by including the determinant Endured protectionism of the complaining country.

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