Journal of Development Economics 96 (2011) 115–125

Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/devec

Trade liberalization, antidumping, and safeguards: Evidence from India's tariff reform

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ARTICLE INFO

Article history:
Received 22 May 2009
Received in revised form 25 May 2010
Accepted 3 June 2010

JEL classification:
F13

Keywords:
India
Tariff reform
Antidumping
Safeguards
Political economy

ABSTRACT

This paper is the first to use product-level data to examine empirically whether countries use antidumping and safeguard exceptions to unwind commitments to lower tariffs in the face of domestic political–economic pressure. We focus on the case of India, a country that underwent a major exogenous tariff reform program in the early 1990s and subsequently initiated substantial use of safeguard and antidumping import restrictions. We first estimate structural determinants of India's import protection using the Grossman and Helpman (1994) model and provide evidence from its pre-reform tariff data of 1990 that is consistent with the theory. We then re-estimate the model on the Indian tariff data after the trade liberalization is complete and find that the model no longer fits, a result consistent with theory and evidence provided in other settings that India's 1991–1992 IMF arrangement can be interpreted as resulting in an exogenous shock to India's tariff policy. However, when we re-estimate the model on data from 2000–2002 that more completely reflects India's cross-product variation in import protection by including *both* its post-reform tariffs *and* its additional non-tariff barriers of antidumping and safeguard import protection, the significance of the Grossman and Helpman model determinant estimates is restored. We interpret these combined results as evidence that India unwound its commitment to reduce tariffs through use of antidumping and safeguard protection in the face of political-economic pressure. The estimates are also economically important and provide one explanation for separate results in the literature that the magnitude of import reduction associated with India's use of antidumping is similar to the initial import expansion associated with its tariff reform. Finally, we interpret the implications of our results for the burgeoning research literature examining the effects of liberalization on India's micro-level development.

1. Introduction

India undertook a substantial episode of unilateral trade liberalization beginning in 1991–1992, one in which it dramatically cut its import tariffs in a process that continued until 1997. Its import-weighted average tariff declined from 87.0% in 1990–1991 to 24.6% in 1996–1997. Before 1992, India had never resorted to using the "safeguard" exceptions embodied in many trade agreements, such as antidumping or a global safeguard, to implement import restrictions that are common alternatives to tariffs. By the period 1997–2002, however, India had transformed from a non-user to become the WTO system's most prolific user of these alternative, non-tariff barriers to trade. In the case of antidumping, the vast majority of Indian investigations resulted in the imposition of new import restrictions, and most of them remained in effect for five years or more. As Fig. 1 indicates, by 2002, India had enough new antidumping trade barriers in place to cover 132 different 6-digit Harmonized System tariff lines.

Combined, the potential exogeneity of India's import tariff cut and the fact that it had no history of using antidumping or safeguard trade restrictions before the liberalization episode make the Indian experience a relatively unique testing environment in which to examine whether there is a relationship between tariff liberalization and the subsequent imposition of these non-tariff barriers to trade. This paper introduces a new approach to examine empirically the extent to which India used antidumping and safeguard exceptions to unwind its commitment to lower tariffs in the face of domestic political–economic pressure.

India is an excellent setting to test for this relationship for a number of reasons that we detail further in Section 2. Following the initiation of its tariff reform program in 1991, India transformed from being a non-user of policy exceptions such as antidumping and safeguards to becoming the WTO system's most frequent user (WTO, 2009a,b) of both types of import restrictions over the next decade. Nevertheless, while the response to the Indian tariff reform program appears well timed with the subsequent rise in filings and implementation of these safeguards and antidumping policy exceptions, is there a *product-level* link? Fig. 2 illustrates suggestive evidence of the basic relationship between the relative sizes of the 1990s tariff cuts and subsequent antidumping use. The figure indicates that products that sought and were granted antidumping protection in effect by 2002, on average started with higher tariffs and received larger tariff cuts between 1990

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doi:10.1016/j.jdeveco.2010.06.001

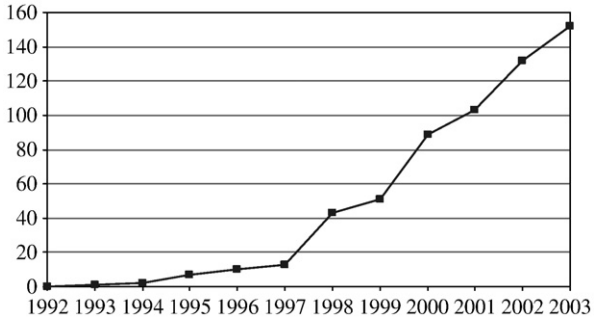

Fig. 1. Number of 6-digit HS products with Indian antidumping measures in force.

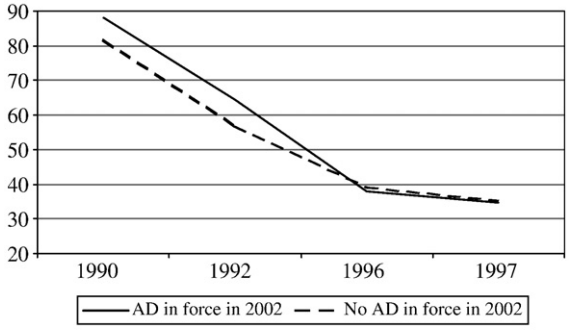

Fig. 2. Average tariffs by year for Indian imported products with and without AD measures in force in 2002.

and 1997. Our econometric analysis investigates whether this suggestive evidence of a relationship between the size of the trade liberalization and subsequent resort to these policy exceptions is economically and statistically important when estimated in a more formal political–economy modeling framework. Our approach is to use the Indian setting and exploit variation at the industry and *product level* to examine whether there is evidence of political–economic pressure to backslide on market opening commitments through resort to global safeguard and antidumping trade restrictions, which themselves are relatively substitutable forms of import protection.[2]

In Section 3 we present our econometric approach which adopts the Grossman and Helpman (1994) model to estimate structural determinants of India's import protection. In Section 4, we present our results. We first estimate the model on India's pre-reform tariff data from 1990 and find results that are broadly consistent with the theory and evidence from other countries and trade policy settings.[3] As a second step we re-estimate the Grossman and Helpman model on the Indian tariff data from years after its trade liberalization is complete. We find that the trade liberalization resulted in cross-product variation in the new level of Indian import tariffs that can no longer be explained by political–economic determinants of the model. The fact that the model no longer fits the tariff data is consistent with theory and evidence provided in other settings that India's 1991–1992 IMF stand-by arrangement can be interpreted as resulting in an exogenous shock to India's tariff policy. As a third step, we then re-estimate the Grossman and Helpman model on data from 2000 to 2002 that more completely reflects India's cross-product variation in import protection. When we measure India's 2000–2002 protection by including *both* its post-reform tariffs *and* its additional non-tariff barriers of antidumping and safeguard import protection in effect during that period, the evidence indicates a restoration of the significant determinants of the Grossman and Helpman model.[4] The combined results indicate that, while tariff levels moved away from the Grossman–Helpman equilibrium with the trade reform, antidumping and safeguards were used in a way that brought India's overall level of protection back to a new (post-reform) political–economy equilibrium consistent with the Grossman and Helpman model, which in turn suggests that those policies were used as substitutes for tariffs.

In our sensitivity analysis, we document how these results continue to hold even after controlling for other factors that the previous literature on antidumping and safeguards suggest is likely to affect India's heterogeneous use of such policies across products. In particular, import protection that is inclusive of use of these particular policy instruments may also be affected by the possibility of future retaliation as well as the need to document evidence of industry "injury" and "dumping" to access these policy instruments. Including such determinants into the analysis does not affect our main results.

The economic significance of our exercise is further highlighted by the evidence that our results are driven by product-level variation within relatively important Indian industries such as iron, steel, fabricated metal products, chemicals, food products, and transport equipment. These industries comprise both a large share of India's manufacturing imports and a major fraction of all Indian use of antidumping and safeguards. Moreover, we find that the estimated coefficients are statistically different (larger in absolute value) in 2000–2002 than in 1990. They imply a lower—although still high—value of the weight that the government places on social welfare relative to political contributions, and a higher fraction of the population that is organized into a lobby in the later period than in 1990. They also imply that on average an organized sector with similar characteristics would receive less protection after the trade reform. Our estimates also provide one explanation for separate results in the literature that the magnitude of import reduction associated with India's use of antidumping is similar to the initial import expansion associated with its tariff reform.[5] Finally, in

[2] Despite substantial legal differences between safeguards and antidumping, they have been shown in many contexts to be relatively substitutable instruments of import protection, given the lax enforcement rules regulating how these policies are implemented. See, for example, Bown (2004), Bown and McCulloch (2003) and also the discussion in Hoekman and Kostecki (2001). Nevertheless, our estimation approach controls for the most important differences (e.g., antidumping is country-specific and discriminatory, safeguards are nondiscriminatory) between them as we describe in substantial detail below. For comprehensive surveys of economic research in the antidumping literature see Blonigen and Prusa (2003) and for the safeguard literature, see Bown and Crowley (2005).

[3] The first papers to estimate structural versions of the Grossman and Helpman model on data for the United States include Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000). While there are too many studies in the subsequent literature to cite here, Cadot et al. (2008) is the first paper of which we are aware to apply the Grossman and Helpman model to determinants of Indian import protection. Nevertheless their study does not examine the questions of interest of this paper — i.e., specifically whether the model can be used to understand the cross-sectional determinants of India's import protection when including tariffs and particular trade policies like antidumping and safeguards.

[4] The "natural experiment" setting created by India's exogenously-mandated tariff reform program of the 1990s may also help us to overcome at least two potential endogeneity concerns associated with examination of the relationship between trade liberalization and the resort to new protection under safeguard exceptions. One concern is that a country's trade liberalization is typically not itself an exogenous event, but instead is part of a negotiated preferential or multilateral trade agreement. In such cases, endogenous factors may determine both the level of initial liberalization and subsequent resort to exceptions for new protection. A second endogeneity concern may arise if the trade liberalizing country is simultaneously negotiating the terms of the "exceptions" in the writing of the trade agreement — i.e., not only the question of whether to have any exceptions at all, but also the legal and economic evidentiary criterion that must be met in order to trigger the exceptions. This is also not of concern for our context as India's accession to the WTO was part of the "Single Undertaking," which meant India would be subject to established GATT/WTO rules governing antidumping and safeguard exceptions.

[5] The size of our estimates for India that link trade policies (tariffs and antidumping/safeguards) over time indicate economically important implication for trade flows and provide evidence consistent with Vandenbussche and Zanardi (forthcoming), whose gravity model estimates find that the trade decrease resulting from India's antidumping policy is of the same magnitude as the trade increase that resulted from its earlier trade liberalization.

Section 4.5, we interpret the implications of our results for the burgeoning research literature examining the effects of the 1990s trade liberalization on patterns to India's micro-level development.

Before turning to the next section, we pause to identify the limits to the implications of our results vis-à-vis other important questions raised by the theoretical literature on trade agreements and "safeguard" type-exceptions. [6] For example, economic theorists have identified how a trade agreement that grants exceptions that allow for a government to re-implement conditional import protection after trade liberalization occurs can help facilitate trade liberalization ex ante.[7] Since we only focus on India's import protectionist response (via use of antidumping and safeguards) to its exogenous trade liberalization episode, our results cannot speak to the important broader question of whether ex post access to these exceptions facilitates a country's willingness to liberalize its import tariffs in the first place.

2. India's tariff reform, antidumping, and safeguards

2.1. Trade liberalization in India in the 1990s

Between 1947 and the late 1980s, India followed an inward-oriented development strategy. A combination of external shocks in the late 1980s and early 1990s led to large macroeconomic imbalances, and as a result, India requested a stand-by arrangement (SBA) from the International Monetary Fund in August of 1991. The SBA has been one facility in the IMF's lending portfolio since 1962, and such arrangements offer countries facing short-term balance of payments problems the ability to borrow conditionally on achieving policy targets.[8] Among the conditionalities for India's 1991 arrangement were that its national government had to implement major structural reforms including trade liberalization, financial sector reform, and tax reform (Cerra and Saxena, 2002).

The trade reform started in 1991 and was completed within the export–import policy announced in the government's Eighth Plan in 1992, which outlined a program of tariff reductions for the next five years on the basis of the 1991 agreement with the IMF (Pursell et al., 2007). [9] The government had to meet strict compliance deadlines, and it chose to implement the reform abruptly so as to avoid the emergence of potential opposition and thus without time to analyze or debate its distributive effects (Topalova, 2006). Such tariff reform characteristics point to its exogenous nature.

Table 1
India's antidumping (AD) and safeguard (SG) initiations and outcomes.

Year	Number of AD initiations	Number of initiations with final AD measure*	Number of SG initiations	Number of initiations with final SG measure
1992	5	5	0	0
1993	0	0	0	0
1994	6	6	0	0
1995	6	5	0	0
1996	21	21	0	0
1997	13	13	1	1
1998	28	18	5	3
1999	63	49	3	2
2000	40	33	2	1
2001	67	60	0	0
2002	79	56	3	1
2003	32	20	1	0
2004	20	9	1	0
Total	380	295	16	8

*Excludes cases with only price undertakings. There was only one (in 2002).
Source: Authors' calculations using data from Bown (2007). Note that India's antidumping statute was established in 1985, although its first investigation did not take place until 1992. India's safeguard statute was established in 1997, and its first safeguard investigation took place in that year.

Prior to the IMF arrangement, the 1990–1991 Indian import-weighted average tariff was 87%, the simple average was 128%, and some tariffs were over 300% (Srinivasan, 2001). The maximum tariff fell from 355% in 1990–1991 to 150% in 1991–1992 and 30.8% in 2002–2003. The weighted average tariff decreased from 87% in 1990–1991 to 24.6% in 1996–1997 before it gradually increased to 38.5% in 2001–2002.[10] Finally, the standard deviation of tariffs fell from 41% to 15% between 1991 and 1997–1998 (Hasan et al., 2007).

As additional evidence on the exogeneity of the tariff reductions, Edmonds, Pavcnik and Topalova (forthcoming) report a marked linear relationship between the pre-reform tariff levels and the tariff cuts by industry—which we also confirm using our data—deriving from the fact that the IMF mandated a reduction in both the tariff levels *and* their dispersion. Moreover, Topalova (2004) regresses the tariff change on late 1980s industry characteristics, including factor shares, concentration, employment, wages, productivity and others, and finds that tariff changes are not correlated with industry characteristics.

Because of the exogenous nature of India's IMF-mandated trade liberalization in the 1990s, a number of researchers have used it as a "natural experiment" case study to test the impact of trade liberalization on many different questions concerning fundamental microeconomic activity.[11] However, one potential concern that we are able to examine is whether this exogenous reduction in import tariffs is to some extent reversed by the subsequent re-application of new forms of import protection in India via WTO-permitted exceptions such as the imposition of safeguards and antidumping import restrictions.

2.2. India's antidumping and safeguard policies and use

Table 1 documents how the pattern of new Indian antidumping initiations evolved over the 1992–2004 period. India introduced its antidumping legislation in 1985 but did not initiate its first

[6] There are some papers related to our approach but which use much more aggregated data and which also do not attempt to deal with the endogeneity issues that we have identified. For example, Crowley (2009) is a cross-country, macro-level study relating the subsequent number of safeguard cases that a WTO member initiated between 1995 and 2000 to a measure of the member's average tariff cut undertaken in the Uruguay Round. Feinberg and Reynolds (2007) is a similar cross-country approach which focuses on antidumping alone and is carried out at a very aggregated industry level. Our approach differs from these two studies along a number of dimensions, including that it focuses on a single country in which the tariff cuts were arguably exogenous thus forming the basis for a better natural experiment, it is conducted at the product (6-digit Harmonized System) level, it examines both antidumping and safeguard use, and the estimates derive from structural econometric models.

[7] For example, Bagwell and Staiger (1990) illustrate how safeguards can play a positive role in maintaining a cooperative trade agreement and relatively low tariffs in the face of unexpected shocks. A separate strand of the theoretical literature on trade agreements (e.g., Staiger and Tabellini, 1987; Maggi and Rodriguez-Clare 1998, 2007) finds that ex ante inclusion of such a safeguard exception can create time-consistency or commitment problems that make it difficult for a government to implement even Pareto-improving trade liberalizing reform announcements ex post. Our approach does not specifically address this literature either.

[8] See, for example, the discussion in IMF (2009). Separately, Wei and Zhang (2010) use a cross-country sample of IMF programs over the 1993–2003 period to examine the effectiveness of trade conditionality in such lending arrangements.

[9] Even though India was a founding contracting party of the GATT, it did not actively reduce its tariffs through multilateral negotiations in GATT rounds over the 1947–1994 period. Topalova (2004) also describes these five-year plans as having been carried out largely as they were originally announced.

[10] Nevertheless, despite the sharp reduction in India's applied tariffs over this period, India did choose to legally "bind" its tariffs with the WTO at somewhat higher levels when it made its 1994 Uruguay Round commitments (Srinivasan, 2001). The increase in applied tariffs after 1997 also coincided with a significant lifting of quantitative restrictions (Narayanan, 2006) and was possible because of the flexibility India had with tariff bindings set higher than the previously applied rates. The simple average tariff rate fell from 128% in 1990–1991 to 34.4% in 1997–1998 and then increased to 40.2% in 1998–99 but continued decreasing after that.

[11] We further discuss and assess the potential implications of our results for this literature below in Section 4.5.

Table 2
India's antidumping and safeguard initiations and imports by industry: 1992–2004.

Industry (3-digit ISIC)	Number of AD initiations	Number of final AD measures	Number of SG initiations	Number of final SG measures	Percentage of manufacturing imports (1988–2004)	Percentage of HS-6 lines with AD initiations	Percentage of 1991 imports in HS-6 lines with AD initiations	Percentage of 1992–2004 imports in HS-6 lines with AD initiations
311—Food products	1	0	1	0	4.7	0.3	3.1	0.3
313—Beverages	0	0	0	0	0.0	0.0	0.0	0.0
314—Tobacco	0	0	0	0	0.0	0.0	0.0	0.0
321—Textiles	9	9	0	0	1.9	0.7	4.6	8.1
322—Wearing apparel except footwear	0	0	0	0	0.1	0.0	0.0	0.0
323—Leather products	0	0	0	0	0.4	0.0	0.0	0.0
324—Footwear except rubber or plastic	0	0	0	0	0.0	0.0	0.0	0.0
331—Wood products except furniture	0	0	0	0	0.1	0.0	0.0	0.0
332—Furniture except metal	0	0	0	0	0.1	0.0	0.0	0.0
341—Paper and products	9	6	1	0	2.3	7.9	48.5	36.3
342—Printing and publishing	0	0	0	0	0.5	0.0	0.0	0.0
351—Industrial chemicals	214	173	9	6	15.5	13.2	33.7	27.3
352—Other chemicals	18	17	2	2	2.7	5.9	16.8	12.8
353—Petroleum refineries	3	3	0	0	9.9	5.9	0.0	0.2
354—Misc. petroleum and coal products	2	1	0	0	0.8	37.5	93.3	93.2
355—Rubber products	2	2	0	0	0.5	1.9	6.9	28.6
356—Plastic products	0	0	0	0	0.4	0.0	0.0	0.0
361—Pottery china earthenware	3	2	0	0	0.1	14.3	37.7	31.1
362—Glass and products	2	2	0	0	0.4	6.6	12.3	8.9
369—Other non-metallic mineral products	9	4	0	0	0.3	11.4	1.1	14.0
371—Iron and Steel	36	25	0	0	3.9	10.0	18.3	28.9
372—Non-ferrous metals	8	1	0	0	13.6	2.0	0.9	0.3
381—Fabricated metal products	2	2	0	0	1.3	0.8	1.0	1.4
382—Machinery except electrical	17	7	1	0	12.6	1.2	3.3	2.6
383—Machinery electric	14	13	0	0	7.4	2.1	0.7	1.8
384—Transport equipment	0	0	0	0	5.0	0.0	0.0	0.0
385—Professional and scientific equipment	4	2	0	0	2.6	3.1	1.8	3.4
390—Other manufactured products	0	0	0	0	12.7	0.0	0.0	0.0
All manufacturing	353	269	14	8	100.0	4.1	13.4	8.3

Source: Authors' calculations using data from Bown (2007) and Nicita and Olarreaga (2007).

antidumping case until 1992 and after its tariff reforms had begun. Furthermore, India enacted its domestic safeguard legislation in 1997 and did not initiate its first safeguard investigation until that year. The use of antidumping in particular accelerated in the late 1990s before reaching a peak in 2002.[12] As Table 1 illustrates, India initiated 380 antidumping cases during that period. India imposed a final antidumping measure—e.g., typically an *ad valorem* or specific duty—in 295 of the investigations, representing 85% of the number of initiations with non-missing data on final decisions (348).[13] Thus not only did India initiate a large number of cases, but a very large majority of these cases resulted in the imposition of new trade restrictions. India imposed final measures in 8 of the 12 safeguard cases with non-missing data during this time period. Finally, India's use of both antidumping and safeguards went unchallenged by WTO members through formal Dispute Settlement Understanding activity until December 2003, when the European Communities brought the first case against Indian antidumping (WTO, 2008). [14]

Table 2 decomposes the Indian use of antidumping and safeguards over the 1992–2004 period for industries within the manufacturing sector. The dominant user of antidumping and safeguards is industrial chemicals, with 214 antidumping initiations and nine safeguard initiations. Other frequent users of antidumping are iron and steel (36), other chemicals (18), machinery except electrical (17) and

[12] Our analysis draws on the publicly available Global Antidumping Database (Bown, 2007) which provides detailed data on policy investigation outcomes, as well as products and exporting countries targeted by Indian use of antidumping between 1992 and 2004. The working paper accompanying the database describes the data in full detail. To summarize, the data for India was taken directly from what the Directorate General of Antidumping and Allied Duties in the Ministry of Commerce publicly reported in *The Gazette of India* http://commerce.nic.in/ad_cases.htm. The information on the duration of measures imposed was frequently supplemented by information India has made available to the WTO's Committee on Antidumping.

[13] While we do not report it in the table, in 26 cases no evidence of dumping was found and in 33 cases no injury was found. Only 10 cases were withdrawn or terminated. Furthermore, in 289 of the 314 observations with non-missing information (92%), a preliminary duty was imposed implying that in almost all cases, petitioning firms received *at least* temporary protection from imports.

[14] A contributing explanation to the high incidence of Indian industry "success" in antidumping and safeguard investigations (i.e., such a high share resulting in the imposition of final measures) is thus that India's use of antidumping and safeguards was not formally challenged by any trading partners under the WTO's dispute settlement provisions until December 2003. Nevertheless, Indian exporters during this time period were increasingly targeted by other WTO members' use of antidumping, as the WTO (2009a) reports that its members initiated 107 antidumping cases against India between 1995 and 2004 alone. India as a target of foreign antidumping was only surpassed by cases against China, Korea, the U.S., the EC and its member states, Taiwan, and Japan during this time period, despite India having a much smaller level of exports than these other economies.

machinery electric (14). Among industries that initiated safeguard investigations, each was also a user of India's antidumping policy during this time period.

2.3. The economic importance of Indian antidumping and safeguard industry-level users

Are the industry-level users of these Indian policies economically important? Table 2 also presents information on the relative size of imports across sectors. Over the period 1992–2004, industrial chemicals was not only the most frequent user of antidumping and safeguards within India, it also competed with the largest value of imports among all Indian manufacturing industries, representing 15% of all Indian manufacturing imports (and 16% in 1988–2004). In some years industrial chemicals represented almost 20% of manufacturing imports, despite the potential trade destructive effects of the imposition of new Indian antidumping and safeguard import restrictions. The other major industrial users of antidumping and safeguards also face substantial competition from imports. An implication is that use of these policies has potentially distorted incentives and activities in significant areas of the Indian economy.

Finally, when we match antidumping use and trade data at the 6-digit Harmonized System (HS) level, we find that 14% of Indian manufacturing imports in 1991 were in products that would subsequently become affected by antidumping or safeguards between 1992 and 2004. When we consider the average of imports from 1992 to 2004, 12% of Indian manufacturing imports between 1992 and 2004 were in products affected by antidumping or safeguard initiations.[15] While this serves as a potential upper bound on the impact of India's use of antidumping on trade flows during this time period, it reinforces the importance of a more in depth examination of India's use of antidumping and safeguards.[16]

3. The Grossman and Helpman econometric approach

3.1. Econometric model

Our econometric approach builds on the Grossman and Helpman (1994) model of trade protection. Their approach has become the leading political economy model of trade protection as it begins from first principles and derives a set of testable predictions about the determinants of protection based on government–industry interaction. The model assumes a small open economy in which there is a numeraire good produced only with labor, and $i=1, \ldots, n$ non-numeraire goods produced with labor and a specific factor. The specific factor owners may organize into lobby groups and simultaneously offer the government a contribution schedule that maps each government policy choice into a campaign contribution level. In the second stage, the government selects the trade policy vector to maximize a weighted sum of contributions and social welfare. The model provides the following equation for equilibrium tariffs:

$$t_i = \frac{I_i - \alpha_L}{a + \alpha_L} \cdot \frac{z_i}{\varepsilon_i}, \tag{1}$$

where t_i is the *ad valorem* tariff; I_i is an indicator variable that equals one if the sector is organized into a lobby and zero otherwise; α_L denotes the fraction of the population that owns some specific factor; a is the weight that the government places on social welfare relative to political contributions; z_i is the equilibrium ratio of domestic output to imports; and ε_i is a measure of the absolute value of the elasticity of import demand defined as follows: $\varepsilon_i = -m'_i(p_i)(p_i^* m_i(p_i))$, where in turn m_i denotes imports of good i, and p_i and p_i^* denote the domestic and world price of good i, respectively.[17]

Our strategy is to proceed as follows. We begin by testing the Grossman and Helpman model's Eq. (1) for India's applied tariffs in 1990. This is the year prior to India's trade policy reform and is arguably thus the last year its *tariffs* were determined endogenously. The objective is to verify whether the Grossman and Helpman model is an appropriate predictor of India's trade policy in the absence of an exogenous mandate of reform. If we find support for this hypothesis, the next step is to estimate Eq. (1) for India's applied tariffs after the reform in the period 2000–2002.

Since subsequent to the 1991 IMF arrangement Indian tariffs were affected by an exogenous mandate, we would expect to find that the Grossman and Helpman model does *not* adequately predict India's applied tariffs by themselves in 2000–2002. However, as Table 1 and Fig. 1 indicate, India had become a relatively heavy user of antidumping and safeguard import restrictions by the early 2000s. If India were exogenously constrained so that it could not increase its applied tariffs, as arguably took place when India committed to reduce its tariffs under the agreement with the IMF, antidumping or safeguard duties could be used as a substitute policy instrument. Therefore, as a third step we estimate the Grossman and Helpman model for tariffs *plus* antidumping and safeguard duties in 2000–2002 as the dependent variable.

If we find support for the Grossman and Helpman model once antidumping and safeguard duties are included in the protection measure, we interpret the combined results (i.e., support for the Grossman and Helpman model for tariffs in 1990; lack of support for the model for tariffs in 2000–2002; and support for it for tariffs plus antidumping and safeguards in 2000–2002) as evidence that, while the trade liberalization reform moved tariffs away from the Grossman and Helpman equilibrium, the use of antidumping and safeguards generated a movement back toward the protection levels that would be predicted by that model. In other words, this would provide evidence that antidumping and safeguards were used as a substitute for tariffs.

Based on Eq. (1), we define the estimation equation as follows:

$$\tau_{i,t} = \beta_0 + \beta_1 \left(I_i \times \frac{z_i}{\varepsilon_i} \right)_t + \beta_2 \left(\frac{z_i}{\varepsilon_i} \right)_t + \mu_{i,t}, \tag{2}$$

where the dependent variable may be defined as the applied tariff only or also include AD/SG duties, t equals either 1990 or 2000–2002, $\beta_1 = 1/(a+\alpha_L) > 0$, $\beta_2 = -\alpha_L/(a+\alpha_L) < 0$ and μ_i is the regression error term.[18] Protection increases with (z_i/ε_i) for organized sectors and decreases in the case of unorganized sectors. The magnitude of the deviation from free trade (in either direction) is thus higher when (z_i/ε_i) is higher, because a larger output means the benefit from protection is higher for the lobby, and the welfare cost from protection is lower the lower are the volume of imports and the elasticity of import demand. The Grossman and Helpman model also predicts that $\beta_1 + \beta_2 > 0$. Finally, from β_1 and β_2 we can retrieve the estimated values of the model parameters a and α_L, defined above.

[15] When measured as a share of *all* Indian imports, these figures are 9% and 7%, respectively. In the same period, the share of tariff lines in manufactures for which there was an antidumping or safeguard initiation is 5% and the share of *all* tariff lines is 4%. Table 2 also shows the share of HS-6 tariff lines for which there was an AD initiation within each 3-digit ISIC sector, as well as the share of imports that those HS-6 products represent.

[16] This is an upper bound because antidumping investigations and measures are typically applied at the 8-digit level, and not all 8-digit products within a 6-digit HS category will necessarily be targeted.

[17] To obtain ε_i from the elasticity defined over domestic prices, e_i, that we use in the estimation, we would need to divide the latter by $p_i/p_i^* = (1+t_i)$. However, since output is measured at domestic prices while imports are measured at world prices, we also need to divide z_i by $(1+t_i)$, which is equivalent to saying that we can directly use e_i instead of ε_i in Eq. (1) in the estimation.

[18] The error term is included to capture potential measurement error in the variables and other factors (not accounted for in the model) that may influence the determination of trade policy.

3.2. Data

3.2.1. Tariffs, antidumping and safeguard policies

First we estimate the model for data from the pre-reform year of 1990. Tariff reductions in India took place mostly between 1991 and 1997, and India began to increase its use and application of safeguards and antidumping in 1997 (Table 1 and Fig. 1). As the data on output is available only until 2001, we perform the estimation for our second set of results on averages over 2000–2002 (where for 2002 we use data on output in 2001). Depending on the specification, for these estimates we use as the dependent variable the average of applied tariffs from 2000 to 2002 *or* the combination of the average applied tariffs plus the antidumping (AD) or safeguard (SG) protection in force during 2000–2002.[19]

We estimate the Grossman and Helpman model on a cross-section of data, and our unit of observation is an imported product at the 6-digit Harmonized System (HS) level either in 1990 or averaged over 2000–2002. The 6-digit HS level Indian applied *ad valorem* tariff data is available from UNCTAD/TRAINS for 1990 and 2000–2002 from the WTO's Integrated Database.

For our last set of specifications we use the sum of the applied tariff and an AD *ad valorem* equivalent. This variable was constructed using data at the exporter-product level and requires some discussion. While most Indian AD measures were imposed as specific duties, we also have data on the final dumping margin calculation in *ad valorem* terms.[20] In some cases this is reported at the level of the exporting firm within an investigated country, but in other cases it is only reported as a *range* of values of new trade barriers facing the exporters of that product in a given investigated country. Therefore, for each AD case we calculate two variables: i) AD_min, which is the average of the minimum AD margins, where the average is taken across all foreign countries that are being subject to the Indian AD measure over that product; and ii) AD_max, defined analogously as the average of the maximum AD margins across all foreign countries that are being subject to the Indian AD measure over that product. [21] We report results using both variables for robustness.[22] Since, in contrast to tariffs, AD duties may apply to only certain exporting countries, the final protection measure is obtained by adding to the tariff the AD margin *weighted* by the import share of the affected countries in total Indian imports of the product.[23] We also complement the baseline specification by estimating the model on a variable defined as the sum of tariffs plus AD *and* SG, for which we used data on safeguard duties imposed by India. Product-specific information on India's AD/SG use derived from Indian government sources as described in the *Global Antidumping Database* (Bown, 2007).

Table 3
Summary statistics.

Variable	Mean	Standard deviation	Minimum	Maximum
a. Data used to estimate the Grossman and Helpman Model: 1990				
Dependent variable:				
Tariff	81.707	44.869	0	355
Explanatory variables:				
$I \times z/e$	31.874	223.650	0	7448.309
z/e	46.126	351.902	0.108	11,033.950
b. Data used to estimate the Grossman and Helpman Model: 2000–2002				
Dependent variable:				
Tariff	31.565	11.499	0	200.667
Tariff and AD_min	32.057	12.547	0	200.667
Tariff and AD_max	32.316	13.784	0	200.667
Explanatory variables:				
$I \times z/e$	18.900	95.094	0	3211.348
z/e	22.064	100.091	0.042	3211.348

Notes: Number of observations is 3293.

3.2.2. Import data, production, elasticities, and political organization

The Indian data for other variables used to estimate the model derive from a number of sources. First, data on import demand elasticities at the 6-digit HS level is from Kee et al. (2008). Production and import data at the 3-digit ISIC level is obtained from the World Bank's *Trade and Production* database (Nicita and Olarreaga, 2007).[24]

As we do not have access to political campaign contribution data for Indian industries, we determine whether a given sector is politically organized by using data on organizations listed in the World Guide to Trade Associations in 1995.[25] The World Guide to Trade Associations is an international directory of trade associations that covers more than 170 countries. Many researchers have used counts of the number of groups listed in the Guide as a measure of interest group activity, examples of which include Murrell (1984), Kennelly and Murrell (1991), Bischoff (2003), and Coates et al. (2007), among others.[26] Since the median number of groups listed by each sector in India is about 5, we start by classifying an industry as organized if it lists at least 5 organizations in the World Guide to Trade Associations. We also experiment with alternative cutoff levels and classification procedures (described later) as robustness checks.

Note finally that for our second set of specifications we use the average values of the right-hand side variables from 2000 to 2002 as regressors. Table 3 presents summary statistics for the relevant variables used to estimate the model.

[19] Tariff data is available from these sources for the years 1990, 1992, 1996, 1997, 2000, 2001 and 2002. Most of the antidumping measures in force in 2000–2002 were applied between 1996 and 2001, since antidumping measures typically remain in effect for five years before WTO rules require a "sunset review" which may lead to their removal. Furthermore, we should highlight that the model is treated as a cross-section, and the variables are the average values for the 2000, 2001 and 2002 years. The baseline specifications give qualitatively similar results if they are estimated instead using data on tariffs and AD in effect in 2002 only. The results are also robust to estimating the model on the 2001 data only, the last year for which output data is available.

[20] In cases in which the final AD margin was missing we use the preliminary margin. The use of *ad valorem* equivalents avoids the problem faced when using coverage ratios, which may understate or overstate protection, as was pointed out by Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) which nevertheless had to use the NTB coverage ratio as the dependent variable in their tests of the Grossman and Helpman model for the United States.

[21] The minimum of the range is the lowest exporting firm-specific dumping margin (trade barrier) that the Indian government calculated across all of the producers from that country in that case, whereas the maximum is the highest exporting firm-specific dumping margin (trade barrier) that the Indian government calculated across all of the producers from that country in that case. When we average across countries, we trade-weight the average according to the exporting countries' share of the Indian market in the product, as follows: $\text{AD\_min} = \sum_j x_{ij} * \text{Impshare}_{ij}$, where x_{ij} denotes the minimum of the AD margins that apply to firms in country j in a given product i, and Impshare_{ij} denotes the share of Indian imports of product i that come from exporting country j (and analogously for AD_max).

[22] The results are also robust to using the mean of AD_min and AD_max.

[23] We use weights from the year in which the AD investigation was initiated, which in the large majority of cases is the year *before* the duty was imposed (in some cases it was two years before). We do this because we expect that the year after the initiation of the investigation imports are likely to decrease.

[24] We use the concordance files to associate HS products to ISIC industries made available in Nicita and Olarreaga (2007).

[25] The following edition from the World Guide to Trade Associations with data for 1999 contains almost identical counts for manufacturing products in India and thus leads to a similar classification in terms of organized industries.

[26] For example, Kennelly and Murrell (1991) argue that although the number of interest groups is not a perfect measure of the level of interest group activity in an industry, they are positively correlated. Each industry may be comprised of several sub-sectors and each sub-sector could potentially be represented by an interest group. At a given point in time, only some groups are active (those for which the benefits of organization outweigh the costs); but if industry characteristics change and collective action becomes more profitable, we expect that the currently active interest groups will expend more and that new groups will form. Moreover, results from the existing literature provide evidence that the count data contains meaningful variation and seems to be an adequate proxy.

Table 4
Estimation of Grossman and Helpman Model's determinants of Indian use of tariffs in 1990.

Dependent variable: Applied tariff in 1990							
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)[1/]
$I \times z/e$	0.120***	0.117***	0.133***	0.111***	0.112***	0.107	0.217**
	(0.027)	(0.027)	(0.029)	(0.023)	(0.027)	(0.080)	(0.085)
z/e	−0.033**	−0.035**	−0.039***	−0.003	−0.029**	−0.085	−0.114*
	(0.014)	(0.015)	(0.015)	(0.010)	(0.014)	(0.075)	(0.069)
Constant	79.254***	79.738***	79.494***	79.094***	79.214***	80.800***	78.998***
	(1.054)	(1.021)	(1.052)	(1.058)	(1.055)	(0.931)	(0.722)
Fraction of population owning specific factor: α_L	0.28	0.30	0.29	0.03	0.26	0.79	0.53
Social welfare weight: a	833.06	854.40	751.59	900.87	892.60	933.79	460.30
An industry is organized if number of listed groups is	At least 5	At least 6	At least 8	More than 10	More than 2	More than 1	At least 5
Observations	2897	2897	2897	2897	2897	2897	2897

Notes: Standard errors of the tobit model's estimates are in parentheses with *, **, and *** indicating statistically significant at 10%, 5% and 1% levels, respectively. [1/] Column 7 uses an IV-GMM estimation procedure where the standard errors are adjusted for clustering at the 3-digit ISIC level.

3.3. Estimation strategy

The dependent variable of import protection in our model is censored below zero. Furthermore, we have potentially endogenous variables entering nonlinearly on the right hand side, which include the output to import ratio, the elasticity, and the organization indicator. Finally, the organization variable and the elasticities may be measured with error. The methodology we apply to address these concerns is a Tobit estimation combining the Smith and Blundell (1986) and the Kelejian (1971) approaches. The methodology requires that we use least squares to regress the right-hand-side endogenous variables and their nonlinear transformations on the instruments and then include the residuals from these regressions as additional variables in the original import protection equation.[27] The instruments can include the exogenous variables, as well as their quadratic terms and cross-products.

We decided to leave the elasticity on the right-hand side of the protection equation, in contrast to Goldberg and Maggi (1999), for two reasons. First, the elasticity estimates that we use have much greater precision, with about 90% of them being significant at the 1% level.[28] Second, this approach allows us to exploit variation at the HS-6 level on the right-hand side variables. A number of papers adopt the approach of leaving the elasticity on the right-hand side, including Gawande and Bandyopadhyay (2000) and Mitra et al. (2002). However, as we describe in more detail below, we do instrument for the elasticity and we also test the robustness of the results to taking that variable to the left-hand side of the protection equation.

Our instruments consist primarily of industry characteristic data, and our choice is motivated by previous tests of the model on other countries and trade policy settings. The variables used to instrument for the political organization variable include the number of employees by establishment, the industry concentration ratio, value added per firm (a measure of scale), and the share of output sold as intermediate goods. The instruments for the output to import ratio include factor shares, such as the share of capital in output and the capital–labor ratio.[29] We instrument for the import demand elasticity by using the average of the elasticities for five other similar countries that are not India's main trade partners (Malaysia, Philippines, Thailand, Tunisia and Indonesia).

The first-stage results from our baseline specification for the period 2000–2002 are shown in the Appendix. Although the literature does not give unambiguous sign predictions for the variables used to instrument for political organization, the instruments for the other variables have the expected signs.[30] In addition, most of the coefficients are statistically significant and the probability of the F-statistic was 0.000 for all instruments.

4. Empirical results

4.1. Results for 1990: Pre-reform import tariffs

The results of our baseline IV-Tobit estimation of the determinants of Indian import tariffs in 1990 are reported in column 1 of Table 4. They provide support for the Grossman and Helpman (1994) model. We find evidence consistent with the theory that politically organized sectors receive more tariff protection than unorganized ones. In particular, the coefficient on $I_i \times (z_i/\varepsilon_i)$ (i.e., β_1) is positive and significant at the 1% level, while the coefficient on (z_i/ε_i) (i.e., β_2) is negative and significant at the 5% level. In addition, the sum of these two coefficients is positive, which further supports the model. We also reject the null hypothesis that the sum of these two coefficients is zero at the 1% level.

Using β_1 and β_2, we can retrieve the estimates of the parameters of the model, a and α_L (also shown in Table 4). We find the value of a, the weight that the government places on social welfare relative to contributions, to be about 833. This high value is consistent with estimates of the Grossman and Helpman model from research examining other countries and trade policies (e.g. Gawande and Bandyopadhyay, 2000; Goldberg and Maggi, 1999). Relative to other studies, we obtain a lower value for α_L, the fraction of the population that is organized into a lobby, which is estimated to equal 0.28.[31]

Next, we perform some robustness tests regarding the classification of organized industries. We had initially classified an industry as organized if the World Guide to Trade Associations listed at least 5 organizations. In column 2 of Table 4 we show that the results are robust to increasing the cutoff level to at least 6 groups. In columns 3 and 4 we increase the cutoff level to at least 8 groups and to more than 10 groups, respectively. In both cases the output-import/elasticity ratio (z_i/ε_i) is significant for the organized industries, but in the case of unorganized industries the variable becomes not significant once we require more than 10 organizations listed for an industry to be classified as organized.[32] In the last two columns of Table 4 we decrease the number of listed groups used to determine organization relative to the baseline.

[27] Including the residuals corrects for endogeneity in the corresponding variables and all the coefficients become consistent. If the residuals are statistically significant we can reject the null hypothesis that the variables are exogenous. Gawande and Bandyopadhyay (2000) and Gawande et al. (2006) also use this procedure, although the first only reports the two-stage least square results.

[28] Furthermore, any remaining measurement error is addressed via the use of instrumental variables.

[29] Some of these data are from Nicita and Olarreaga (2007) and others from Cadot et al. (2008). Note that we use lag values of the instruments to further alleviate endogeneity concerns.

[30] The signs of the coefficients of factor shares are consistent with capital being relatively scarce in India. The elasticity average used is the actual (not absolute) value.

[31] Notice that since the dependent variable in our data is expressed as a percentage, we need to divide the coefficients by 100 before retrieving the parameters.

[32] A limitation with the results in columns 3 and 4 is that although the Wald test indicates that we cannot reject exogeneity at the 1% or 5% level in those two specifications, we could reject it at the 10% level. In all other specifications the exogeneity test is passed at any conventional levels of significance.

Table 5
Estimation of Grossman and Helpman Model's determinants of Indian use of tariffs, antidumping and safeguards in 2000–2002.

Dependent variable is	Tariff	Tariff and AD_min	Tariff and AD_max	Tariff, AD_min and SG	Tariff, AD_max and SG	Tariff and AD_min	Tariff and AD_max
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$I \times z/e$	0.074	0.186**	0.251***	0.189**	0.254***	0.206**	0.289***
	(0.068)	(0.083)	(0.096)	(0.084)	(0.097)	(0.095)	(0.111)
z/e	−0.064	−0.179**	−0.247**	−0.182**	−0.250***	−0.202**	−0.287**
	(0.068)	(0.083)	(0.096)	(0.084)	(0.097)	(0.096)	(0.113)
Constant	31.566***	32.473***	32.992***	32.499***	33.016***	31.912***	32.432***
	(0.321)	(0.391)	(0.452)	(0.393)	(0.454)	(0.523)	(0.611)
Within industry retaliation indicator						−0.377	−0.858
						(0.732)	(0.856)
Growth in output						7.088**	8.027**
						(3.110)	(3.636)
Growth in employees						14.144***	15.360***
						(1.781)	(2.082)
Growth in import value						0.003	−0.024
						(0.226)	(0.264)
Growth in import unit value						1.363	1.605
						(1.209)	(1.413)
Fraction of population owning specific factor: α_L	0.86	0.96	0.98	0.96	0.98	0.98	0.99
Social welfare weight: a	1350.49	536.67	397.42	528.14	392.72	484.46	345.03
Observations[1/]	3297	3293	3293	3293	3293	3091	3091
Wald exogeneity test: p-value	0.49	0.22	0.15	0.22	0.14	0.19	0.11

Notes: Standard errors of the tobit model's estimates are in parentheses with *, **, and *** indicating statistically significant at 10%, 5% and 1% levels, respectively. [1/]Observations are cross-section of 6-digit HS products averaged over 2000–2002.

In column 5 we use a threshold level of more than 2 groups and in column 6 we use more than 1 group.[33] In the first case the results are also robust to this alternative classification. In the second case the coefficients have the predicted signs but they are not significant.

In sum, the results are robust to several alternative cutoff levels used to determine industry organization. The model's predictive performance decreases if we adopt classifications that lead to few sectors being considered organized or that lead to almost all sectors to be classified as organized, as we would expect, since we need enough variation in the organization indicator to be able to identify the two independent variables, i.e., $I_i \times (z_i/\varepsilon_i)$ and (z_i/ε_i).

The results are also robust to clustering the standard errors at the 3-digit ISIC level. To be able to adjust the standard errors for clustering we used an IV-GMM estimation procedure, and the results are reported in column 7 of Table 4.[34] Overall the evidence indicates that the Grossman and Helpman model is a good predictor of India's 1990 tariff levels before the trade reform.

4.2. Results for 2000–2002: Post-reform import tariffs, antidumping and safeguards

In column 1 of Table 5 we report the results of estimating Eq. (2) for Indian *post-reform* applied import tariffs averaged over 2000–2002. Although the coefficients have the predicted signs they are not statistically significant, suggesting that tariffs had moved away from the Grossman and Helpman equilibrium levels. This is what we expected given that the IMF-mandated reform exogenously reduced India's import tariff levels during the 1990s.

The next step of our estimation is to also include AD duties, which could have been used as a substitute for tariffs. In columns 2 and 3 we report the results of estimating Eq. (2) for 2000–2002, but we redefine the dependent variable to include tariff *and* AD protection, as described in Section 3.2. Column 2 uses the minimum of the AD margins to calculate the dependent variable and column 3 uses their maximum. In both cases the coefficients are statistically significant and have the predicted signs. In addition, the sum of the coefficients is again positive, as predicted by the model.

We also find that the estimated coefficients on the 2000–2002 sample of data are statistically different from the coefficients obtained from the 1990 sample (column 1 of Table 4). We would expect that the lower protection levels associated with the trade reform may be reflected in a higher estimate of the parameter a and/or α_L (the latter since the lobbies tend to neutralize one another through more competition). The implied values of the parameter a from the theory are about 537 and 397 using the results from columns 2 and 3, respectively. These values are lower than those obtained from the 1990 data but are still quite high. The values of the parameter α_L are 0.96 and 0.98, respectively, which are higher than the values we obtained for 1990 but closer to estimates obtained by previous authors for other countries. In addition, the sum of the coefficients β_1 and β_2 is lower in 2000–2002, which implies that on average an organized sector with similar characteristics would receive *less* protection in this period (i.e., after the trade reform), as we would expect.

The fact that the values of a and α_L move in opposite directions is consistent with the predictions of Mitra (1999). The decrease in a could help explain the increase in α_L, since when the government places relatively less weight on social welfare and more on political contributions, there is more incentive for lobbying and lobby formation. The decrease in a might seem counter-intuitive as India moved toward lower protection levels; however, two things should be noted. First, if we consider tariffs only, although the coefficients are not significant (column 1 of Table 5), the implied value of a from those estimates is higher in 2000–2002 than in 1990, and it is only once we include antidumping protection that the value of a falls. Second, as Gawande et al. (2009) emphasize, the prediction of the Grossman–Helpman model regarding the value of a does not depend simply on whether protection levels are low or high, but also on the other determinants of protection such as the output–import ratio and

[33] A threshold level of more than 3 groups (or more than 4) leads to the same classification of our baseline estimation.

[34] Although this procedure does not account for the data censoring, the coefficients are significant and the results are also robust to controlling for potential heteroskedasticity.

import demand elasticities and their covariance with protection and with each other. Thus, if a government uses antidumping in industries with high import–output ratios (e.g., industrial chemicals in our Indian case) or high import demand elasticities, that reveals a willingness to trade social welfare for private gain. The authors also find a low correlation between their estimates of a and average tariffs across countries, which is also consistent with such an explanation. Therefore, lower protection levels do not imply a higher value of a and can well be consistent with a lower value.[35]

These results provide evidence that Indian industries and policy-makers used the AD policy as a way to move the country's level of overall (combined) import protection back toward a "new" (post-reform) Grossman and Helpman equilibrium and suggest that AD was used as a substitute for tariffs. This is a potentially important result, as it indicates that at least part of the trade liberalization undertaken by India was reversed with the later re-application of import-restricting measures through new forms of protection.

4.3. Robustness checks

Next, we examine the sensitivity of the results to inclusion of India's use of safeguard duties in addition to antidumping and the level of applied import tariffs. Columns 4 and 5 of Table 5 replicate the specifications from columns 2 and 3 but allow the dependent variable to include AD *and* SG protection in addition to tariffs. The results are robust to this change, and they are also quantitatively close to the baseline specification.

As additional robustness tests, we estimate specifications in which we redefine the indicator variable for whether an Indian industry is organized based on the results of Cadot et al. (2008). They use an iterative procedure in which they first estimate a standard Grossman and Helpman equation on Indian tariff data without distinguishing between organized and unorganized sectors. They then use the residuals from this estimation to rank industries, reclassifying those with high residuals as organized before performing a new estimation and repeating the process iteratively until the sum of squares is minimized. They use a search grid to determine the cutoff value used to reclassify an industry as organized. When we use their classification, we find that the coefficient of the output–import/elasticity ratio is still positive and significant for the organized industries, consistent with the theory, although it is not significant (and positive) for the unorganized ones.[36]

We also examined the robustness of the results to including other variables that may influence the use of AD. We construct an indicator variable that equals one if at least one of the foreign exporting industries (from whom the Indian imports derive) had filed its own antidumping initiation *against* Indian exports in a 6-digit HS product within the same 4-digit ISIC industry during the five years prior to the 2000–2002 period. This variable is constructed from data in the *Global Antidumping Database* and is designed to capture the potential for India's import-competing industries that also export to avoid using AD in products that come from trading partners from whom there is a retaliation threat concern (Blonigen and Bown, 2003).[37] In addition, we include variables to control for the likelihood of injury or dumping; evidence needed to justify imposition of safeguards or antidumping. These variables include the lagged growth in imports of the product (at the HS-6 level), as well as the lagged growth in each of the following variables: output, the number of employees, and the unit value of imports (at the ISIC-3 level). We expect a decline in output growth and employment growth (e.g., industry "injury") and a decline in the growth in the unit value of imports (e.g., "dumping") to potentially increase the level of AD protection based on the evidentiary requirements to using these policies. Similarly, evidence of higher import growth may be expected to increase the overall protection due to these policies, ceteris paribus.

Columns 6 and 7 of Table 5 show the results when we add these variables to the specifications from columns 2 and 3. We find that the retaliation variable is negative but not significant. The growth in output and the number of employees are significant but positive, and the growth in unit value and the value of imports are not statistically significant. The main implication is that the estimates on our key variables of interest continue to hold.

In unreported results, we have also performed other forms of sensitivity analysis worthy of discussion. First, we experimented with the alternative of taking the elasticity to the left-hand side of the protection equation, as done by Goldberg and Maggi (1999). We re-estimate our baseline specifications—columns 2 and 3 from Table 5—but with the elasticity multiplying the dependent variable instead, and find that the results still hold; the coefficients (of $I_i \, x \, z_i$ and z_i) are statistically significant and with the predicted signs.[38] Second, the increase in the number of observations for the 2000–2002 regressions (e.g., column 2 of Table 5) relative to the 1990 sample (e.g., column 1 of Table 4) is due to the fact that India imported many more products in the later period. Nonetheless, in order to establish that the change in the results is not simply due to the increase in the sample, we also estimate the specifications from columns 1, 2 and 3 from Table 5 but restricting the sample to products that were present in the 1990 sample. We find that our key results still hold. The coefficients are not significant when the dependent variable only includes tariffs, but they are significant (and have the expected signs) once we add antidumping duties to the protection measure.

4.4. Economic significance and sectoral decomposition

In terms of the economic interpretation of the results of Table 5, consider the manufacturing products for which an AD duty was in force in 2000–2002. For these products the average tariff was 32% and the sum of the average tariff and AD duties was 51% and 61% when using the minimum and maximum of the AD margins, respectively. The standard deviation for the same products also increases significantly from 5% for tariffs to 25% and 38% for tariffs plus AD, again using the minimum and maximum of the margins. Moreover, the maximum tariff for those products was 38%, while the maximum *ad valorem* protection from tariffs *and* AD was 167%. These figures suggest that the use of AD had a significant effect on the protection levels in those sectors in which an AD duty was imposed.

In order to determine which industries are driving our results, we re-estimate the baseline specifications (columns 2 and 3 from Table 5) and interact the variable $I_i \times (z_i/\varepsilon_i)$ with ISIC-3 industry dummies for

[35] Gawande et al. (2009) also consider models of electoral competition and legislative bargaining to identify potential structural determinants of a within the Grossman–Helpman framework and they find that lower values of a may arise due to a greater ability of a dollar of campaign spending to influence uninformed voters (e.g., the productivity of media advertising), a larger perceived difference in the characteristics of parties in the eyes of voters, undivided governments, among other factors.

[36] This may be due to the fact that they classify most sectors as unorganized and their estimation is for 1997. If some of those sectors are actually organized in our time period, then that would explain why the coefficient of this variable could become positive and not significant.

[37] See Prusa (1992) and Hoekman and Mavroidis (1996), for example, for discussions. In addition to Blonigen and Bown (2003), recent papers finding evidence consistent with retaliatory effects on different samples of antidumping use data include Prusa and Skeath (2002), Feinberg and Reynolds (2006) and Vandenbussche and Zanardi (2008). Note that none of these earlier empirical papers match antidumping use across countries at the actual level of product disaggregation (6-digit Harmonized System) that we have done here.

[38] They imply an approximately similar value of α_L and a lower value of a relative to the baseline.

Table 6
Estimation of Grossman and Helpman Model's determinants of Indian use of tariffs, antidumping and safeguards in 2000–2002: industry effects.

Explanatory variables	Dependent variable is	
	Tariff and AD_min (1)	Tariff and AD_max (2)
$(I\times z/e)\times$Food products	0.307***	0.303***
	(0.051)	(0.055)
$(I\times z/e)\times$Tobacco	0.025**	0.026**
	(0.012)	(0.013)
$(I\times z/e)\times$Industrial chemicals	0.577***	0.757***
	(0.112)	(0.122)
$(I\times z/e)\times$Other chemicals	0.106***	0.106**
	(0.038)	(0.042)
$(I\times z/e)\times$Iron and steel	0.208***	0.205***
	(0.051)	(0.056)
$(I\times z/e)\times$Fabricated metal products	0.179**	0.172**
	(0.076)	(0.083)
$(I\times z/e)\times$Transport equipment	0.162*	0.156
	(0.098)	(0.107)
$I\times z/e$	0.101	0.104
	(0.066)	(0.072)
z/e	−0.124*	−0.129*
	(0.064)	(0.070)
Constant	31.269***	31.385***
	(0.480)	(0.524)
Observations[1/]	3289	3289

Notes: Standard errors of the tobit model's estimates are in parentheses with *, **, and *** indicating statistically significant at 10%, 5% and 1% levels, respectively. [1/] Observations are cross-section of 6-digit HS products averaged over 2000–2002.

those sectors classified as organized. In Table 6 we report results from inclusion of interactions for those sectors that were found to have positive and statistically significant coefficients. The sectors driving the results are food products, tobacco, industrial chemicals, other chemicals, iron and steel, fabricated metal products, and transport equipment.[39] Thus, the results are not driven by any single industry and the sectors listed include the heaviest users of AD in India such as industrial chemicals, other chemicals, and iron and steel. These industries represent 71% of the number of products with at least one AD duty in force in 2000–2002, and they are significant importing industries as well, combined accounting for more than 33% of India's manufacturing imports during 1988–2004 (Table 2).

4.5. Summary and implications of results

Our empirical results indicate that at least part of India's trade liberalization in the 1990s was reversed by the reapplication of new forms of import protection via exceptions that the WTO permits such as antidumping and safeguards. This evidence is consistent with the results of Vandenbussche and Zanardi (forthcoming), who estimate a gravity equation for a group of countries to quantify the effects of the adoption of AD laws on trade flows. For the case of India, they find the effects of AD measures have offset most of the gains from trade liberalization, providing further support for the results identified here.

Finally, we note that our identification of a link between India's 1990s tariff reform and the subsequent use of new forms of import protection via antidumping and safeguard policy is potentially important for other areas of economic research. A substantial literature has evolved that uses the size of the exogenous Indian tariff cuts alone to examine the impact of trade liberalization on other fundamental microeconomic changes (poverty, productivity growth, labor demand, product turnover, etc.) transforming the Indian economy.[40] Our results suggest that relying on only tariff cuts to proxy for trade liberalization in certain Indian industries runs the risk of substantial mismeasurement when focusing on the post-2000 period. In particular, our result of a relationship between the tariff reform and subsequent use of antidumping and safeguards in a number of economically sizable sectors indicates *less* dispersion in the actual reduction of *protection* across products than in the tariff-only data that many prior studies have used.[41] While the research to date examines data from the period *prior* to India's run in up in antidumping and safeguard use, in the least, our results identify a caveat for future research seeking to extend this approach to more recent time periods.

5. Conclusion

This paper uses India's exogenously-induced tariff reform in the 1990s to test for one particular relationship between trade liberalization and the imposition of new import protection via WTO-permitted policy exceptions such as safeguards and antidumping. We exploit cross-product variation and provide evidence that India used antidumping and safeguard protection in the early 2000s to unwind commitments to lower tariffs in the face of domestic political–economic pressure.

Our results derive from structural estimates of a Grossman and Helpman (1994) political economy model. We find evidence in support of the model estimated on India's pre-reform (1990) tariffs, no support for the model estimated only on India's post-reform tariffs, and a restoration of support for the model estimated on the combined level of import protection via import tariffs *plus* the antidumping and safeguard restrictions in effect in 2000–2002. The estimates are driven by a number of sizable and economically important Indian industries, and they provide evidence of the persistence of political economy influences on India's overall level of import protection over time, albeit through changing access to policy instruments. These results hold even after we control for other potential determinants of antidumping use such as retaliation motives and proxies for industry injury and dumping. Overall, our results have important implications for understanding the resulting and longer-term pattern of India's import protection associated with its market access reforms of the early 1990s.

Acknowledgments

Thanks to Robert Staiger, Nuno Limão, Meredith Crowley, Steve Redding, Bernard Hoekman, Marcelo Olarreaga, T.N. Srinivasan, Hylke Vandenbussche, Jaimie de Melo, Giovanni Facchini, Sajal Lahiri, Kamal Saggi, Maurizio Zanardi, and seminar participants at LSE, Seoul National University, the University of Geneva, the World Bank, the WTO, and the MWIEG meetings in Michigan for helpful comments. Olivier Cadot, Jean-Marie Grether, and Marcelo Olarreaga also shared useful data. Bown thanks the WTO for hospitality while a portion of this paper was being written. All remaining errors are our own, and any opinions expressed within are our own and should not be attributed to the World Bank or the WTO.

[39] Although the coefficient corresponding to transport equipment becomes not significant when the maximum of the AD margins was used to construct the dependent variable, as seen in column 2 of Table 6.

[40] Examples of recent studies of India examining such links include the relationship between liberalization and industry/firm productivity (Krishna and Mitra, 1998; Topalova, 2004), poverty Topalova (2006), the demand for labor (Hasan et al., 2007) as well as child labor (Edmonds, et al., forthcoming) and the introduction of new varieties and product mix (Goldberg et al., 2009).

[41] Note that we also found that 91% of the AD/SG initiations from 1992 to 2004 were in industries in which the standard deviation of the tariff cut was larger than the median for all industries.

Appendix A

Table A1
First-stage estimates of the Grossman and Helpman Model's determinants of Indian use of tariffs and antidumping in 2000–2002.

	Dependent variable is	
	$I \times z/e$	z/e
Explanatory variables	(1)	(2)
Employees by establishment	−4.917***	−4.719***
	(0.363)	(0.386)
Scale	0.001	0.003
	(0.015)	(0.016)
Elasticity (5-country average)	18.905***	21.486***
	(2.932)	(3.115)
Capital–labor ratio[a]	−0.121***	−0.145***
	(0.036)	(0.038)
Concentration ratio	−759.012***	−616.344**
	(286.445)	(304.395)
Capital–output ratio	−363.691***	−280.525***
	(62.975)	(67.016)
Employees by establishment squared	0.045***	0.043***
	(0.003)	(0.003)
Scale squared[a]	−0.015*	−0.017*
	(0.008)	(0.008)
Elasticity (5-country average) squared	1.609***	1.831***
	(0.340)	(0.362)
Capital–labor ratio squared[b]	0.008**	0.010***
	(0.004)	(0.004)
Concentration ratio squared	2740.399**	2090.632
	(1266.053)	(1345.386)
Capital–output ratio squared	311.732***	299.001***
	(58.669)	(62.433)
Constant	182.029***	188.093***
	(12.806)	(13.608)
Observations	3293	3293
R-squared	0.16	0.15

Notes: Standard errors are in parentheses with *, **, and *** indicating statistically significant at 10%, 5% and 1% levels, respectively. [a] and [b] indicate that the variable was scaled by 1000 and 100,000,000, respectively.

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