

How Vulnerable is India's Trade to Possible Border Carbon Adjustment in the EU?

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Abstract

This paper presents an empirical exercise with the aim of addressing the following research questions: how vulnerable is India's trade to any future border carbon adjustment in the European Union and which sectors/items are most likely to be affected? The empirical exercise is based on the EU List released in December 2009 in which the bloc has identified 164 (sub)sectors as deemed to be exposed to a significant risk of carbon leakage. Given that the HS 6-digit items corresponding to the 'Full EU List' have been found to comprise the lion's share of India's exports to the EU, it is argued that there is a very high probability of any such border measure having a considerable impact on India's exports to the bloc. The study further reveals that even if the EU decides to bring only the 47 (sub)sectors belonging to the 'Truncated EU List' (that leaves out the 117 highly trade-intensive but low carbon-intensive sectors) under the ambit of its border measure, the overall vulnerability of India could still be quite high. Among the four BASIC countries (namely, Brazil, China, India and South Africa), India appears to be the second-most vulnerable, after South Africa.

I. Introduction

Among the various issues in the interface between international trade and climate change, perhaps the most contested one is the proposed use by developed countries like the European Union (EU) and the United States (US) of border carbon adjustments¹ on imports from countries that are not implementing comparable green house gas emissions reduction measures on the grounds of addressing the risk of 'carbon leakage'. Carbon leakage refers to the effect that a part of the carbon dioxide (CO₂) emissions reduction achieved by the countries undertaking abatement measures is offset by an increase in carbon dioxide emissions in the non-abating countries. The developed countries are concerned that in the energy intensive, trade-exposed sectors, the carbon costs imposed by their domestic climate policies (e.g. carbon tax or cap-and-trade scheme) would put their own producers at a competitive disadvantage *vis-à-vis* producers in developing countries that are not imposing comparable carbon constraints. They further argue that carbon leakage could end up undermining the environmental integrity of the carbon constraining domestic policy measures adopted by them and create 'carbon havens' in the non-carbon-constrained countries. Another issue underscored by the developed countries in this context is that production (re)location in favour of non-carbon-constrained regions could have detrimental social consequences with job losses. In keeping with the above arguments, law makers in both the US² and the EU have proposed introduction of border carbon adjustments as a measure to obviate the disadvantages that their domestic products may face *vis-à-vis* imports as a result of emission reduction measures adopted by them. The EU, for instance, has included proposals on border carbon adjustment in its post-2012 climate change and energy package finalized in April 2009³ (henceforth the 2009 Directive). The 2009 Directive includes, among other things, an array of measures towards strengthening and expanding the EU Emissions Trading Scheme (EU ETS)⁴ beyond 2012 and improving its functioning. These measures include *inter alia* a much larger share of allowances to be

¹ Different terms have been used in the existing discourse to refer to these proposed border measures in the context of climate change. These include 'carbon equalization system' 'border carbon adjustment', 'carbon tariff', 'carbon border adjustment' and so on. The EU legislation has used the term 'carbon equalization system'. This paper uses the terms 'border carbon adjustment', 'carbon equalization system', and 'border measure' interchangeably.

² border carbon adjustment proposals have been included in several US bills as well, which include the American Clean Energy and Security Act of 2009 (also referred to as the Waxman-Markey Bill), as approved by the US House of Representatives in June 2009. However, the senate version could not be passed till date, despite the fact that several bills have been proposed at the Senate. These include, among others, the 'Clean Energy Jobs and American Power Act' (also known as Kerry-Boxer Bill), which was introduced in September 2009. In May 2010, this version was replaced by the 'American Power Act' (also called the Kerry-Lieberman Bill). These bills also included provisions on border measures.

³ The package was proposed by the European Commission on 23 January 2008 [see EU (2008)]. A revised (watered-down) version of the package was adopted as the final Directive on 23 April 2009 [see EU (2009a)]. The package proposed a 20-20-20 targets for the EU to achieve by 2020: a 20% reduction in green house gas emissions from 1990 levels; increasing the share of renewables in the EU's energy mix to 20% from 8.5% today; and a 20% cut in energy use through improved energy efficiency.

⁴ The EU ETS is a 'cap and trade' system that was launched on 1 January 2005 as the key tool for the bloc to achieve, in a cost-effective manner, its emissions reduction commitments under the Kyoto Protocol. While the first phase of the EU ETS, 2005-07, was seen as an experimental phase, the second phase, 2008-12, coincides with the first commitment period of the Kyoto Protocol.

auctioned in the third phase of the EU ETS (2013-20) instead of being allocated for free, which is the predominant practice under the first two phases. The implications of increased auctioning of emission allowances in the third phase of the EU ETS, particularly for competitiveness of the EU industries and the concomitant problem of carbon leakage, dominated much of the domestic policy debates in the EU on the post-2012 climate change and energy package ever since the proposals were unveiled by the European Commission in January 2008. The 2009 Directive includes two alternative strategies towards addressing the problem of carbon leakage, namely free allocation and border measures.⁵ On the proposed carbon equalization system (or border carbon adjustment), the package envisages that ‘(s)uch a system could apply requirements to importers that would be no less favourable than those applicable to installations within the Community, for example by requiring the surrender of allowances’. It needs to be underscored at this juncture that as of now, the EU is planning to use free allocation as the key instrument to deal with the problem of carbon leakage.⁶ However, the possibility of using border measures in the future has not been ruled out by the EU entirely. It must also be noted that some of the EU members like France and Italy have continuously been pushing for use of border measures on imports. Hence, border carbon adjustment continues to remain an option that the EU may choose to use in the future, depending on how the post-2012 global climate regime shapes up. As observed by Carbon Trust (2010), “(t)he debate in Europe about how to tackle carbon leakage ... is far from over... it is only just beginning.”⁷

It is widely argued by developing countries that such border measures on imports, if adopted by developed countries, would be akin to protectionism in the garb of combating climate change. Serious concerns have been raised by the so-called ‘emerging economies’ (such as, China and India), which apparently are the key targets of such border measures, that these measures could act as a discriminatory market access barrier affecting their exports to the developed countries concerned in energy intensive sectors that may come under the ambit of such border measures.

This paper presents a detailed empirical exercise undertaken with the aim of addressing the following research questions: how vulnerable is India’s trade to any future carbon equalization system in the European Union and which sectors/items are most likely to be affected? The empirical exercise is based on the EU List released in December 2009 in which the bloc has identified 164 (sub)sectors (activities) as deemed to be exposed to a significant risk of carbon leakage. In order to determine the product items as per the HS (6 digit) classification corresponding to the EU List, a concordance table has been prepared

⁵ The 2009 Directive states that: ‘Energy-intensive industries which are determined to be exposed to a significant risk of carbon leakage could receive a higher amount of free allocation or an effective carbon equalization system could be introduced with a view to putting installations from the Community which are at significant risk of carbon leakage and those from third countries on a comparable footing’ [EU (2009a)].

⁶ EU (2010a).

⁷ Carbon Trust (2010), p.27.

for the present study. The first part of the empirical exercise is based on the 'Full EU List' comprising 164 (sub)sectors, whereas the second part undertakes a deeper assessment of the items corresponding to the 'Truncated EU List', which comprises only those 47 (sub)sectors from the 'Full EU List' that are more likely to come under the ambit of any future carbon equalization system in the EU. The study also explores India's exposure to the EU markets *vis-à-vis* other three BASIC⁸ countries (namely, Brazil, China and South Africa) in respect of the items corresponding to the 'Truncated EU List'.

The paper is organized as follows. Section II provides a brief overview of the EU List of 164 (sub)sectors deemed to be exposed to a significant risk of carbon leakage, while Section III undertakes a critical assessment of the methodology followed by the EU in arriving at the aforesaid list. Section IV presents the findings from the empirical exercise, while Section V discusses some caveats underlying the study. Finally, Section VI concludes the paper.

II. A Brief Overview of the EU List of Sectors at Risk of Carbon Leakage

As noted before, the post-2012 climate change and energy package was finally adopted in April 2009.⁹ The Directive provides for free allocation of emission allowances at 100% of a benchmark to (sub)sectors determined to be exposed to a significant risk of carbon leakage and includes detailed guidelines for determination of sectors at risk. The first list of such sectors, released in December 2009 (referred to here as the 'EU List' or the 'Full EU List'), has been determined as per these guidelines.

The main criteria for the identification of sectors for this purpose are defined in the Directive, particularly in its Articles 10a(15) and 10a(16). According to Article 10a(15), a (sub)sector shall be deemed to be exposed to a significant risk of carbon leakage if the sum of direct and indirect additional costs induced by the implementation of this Directive would lead to a cost increase of at least 5% of its gross value added *and* the sector concerned has a trade intensity with third countries¹⁰ exceeding 10%.

On the other hand, according to Article 10a(16), a sector or subsector is deemed to be exposed to a significant risk of carbon leakage if the sum of direct and indirect additional costs induced by the implementation of the directive would lead to a *particularly high cost increase* of at least 30% of its gross value added; *or* the sector concerned has a *particularly high trade intensity* with third countries exceeding 30%.

⁸ The BASIC is a grouping of four large developing countries – Brazil, South Africa, India and China – formed by an agreement on 28 November 2009. The four committed to act jointly at the Copenhagen climate summit.

⁹ See the 2009 Directive [EU (2009a)].

¹⁰ A 'third country' refers to a country outside the EU 27 bloc. The third-country trade intensity is defined as total value of third-country exports and third-country imports divided by the total value of the sector's turnover and third-country imports.

Notably, the cost component has two parts: the direct cost of the required allowances and the indirect costs from higher electricity prices resulting from the implementation of the Directive. This is because, the installations covered by the EU ETS have to face cost increases both directly as well as indirectly. First, the covered installations are required to either reduce their emissions themselves or to cover their emission gaps by acquiring the required amount of permits from the relevant markets. The direct costs emanating from either of these two options are proportional to the CO₂ price as well as to the installations' direct emissions.¹¹ The installations' emission intensity (i.e. CO₂ emissions per unit of production) is a good proxy for the direct emissions from the industrial production process. Second, the covered installations (particularly the energy intensive ones) have to pay a higher price for the electricity, which is increased by the market value of the allowances passed through by the energy generators. These indirect costs are proportional to the marginal increase of the electricity price and to the industrial process' indirect emissions.¹² The installations' electricity intensity (MWh per tonne of production) is a good proxy for the indirect emissions¹³ from electricity consumption.¹⁴

A sector's direct cost increase has been estimated assuming that all the emissions would have been covered by acquiring permits at a price of €30/tonne.¹⁵ Indirect costs have been estimated multiplying the amount of electricity consumed by the marginal increase of electricity price under the assumption that the €30/tonne price is fully passed through into electricity prices.¹⁶

As for the estimation of direct additional cost induced by the implementation of the Directive, since the 'benchmarks' for allocation of free allowances were yet to be decided, it was not possible for the European Commission to know at the time of determination of the list of sectors the precise quantity of allowances which would be given out for free. Hence, it was based on the 'best estimates for 2013 and 2014' according to which around 75% of allowances for non-exposed sectors will be purchased in 2013-14.¹⁷

¹¹ An installation's direct emissions mainly depend on the fuel mix, technology efficiency, the amount of self-produced electricity and the industrial process emissions.

¹² An installation's indirect emissions mainly depend on the consumption of electricity and on the fuel mix used to generate the purchased electricity.

¹³ It is worth noticing that indirect emissions are not related only to electricity consumption, but to all the phases composing the product life-cycle: from the raw material extraction and transportation to the product distribution and final disposal. In principle, it would be more appropriate to count for the product life-cycle direct and indirect emissions. The 2009 Directive, however, takes into account only the indirect emissions from the consumption of electricity in the production process. This, according to Cló (2010:2424), is because the European climate policy is mainly production based (rather than consumption-based), regulating only the emissions from production (which can be easily monitored), while not taking into account the whole product life-cycle and the whole product emissions linked to consumption.

¹⁴ Cló (2010), p.2424.

¹⁵ Article 10a (14) of the 2009 Directive states that the assessment should be based on an average carbon price determined by the Commission's impact assessment accompanying the climate change and energy package. This price was €30 per tonne of CO₂, and has been used in all calculations related to this issue [EU (2009c)].

¹⁶ Cló (2010), pp. 2425-26.

¹⁷ The Commission services initially based their assessment on a simplified assumption of 100% auctioning and the preliminary results from this exercise were presented to the Member States and stakeholders at the ad-hoc meetings of

Regarding the data sources, the data on greenhouse gas emissions have primarily been collected from the Community Independent Transaction Log¹⁸ for the calculation of direct cost. For the process emissions of new activities and greenhouse gases added in the Annex I of the 2009 Directive, data has been collected from Member States and their national greenhouse gas inventories. The data on electricity consumption for the calculation of indirect cost from higher electricity prices have been obtained from the Member States. For the estimation of gross value added, data from the Eurostat Structural Business Statistics¹⁹ have been used. The trade data as well as the data on the total annual turnover in the Union have been taken from the Comext database²⁰ of the Eurostat. Depending on availability, the data from the three most recent years for each sector have been used. As a general rule, the trade data has been taken for 2005-07 and the CO₂ cost for 2005-06.

In line with the directions provided in the Directive,²¹ comprehensive quantitative analyses for all the 258 sectors in Mining and Manufacturing has been carried out at NACE-4²² level, as in principle any of them could comprise an installation, which is already covered under the ETS or is supposed to be covered with effect from 2013. Out of the 258 sectors, 146 have been found to meet the criteria specified for carbon leakage risk determination. Among these, 27 sectors have both CO₂ cost above 5% and trade intensity above 10%; two sectors have CO₂ cost above 30% of the gross value added with trade intensity below 10%; and 117 sectors have a trade intensity above 30%.

the European Climate Change Programme in April and July of 2009. However, based on the comments received at these meetings and following a detailed legal assessment and taking into account the list's period of application, the Commission felt that the term 'additional costs induced by the implementation of this Directive' in Articles 10a (15) and 10a (16), required it to base the calculations of direct costs on its best estimate of the additional cost of the allowances in 2013 and 2014. Hence, in the final determination, costs were based on best estimates for 2013 and 2014, taking into account: (i) the declining share of free allowances; (ii) the required stringency of the benchmarks; and (iii) the linear factor of the cap. The best estimates resulted in the figure that around 75% of allowances would be auctioned out. However, no sector was removed from the list due to the change in assumption on auctioning from 100% to 75%.

¹⁸ The EU Community Independent Transaction Log handles responsibilities for verifying transactions conducted by registries located in Europe. It maintains an electronic accounting system that assists in tracking emission allowances and carbon credits of entities participating in carbon markets.

¹⁹ Structural business statistics (SBS) cover industry, trade and services. The statistics describe the behaviour (structure, conduct and performance) of businesses across the EU – data are available for the EU-27 and for the Member States. The statistics can be broken down to a very detailed sectoral level (several hundred economic activities).

²⁰ Eurostat's Comext database contains the official European Foreign Trade Statistics. It includes detailed statistics on the intra- and extra-trading in goods of all EU member states. Aggregated data for the EU12, EU15, EU25, EU27, EU10 (NMS) and EU12 (NMS+Romania+Bulgaria) is available. Trade goods are classified by the 8-digit European Harmonized System (CN8, Combined Nomenclature) as well as NACE (up to 4 digits) and SITC Rev. 3 (up to 5 digits).

²¹ As set in recital 24 of the Directive, in order to establish the list of sectors and sub-sectors, which are deemed to be exposed to a significant risk of carbon leakage, the assessment should be undertaken as a starting point, at a 3-digit level (NACE-3 level) or, where appropriate and where the data is available, at a 4-digit level (NACE-4 level) [EU (2009a)].

²² NACE is the acronym for 'Nomenclature statistique des activités économiques dans la Communauté européenne'. NACE is used to designate the various statistical classifications of economic activities developed since 1970 in the European Union. NACE provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment, national accounts) and in other statistical domains. Statistics produced on the basis of NACE are comparable at European and, in general, at world level. The use of NACE is mandatory within the European Statistical System.

For some particularly heterogeneous sectors that were not found to be exposed to a significant risk of carbon leakage at the NACE-4 level, more detailed analyses have been carried out at Prodcom-6 or -8 levels.²³ As a result of this analysis, another set of 13 sub-sectors/products have been added to the list of sectors at risk.

In addition, a qualitative assessment²⁴ has been carried out for seven out of the 112 sectors that were not found to be at risk at the NACE-4 level.²⁵ From this analysis, another five sectors have been found to be at risk.

To sum up, the list of sectors/sub-sectors deemed to be exposed to a significant risk of carbon leakage contains 151 sectors at NACE-4 level and another 13 sub-sectors/product groups at Prodcom-6 or -8 levels.

It is indeed striking that out of the 258 NACE 4-digit level sectors, as many as 151 (59%) have been found to be at a significant risk of carbon leakage. It may be noted that such a wide coverage is largely attributable to the dominating influence of the high trade intensity criteria. As mentioned above, among the 151 NACE 4-digit sectors included in the EU List, as many as 117 (77%) have been included only on grounds of their particularly high trade intensity with third countries (> 30%), despite not having any significant cost impact from the implementation of the Directive. The methodology followed by the European Commission in determining the list of sectors at a significant risk of carbon leakage, particularly the use of the single threshold of >30% trade intensity may be criticized on several counts, as elaborated in the next section.

III: A Critical Look at the EU's Methodology for Carbon Leakage Risk Determination

The European Commission has classified 164 (sub)sectors – representing over three-quarters of manufacturing emissions under the EU ETS – as deemed to be exposed to a significant risk of

²³ The term Prodcom comes from the French "PRODUCTION COMMUNAUTAIRE" (Community Production). Prodcom is the EU's standard classification of production statistics. Prodcom provides statistics on the production of manufactured goods. Prodcom uses the product codes specified on the Prodcom List, which contains about 4500 different types of manufactured products. Products are identified by an 8-digit code: the first four digits are the classification of the producing enterprise given by the Statistical Classification of Economic Activities in the European Community (NACE); the first six correspond to the Classification of Products by Activity (CPA); and the remaining digits specify the product in more detail.

²⁴ According to Article 10a(17) of the Directive, the list of (sub)sectors that are determined to be exposed to a significant risk of carbon leakage as per Articles 10a(15) and 10a(16) may be supplemented after completion of a qualitative assessment, taking into account both the sectors' technological potential to reduce either emissions or electricity consumption and on the sectors' current and projected market characteristics. The relevant criteria are: (a) the extent to which it is possible for individual installations in the sector or sub-sector concerned to reduce emission levels or electricity consumption, including the increase in production costs that the related investment may entail, for instance on the basis of the most efficient techniques; (b) current and projected market characteristics, including when trade exposure or direct and indirect cost increase rates are close to one of the thresholds mentioned in paragraph 16 of Article 10(a); (c) profit margins as a potential indicator of long-run investment or relocation decisions.

²⁵ The triggers for such additional investigations included absence of data for one of the indicators, doubts about accuracy or coverage of quantitative data (e.g. discrepancy in gross value added vs. emissions), or integrated production processes [Dröge and Cooper (2010), p.24].

carbon leakage. It has been argued that if all of these sectors were granted free allowances to compensate them for this “risk”, the economic incentives to invest in low carbon manufacturing would be greatly weakened.²⁶ Importantly, as per the findings of Carbon Trust (2010:2), the EU’s list of 164 (sub)sectors includes many sectors that are unlikely to suffer significant leakage. This not only underscores the need to pay a careful attention to the proposed counter measures, but also raises serious questions about the methodology adopted by the European Commission for determining the list of sectors at the risk of leakage.

As discussed before, the *quantitative* methodology adopted by the European Commission to assess the risk of carbon leakage faced by a sector is based on two different approaches. According to one approach, a sector is deemed to be exposed to a significant risk of carbon leakage if the sum of direct and indirect additional costs induced by the ETS is found to result in a particularly high cost increase of at least 30% of its gross value added (henceforth referred to as the ‘high cost increase criterion’); *or* if the value of its exports (to third countries) and imports (from third countries) divided by the total value of its turnover and imports (from third countries) is found to exceed 30% (henceforth referred to as the ‘high trade intensity criterion’). Thus, according to this approach, an ETS sector is considered to be at risk if it satisfies only one among the two criteria: high cost increase or trade intensity. This approach may be called the ‘either-or approach’.²⁷ Under the other approach followed by the European Commission, a sector is deemed to be exposed to a significant risk of carbon leakage if the sum of direct and indirect additional costs induced by the implementation of the Directive would lead to a cost increase of at least 5% of its gross value added, *and* the sector’s trade intensity with third countries exceeds 10%. This approach may be called the ‘integrated approach’, since under this approach, a sector is taken to be exposed to the risk of carbon leakage only if *both* the aforesaid criteria are satisfied simultaneously.²⁸

To sum up, the two alternative *quantitative* approaches adopted by the European Commission differ substantially. The ‘integrated approach’ takes into account both the cost increase criterion and the trade intensity criterion simultaneously. On the contrary, according to the ‘either-or approach’, carbon leakage is assessed *either* on a cost increase basis *or* on a trade intensity basis. Above the 30% cost increase threshold, a sector automatically qualifies for inclusion in the list irrespective of its exposure to international competition. Similarly, above the 30% trade intensity threshold, a sector qualifies for inclusion in the list irrespective of the extent to which the ETS impacts its production costs. The aforesaid *quantitative* criteria, particularly, the adoption of the ‘either-or approach’ is fraught with certain fundamental flaws, some of which are discussed below.

²⁶ Carbon Trust (2010), p.2.

²⁷ Cló (2010), p.2425.

²⁸ *Ibid.*

In the absence of any policy measure aimed at addressing the carbon leakage (such as, free allocation of emission allowance or border measure), the extent to which a domestic cap-and-trade scheme would potentially lead to emission leakage in a particular sector would depend on (a) the extent to which such a scheme would affect the sector's domestic production costs; and (b) on the extent to which a given change in those costs would lead to increased imports (from third countries) or reduced exports (to third countries).

The primary determinants of a cap-and-trade scheme's effect on a sector's production costs include the emission allowance price; the emission-intensity of the sector's production (taking into account both its direct emissions and its indirect emissions); and the sector's ability to shift to less emission-intensive production methods. The higher the allowance price, the more emission-intensive the sector's production, and the less able the sector is to shift to less emission-intensive production methods, the greater would be a cap-and trade scheme's impact on the sector's production costs.

However, it is important to recognize that impacts on production costs do not directly translate into impacts on industry profitability, competitiveness, and carbon leakage. Sectors that are not exposed to international competition may be able to pass on the increased costs to the final market price without losing market share substantially. Thus, even among those sectors that experience the same percentage increase in production costs, differences in competitive conditions may allow some of them to pass on a higher share of the increased costs to consumers than others, resulting in varying impacts on sectoral profitability.²⁹ Thus, it becomes necessary to assess the extent to which the effective exposure to international competition prevents the sector from passing through the increased costs to the final product price without any substantial loss of market share. First, a definition of the relevant market and, second, the assessment of the elasticity of the relevant market demand to marginal changes in prices would be required to measure appropriately the pass-through possibility in a particular sector.

Besides, since profit margins (as a percentage of revenue) vary across sectors, a given impact on production costs may have different impact on profitability of different sectors depending on profit margin. Moreover, many emission-intensive sectors have various characteristics that make them relatively immobile in the face of small changes in production costs that might encourage firms to relocate to other countries.³⁰ In fine, the high cost increase criterion alone may not provide the extent of carbon leakage risk confronting a particular sector.

In a similar vein, it may be argued that the high trade intensity criterion alone is not necessarily indicative of a risk of carbon leakage, if products from a sector within a carbon pricing area are highly differentiated and carbon intensity is low. Even among those emission-intensive sectors that are considered to be trade-exposed, several factors may influence the extent to which a given

²⁹ USEPA (2009), p.21.

³⁰ *Ibid.*

sector is susceptible to international competition. As a result, in the face of similar increases in domestic costs, some trade-exposed sectors may experience far smaller increases in imports or reductions in exports than others. The extent to which a sector is susceptible to relocation may also vary. A few examples of these factors are discussed briefly below:³¹

Existing cost advantages: Due to access to inexpensive raw materials, advanced technologies, highly skilled labour, or other advantages, some domestic industries or firms in the EU may already enjoy a cost advantage relative to their international competitors that would continue to exist even in the face of an increase in domestic production costs resulting from the implementation of the Directive.

Fixed plant costs: Firms with a significant share of their investments in large, fixed physical structures, such as large manufacturing plants, may be less sensitive to increases in production costs, because the costs of relocation may outweigh the gains to relocating in a less stringent regulatory environment. For the same reason, they may be less exposed to international competition from other firms in the face of increased domestic costs, if the capital investments required to build new capacity in foreign countries are large compared to the increase in domestic production costs.

Transportation costs: Because of transportation costs, sectors that produce products with a relatively low value per unit of weight may be less affected by a given increase in domestic production costs than those that produce products with a relatively high value per unit of weight.

Availability of spare international production capacity: In the short run, an increase in domestic production costs may not have a significant effect on the competitive position of a domestic industry in the EU, if globally there is little spare production capacity.

Uncertainty about future conditions: In the energy intensive, trade exposed sectors that are also capital intensive, foreign competitors may be reluctant to make significant investments in response to increases in production costs in the EU, if there are significant uncertainties regarding future market conditions, including the regulatory regimes in those foreign countries. Given the long lifetimes of these capital investments and the relative level of capital abundance in developed countries like the EU, a brief period of differentiation in the domestic climate policies may not justify expansion by foreign competitors.

Agglomeration economies: As a result of agglomeration economies³² firms may have an incentive to locate near one another. Thus, sectors with significant agglomeration economies

³¹ This discussion draws on USEPA (2009), pp. 22-23.

³² While the sources of agglomeration economies are varied (e.g. knowledge spillovers, labour market pooling, proximity to firms that produce inputs or purchase outputs), their effect is the same — firms will have an incentive to locate near one another.

may be insensitive to increases in production costs to a great extent, if the gain from remaining close to other firms in the sector outweighs the gains from relocating to a region with less stringent climate policies.

It is clear from the aforesaid discussion that the risk of carbon leakage that a sector faces depends on a complex interaction of a range of factors, many of which are often case and context-specific. In view of such complexities, Dröge and Cooper (2010:27) maintain that the two *quantitative* criteria that have been used by the European Commission cannot take into account the fundamental differences between sectors and, as a consequence, the nature of the leakage risk they face. According to them, the quantitative criteria should have been supplemented by qualitative analysis in order to explore whether a particular sector that met the *quantitative* criteria should be taken off the list on the ground that other characteristics of the sector revealed that it was not at risk. According to the European Commission's methodology, however, the sectors that qualified under the quantitative criteria did not have to pass any other tests. Qualitative analysis was used by the Commission only to determine whether those sectors that did not qualify on the basis of the quantitative criteria, or for which there were severe data problems, could also be considered as at risk.

A vast majority of the sectors that have been included in the EU List on grounds of high trade intensity (>30%) alone, have very low carbon intensity - as indicated by the cost increase as a percentage of gross value added. Many of these sectors would face a cost increase lower than 1% of their respective gross value added. As noted by Carbon Trust (2010:25), '(m)any of these are minor sectors with specialised products – the trade being often driven by such specialisation and facilitated by low transport costs relative to value. These tend not to be very carbon intensive sectors.' The inclusion of the vast majority of sectors in the EU List based solely on grounds of high trade intensity, therefore, raises serious questions about the European Commission's methodology. According to Cló (2010:2428), the 'either-or approach' - based either on the high cost increase criterion or on the high trade intensity criterion - is not sufficiently economically grounded. He observes that '(i)t looks more like the final result of a political compromise aimed at limiting the impact of the European regulation – via exemption from auctioning – to the vast majority of the regulated sectors independently on their effective exposure to Carbon Leakage.'

Another criticism is that the industry data is aggregated at the EU-27 level for the leakage analysis. Such aggregation fails to take into account the important differences among national industry structures within the bloc.

As for the thresholds adopted, the European Commission does not explain why the chosen thresholds should be tailored to evaluate the risk of carbon leakage. It is not clear whether the 5%, 10% and 30% thresholds have been set arbitrarily or whether they have been specified according to some economic principles. According to Dröge and Cooper (2010:25), analysis to support the choice of thresholds would have been particularly useful for the single criteria

thresholds. Cló (2010:2428) argues that deciding on a threshold basis whether permits should be assigned for free or auctioned out, implies that sectors can either be fully exempted from auctioning or not exempted at all. This would impose a regulatory measure, which is not proportional to the sectors' effective exposure to the risk of carbon leakage and might as well provide a perverse incentive to adopt opportunistic behaviour. For instance, fully exempting a sector whose carbon and trade intensities are 5.1% and 10.1%, respectively, while at the same time not exempting at all a sector whose carbon and trade intensities are 4.9% and 9.9% might not induce effective behaviour on the part of the non-exempted sector and might eventually lead to increase in its emissions in order to reach the specified threshold.

The European Commission's assessment is not the only methodological approach that can be used to identify sectors at risk of carbon leakage, however. A number of different methodological approaches, assessment criteria and thresholds exist. Dröge and Cooper (2010:28-30) provide a host of criteria that may be applied for this purpose. These criteria are classified under four broad categories: (a) cost structures, (b) pass-through ability, (c) abatement potential, and (d) institutional factors. According to them, the different reactions of sectors to a carbon price become more transparent if more criteria are applied. Hence, adding additional assessment criteria can give a more accurate insight into the decision making process of the firms that face an increasing carbon price.

The risk of carbon leakage could also be estimated by means of economic modelling techniques, such as general equilibrium models. Although there are several limitations of general equilibrium models on carbon leakage, which have attracted significant criticisms,³³ the methodology adopted by the European Commission is also not free from limitations either. Interestingly, the number of sectors officially identified by the Commission as exposed to a significant risk of carbon leakage is considerably higher than those identified in all of the modelling studies undertaken thus far. Collating the findings of some of the most recent modelling studies Dröge and Cooper (2010:21) report that the sectors found to be at the risk of carbon leakage include (in no particular order of risk): steel; cement (and lime); some basic chemical subsectors (inorganic, organic, fertilizers); aluminium; pulp and paper; and refineries.

Given that some of the modelling studies have been financed by the European Commission itself, Cló (2010:2428) raises questions as to why they have not been taken into consideration while determining the sectors at risk of carbon leakage. He is of the view that given the time constraints imposed by the political agenda, the European Commission designed a simplified methodology to assess the exposure of the European sectors to non-EU competition based on the trade flows.

Notably, there is an inherent trade-off between complexity and comprehensiveness of the assessment criteria. Modelling studies would usually include only a few variables, which

³³ For more on the shortcomings of the general equilibrium models on carbon leakage, refer Sijm, *et al.*, 2004, p.14; and Reinaud, 2008, p.5.

they believe capture the majority of the production location decisions made by the firm.³⁴ Moreover, changing the modelling assumptions (e.g. carbon price, allocation methodology), the assessment criteria and the thresholds used would also affect the number of sectors, which are identified as being at risk of carbon leakage.³⁵ According to Dröge and Cooper (2010:31), '(s)ubjectivity is inherent with the selection of thresholds and weighting of different criteria. It is a political task to determine where to draw this line as some carbon leakage seems unavoidable given the lack of full information on the sectoral behaviour under the future EU ETS and the interaction of carbon pricing with other economic developments.'

According to Carbon Trust (2010:2), measures to tackle leakage should be limited to specific exposed sectors, because both the main approaches to tackling carbon leakage (namely, levelling down the carbon cost and border carbon adjustments) carry serious drawbacks. For instance, 'levelling down' the carbon cost faced by a sector through free allocation may not prevent carbon leakage and could retard low carbon investment and innovative solutions for the exposed sectors, increasing the cost of meeting carbon targets for the rest of the economy.³⁶ Adjusting for cost differentials at the border of the carbon pricing zone, on the other hand, may open up Pandora's Box involving ticklish questions about WTO legality,³⁷ potential to trigger trade war, as well as the various other complex implementation and governance issues.

IV. The Study

The empirical exercise carried in this paper is based on the EU List of (sub)sectors deemed to be exposed to a significant risk of carbon leakage, brought out by the European Commission in December 2009 (which is referred to as the EU List). In case the EU opts for applying the border carbon adjustment route, it is difficult to gauge at this juncture as to which sectors would come under the ambit of such a system. However, it is clear that the covered sectors would be among the sectors identified as deemed to be exposed to a significant risk of carbon leakage in the EU List. In view of the above, the EU List has been considered here as the basis for identifying the items of India's export interest that are potentially likely to come under the purview of any impending carbon equalization system in the EU. The extent of India's exposure to the EU markets in these items has also been analyzed.

IV.1 Data Sources and Methodology

³⁴ Dröge and Cooper (2010), p.31.

³⁵ *Ibid.*, p.25.

³⁶ For instance, given the current EU emissions target, granting free allowances to cement, steel and aluminium could increase the carbon price faced by the rest of industry by 10-30%; whilst cement sector profits could rise by £0.7bn – £3.4bn annually during Phase III, depending on how the sector responds, without necessarily preventing leakage.

³⁷ For an analysis of the issue of the WTO-legality of the border carbon adjustment measure proposed by the EU, refer Dhar and Das (2009).

At the first stage of the empirical exercise, a concordance table of HS 6-digit items that correspond to the EU List has been prepared. The concordance table is based on the correspondence tables already available on the web portal of the United Nations Statistics Division.³⁸ As discussed earlier, among the 164 (sub)sectors included in the EU List, 151 have been identified at NACE 4-digit level, while the remaining 13 sub(sectors)/product groups have been identified at Prodcom 6-digit or 8-digit levels. The European Commission has used the NACE Rev. 1.1 and Prodcom 2002 classifications for this purpose.

For the NACE 4-digit sectors included in the EU List, the concordance table has been prepared at three levels using the correspondence tables already available on the UNSTATS portal. The three levels are as follows:

Level (I): NACE Rev 1.1 to ISIC Rev 3.1³⁹

Level (II): ISIC Rev 3.1 to CPC Ver 1.1⁴⁰

Level (III): CPC Ver 1.1 to HS 2002.

For the 13 Prodcom items belonging to the EU List, the correspondence table for Prodcom 2002 to HS 2002 available on the UNSTATS web portal has been used.

In this context, it deserves to be mentioned that there are certain unavoidable difficulties that crop up in preparation of any concordance table that involves going from an activity-based classification (e.g. NACE) to a product-based classification (e.g. HS). This is particularly relevant for the present exercise, since barring the case of the few Prodcom items, a *three level* concordance exercise had to be carried out to eventually arrive at the set of HS 6-digit items corresponding to the EU List. Certain steps have been followed in the course of preparation of the concordance table with the aim of minimizing the errors. At the first stage, a preliminary concordance table has been prepared based on correspondence tables available on the UNSTATS portal. After preparing this preliminary table, each item at each level of the concordance exercise has been individually checked once again in order to minimize on omission of relevant items (Type-I error) as well as inclusion of irrelevant items (Type-II error) to arrive at the final concordance table corresponding to the EU List.

³⁸ <http://unstats.un.org>

³⁹ The International Standard of Industrial Classification of All Economic Activities (ISIC) code was developed by the UN as a standard way of classifying economic activities. The ISIC code groups together enterprises if they produce the same type of goods or service or if they use similar processes (i.e. the same raw materials, process of production, skills or technology). The ISIC system is now used widely by governments and international bodies as a way of classifying data according to economic activity.

⁴⁰ The central product classification (CPC) is a classification based on the physical characteristics of goods or on the nature of the services rendered. Each type of good or service distinguished in the CPC is defined in such a way that it is normally produced by only one activity as defined in ISIC. The CPC covers products that are an output of economic activities, including transportable goods, non-transportable goods and services. Conversely, each activity of the ISIC is defined in such a way that it normally produces only one type of product as defined in the CPC (where each type of product may have a number of individual products coded under it).

Relevant trade data have been extracted from the UN Comtrade database.⁴¹ Notably, apart from country-level data, the Comtrade database includes trade data for EU 25 as a bloc, and not for EU 27. Hence, the data for the remaining two countries in the EU 27 bloc, namely Bulgaria and Romania had to be added to each export/import data for the EU 25 to arrive at the data for the EU 27.

Table 1: GDP and Merchandise Trade (2006-08)

[Annual % change at constant prices]

	GDP			Exports			Imports		
	2006	2007	2008	2006	2007	2008	2006	2007	2008
World	3.7	3.5	1.7	8.5	6	2	8	6	2
EU 27	3	2.8	1	7.5	3.5	0	7	3.5	-1
India	9.8	9.3	7.9	11	13	7	8	16	12.5

Data source: http://www.wto.org/english/news_e/pres09_e/pr554_e.htm

The study is based on the trade data for the period 2003-07 (annual years). Although trade data for the year 2008 were already available when the study was undertaken, 2008 was not included in the time period of the study for two reasons. First, 2007 is the latest year for which the trade data have been used by the EU in determining the list of sectors at a significant risk of carbon leakage. Second, 2008 was an abnormal year since the financial crisis had already started impacting trade flows. Signs of the sharp deterioration in trade were evident in the latter part of 2008 as demand sagged and production slowed. Although world trade grew by 2% for the whole of 2008, it tapered off during the last six months and was well below the 6% growth rate recorded in 2007.⁴² Table 1 shows the extent to which the trade flows of the EU 27 and India were affected in 2008.

IV.2 Results and Analysis based on the ‘Full EU List’

The analysis carried out in this section is based on the ‘Full EU List’ of 164 (sub)sectors contained in six sub-lists.

Items corresponding to the ‘Full EU List’

From the concordance table prepared for this study, 4010 HS 6-digit items have been identified as corresponding to the ‘Full EU List’ of (sub)sectors that are deemed to be exposed to a significant risk of carbon leakage.⁴³ The large number of HS 6-digit items is quite in tune with the overwhelming coverage of sectors in the ‘Full EU List’. The HS chapter-wise distribution of these 4010 items is provided in Annex 1. It shows the number of HS 6-digit items under each

⁴¹ The United Nations Commodity Trade Statistics Database (UN Comtrade) contains detailed imports and exports statistics. Containing over 1.1 billion records, the UN Comtrade Database is considered to be the most comprehensive trade database available. Commodities are classified according to SITC, the Harmonized System (HS) and Broad Economic Categories (BEC).

⁴² Source: http://www.wto.org/english/news_e/pres09_e/pr554_e.htm

⁴³ See Dhar and Das (2011).

chapter, which have been found from the concordance table as corresponding to the 'Full EU List'. In Annex 1, the HS chapters are arranged in descending order as per the number of HS 6-digit items corresponding to each chapter. Annex 1 shows that these 4010 items are spread across 84 chapters. This indicates that the spread of the items that correspond to the 'Full EU List' is quite wide and diverse. As indicated earlier, the broad-based coverage of the 'Full EU List' is primarily attributable to the inclusion of a large number of sectors on grounds of their high trade intensity with third countries (exceeding 30%), notwithstanding their low carbon intensity.

India's Exports in the Items corresponding to the 'Full EU List'

Among the aforementioned 4010 HS 6-digit items, there are only 3851 items in which India had exports for at least one year of the time period of the study (henceforth, referred to as the '3851 List').

It could be observed from Annexes 2 and 3 that India's exports both to the EU and the World in these 3851 items, as a whole, had recorded upward trends during this period. Moreover, the share of India's exports to the EU in these items in India's total exports to the EU, as well as the share of India's global exports in these items in India's total global exports was in the range of 82% to 84%. In fine, these 3851 items, as a whole, are not only significant for India's EU export basket, but also for India's World export basket.

Although it is not known at this juncture as to which sectors would eventually come under the ambit of any impending carbon equalization system in the EU; in view of the fact that the HS 6-digit items that are found to correspond to the 'Full EU List' comprise the lion's share of India's exports to the EU, there is a very high probability of any future carbon equalization system having a considerable impact on India's exports to the EU.

IV.3 Results and Analysis based on the 'Truncated EU List'

The analysis in Section IV.2 has been based on the 'Full EU List' covering 164 (sub)sectors. However, it seems unrealistic to assume that the EU would choose to apply any impending border carbon adjustment regime to all the sectors included in the EU List. First, free allocation of allowances has already been declared by the EU to be the preferred route to address the problem of carbon leakage. Second, it has also been officially recognized by the EU that '(i)t could be hard to implement a system which sought to define in detail the carbon content of each individual category of goods, but such precision might be required: this suggests that the system could at best only be envisaged for a limited number of standardised commodities...'⁴⁴

⁴⁴ EU (2010b), p.12.

The question then is, if the EU decides to implement the carbon equalization system only for a small subset of sectors included in the EU List, which sectors are potentially more likely to come under the purview of the measure?

Among the 164 (sub)sectors included in the EU List, as many as 117 have been included only on grounds of their very high trade intensity with third countries (exceeding 30%). These are the (sub)sectors that are included in the EU Sublist No. 1.4. Notably, these 117 (sub)sectors have low carbon intensities, by definition. Because, these are the (sub)sectors for which the sum of the direct and indirect additional costs induced by the EU ETS leads to a cost increase of ‘less than 5% of its Gross Value Added’. It seems plausible to argue that given the small cost burden imposed on these sectors by the EU ETS and in view of the administrative and methodological costs involved in covering any sector under the carbon equalization system, the EU may prefer to address the problem of carbon leakage in these 117 sectors through other means than opting for covering them under the carbon equalization system. It may be noted here that by analyzing the suitability of alternative means of addressing the problem of carbon leakage in different types of sectors, Carbon Trust (2010:63) argued that for the highly trade-intensive sectors with relatively low direct and indirect cost exposures, which may still be classified as ‘at risk of carbon leakage’ under the EU proposals, any residual impacts could be addressed by reducing other costs confronting the businesses (e.g. corporate or labour taxes), with any Treasury revenue losses being offset by auction revenues. However, there is no case for invoking border levelling until costs become far more substantial.

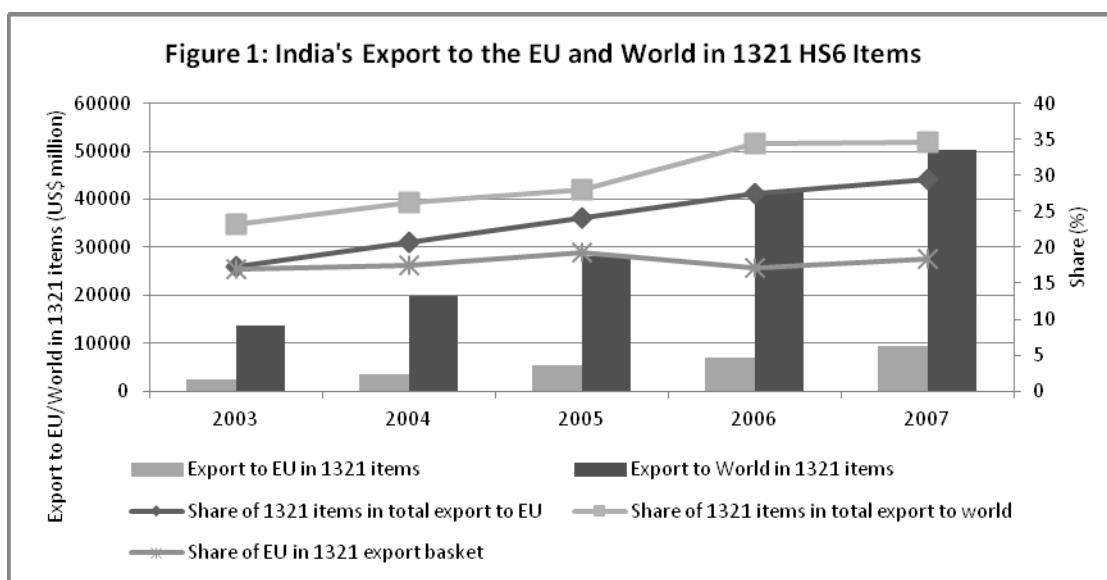
On the basis of the aforesaid discussion, it may reasonably be argued that, in case the EU chooses to apply the carbon equalization system only to a small subset of sectors included in the EU List, then the 117 sectors included in the Sublist 1.4 on grounds of above 30% trade intensity alone are much less likely to be covered under such a system. In other words, the 47 (sub)sectors spread across the rest of the five sub-lists could be expected to have a greater likelihood of being covered under the carbon equalization system. This pruned list of 47 (sub)sectors is hereinafter referred to as the ‘Truncated EU List’. If the EU presumably brings all these 47 (sub)sectors under the purview of the carbon equalization system, it would be worth exploring which items of export interest of India are potentially most likely to be affected by such a system. The analysis carried in this section attempts to address this question.

Items corresponding to the ‘Truncated EU List’

As per the concordance table prepared for this study, 1399 HS 6-digit items have been found to correspond to the 47 (sub)sectors included in the ‘Truncated EU List’. The chapter-wise distribution of these 1399 items is provided in Annex 4, in which the chapters are sorted in descending order based on the number of items corresponding to each chapter. Going by this sorting process, the top 20 chapters (as shown in Annex 4) include some of the most energy-intensive sectors, such as Iron and steel; Chemicals; Glass; Pulp and Paper; Aluminium; Copper; Cement, and Refined petroleum products, among others.

India's Exports in the Items corresponding to the 'Truncated EU List'

Among the aforementioned 1399 HS 6-digit items, India had exports only in 1321 items for at least one year of the entire study period (2003-07). Annexes 5 and 6 provide chapter-wise distribution of India's exports to the EU and the World, respectively, in the aforesaid 1321 items. It could be observed from these two tables and also from Fig. 1 that India's exports both to the EU and the World in these items, as a whole, had shown a steady rise between 2003 and 2007. An upward trend could also be observed for the share of India's exports to the EU in these items in the country's total exports to the bloc (from 17 to 29 per cent); as well as in the share of India's exports to the World in these items in the country's total global exports (from 23 to 35 per cent). In other words, these items seem to assume an increasing significance not only for India's total exports to the EU, but also for India's total global exports. Fig. 1 further depicts that the share of the EU in India's total global exports in these 1321 items was hovering around 17 to 19 per cent. Thus the EU alone accounted for close to 1/5th of India's exports in these 1321 items, as a whole, which implies a fairly high exposure of India to the EU markets for this export basket.



Data source: The UN Comtrade Database.

These 1321 items are spread across 45 chapters. In Annex 7, these chapters are sorted in descending order as per India's exports to the EU in the year 2007, i.e. the latest year considered in this study. Interestingly, the top 20 chapters according to this sorting comprise as many as 1075 items that account for nearly 99 per cent of India's exports to the EU in the 1321 items in 2007. It could also be observed that for most of the chapters, India's exports to both the EU and the World had recorded upward trends during 2003-07. So, it may be argued that among the 45 chapters corresponding to the 1321 list of items, the top 20 chapters identified in Annex 7 seem to be more important than the rest.

In line with the approach followed in analyzing India's exports in the items corresponding to the 'Full EU List', in case of the 'Truncated EU List' also the list of the corresponding HS 6-digit items has been further narrowed down to arrive at the 'Truncated Above 10 List', the 'Truncated Above 33 List' and finally the 'Truncated Above 50 List'. These narrowed down lists contain those HS 6-digit items (among the aforesaid 1321 items) for which India's export to the EU is greater than 10%, 33%, and 50%, respectively, of India's global export *in that item*, for all the five years of the study. It is found that 308, 81 and 21 items, respectively, qualify for inclusion in these three narrowed down lists.

India's exports to the EU and the World, respectively, in the items included in the 'Above 10 List', 'Above 33 List' and 'Above 50 List', respectively could be observed from Annexes 8 and 9.

IV.4 India's Exposure to the EU Markets *vis-à-vis* other BASIC Countries in the Items corresponding to the 'Truncated EU List'

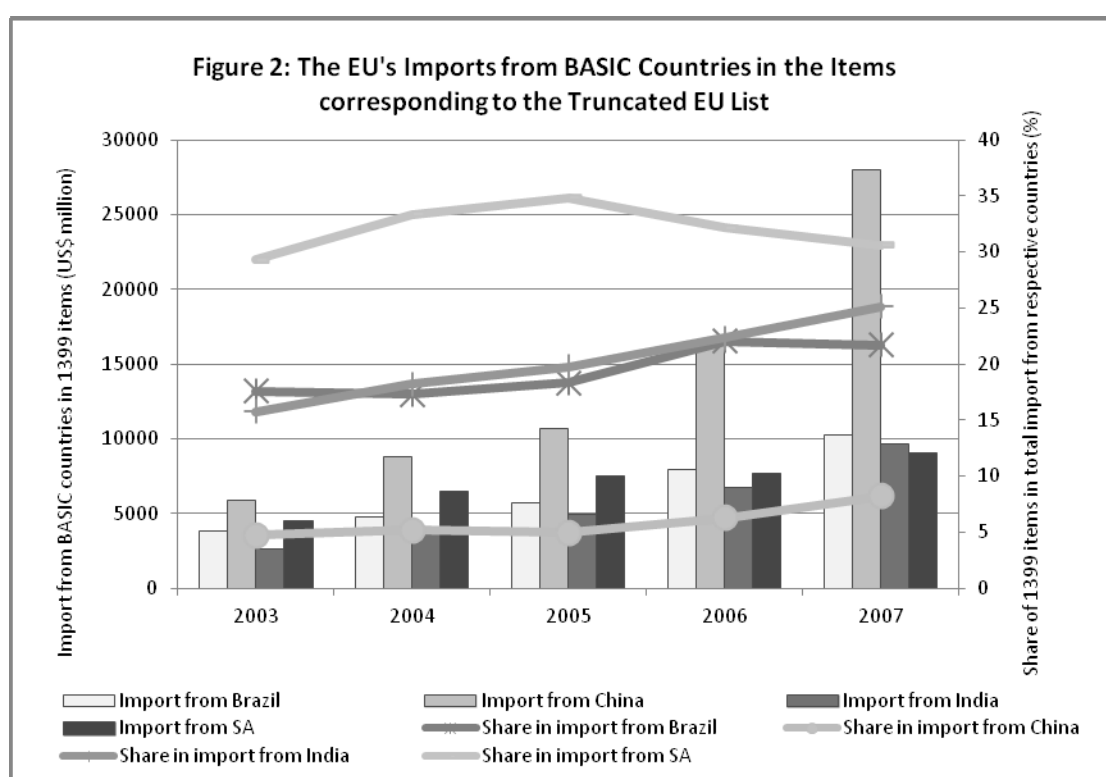
The empirical study carried in this paper has focused so far on India alone. This sub-section attempts to analyze the exposure of India to the EU markets *vis-à-vis* other three BASIC countries, namely Brazil, China and South Africa, in the 1399 HS 6-digit items corresponding to the 'Truncated EU List'. It deserves to be mentioned at this juncture that apparently, the other three BASIC countries are also among the key targets of the border carbon measures being contemplated in the EU (or the US for that matter). It may also be noted that the BASIC countries have already joined forces to oppose these border measures at the UNFCCC negotiations.⁴⁵

While the empirical exercise has been based so far on export data, the rest of the analysis uses the data on the EU's imports from each of the BASIC countries.⁴⁶ Annex 10 provides the EU's imports in the 1399 items corresponding to the 'Truncated EU List' from each of the BASIC countries, as well as the shares of these items in the EU's respective total imports from these countries.

⁴⁵ In the Fifth BASIC Ministerial meeting on climate change held in Tianjin, China, on the 10-11 October 2010, just after the UNFCCC meeting (4-9 October), the ministers from these countries rejected the notion of unilateral actions against products and services of developing countries on grounds of combating climate change, including tax and non-tax, or other fiscal and non-fiscal border or other measures, which according to them, are incompatible with the principles and provisions of the UNFCCC and will seriously jeopardize international collaboration on climate change and international trade. In the latest (eighth) BASIC Ministerial Meeting held in Inhotim, Minas Gerais on 26-27 August 2011 also the Ministers expressed their concern with unilateral climate change measures, planned or implemented, which generate negative impacts on other countries.

⁴⁶ Discrepancies may be observed in India's total exports in the items corresponding to the 'Truncated EU List' presented in Annex 5 and the EU's total imports from India in these items presented in Annex 10. Such discrepancies may crop up due to several reasons, which include, among others, the following: (a) freight and insurance, which increase the c.i.f. values above f.o.b. values; (b) time lags between the f.o.b. stage in the exporting country and the c.i.f. stage in the importing country; (c) differences in the reporting periods of the statistics; and (d) differing valuation practices at the customs services of different countries.

It may be observed from Annex 10 and Fig. 2 that in terms of the value of imports, China is far more exposed to the EU markets compared to the other three countries. The EU's imports from China also show a very high and steady growth during this period. South Africa occupies the second position during 2003-05 in terms of the value of the EU's imports. However, in the subsequent two years, Brazil overtakes South Africa to occupy the second position. Both for South Africa and Brazil, the EU imports in these items show steadily rising trends. Although a similar upward trend may be observed for the EU's imports from India as well, in terms of value India always remains behind the other BASIC countries. In other words, in terms of the value of the EU's imports in these 1399 items, it seems that India would be the least affected among the BASIC countries, should the EU bring all these items under the purview of the carbon equalization system.



Data source: The UN Comtrade Database.

However, a very different picture of vulnerability of the BASIC countries emerges when judged in terms of the share of these 1399 items in the EU's respective total imports from these countries. In this respect, South Africa tops the list with these items covering around 30% of the EU's total imports from the country, though this share shows a slightly declining trend. India and Brazil come very close to South Africa, while China seems to be the least vulnerable. The respective shares of India, Brazil and China also show a more or less rising trend.

To sum up, in case the EU decides to bring all these 1399 items corresponding to the 'Truncated EU List' under the purview of its carbon equalization system, India may turn out to be the least

vulnerable among the BASIC countries in terms of the value of the EU's imports from these countries. As for the shares of these items in the EU's respective total imports from these countries, except for China, substantial shares of the imports from all the other three BASIC countries are likely to get affected. In terms of this share, India appears to be the second-most vulnerable (after South Africa). The share for India also shows a steadily rising trend over the period of the study covering more than 25% of the EU's imports from the country in 2007.

V. Select Caveats of the Study

In the empirical exercise carried in this paper, the identification of the sectors that are potentially likely to come under the ambit of any impending border carbon adjustment in the EU has been based on the concordance table prepared on the basis of the EU List of (sub)sectors deemed to exposed to a significant risk of carbon leakage, released in December 2009. However, it is not known at this juncture which sectors would actually come under the purview of the border carbon adjustment regime in the EU, should the bloc finally decides to implement this unilateral trade measure.

Most of the (sub)sectors at risk of carbon leakage have been identified by the EU at the NACE 4-digit level. In the present paper, the HS 6-digit items corresponding to these NACE 4-digit items have been obtained on the basis of a three-level concordance exercise using the correspondence tables already available on the UNSTATS web portal. There are certain inherent difficulties in any conversion from an activity-based classification (e.g. NACE) to a product-based classification (e.g. HS). It is difficult to find an exact match between these two types of classifications. This is particularly true for the present exercise since for most of the items the concordance exercise has been done at three levels. However, certain steps have been followed in the course of the preparation of the concordance table with the aim of minimizing the errors, as discussed earlier.

The analysis is based on trade data at HS 6-digit level. It would have been more accurate to base the exercise on HS 8-digit level data. However, any further disaggregation would have made the analysis unwieldy. Moreover, a comparative assessment of the BASIC countries would have been rather complicated to undertake beyond 6-digit level, because classifications may differ by country due to lack of harmonization beyond HS 6-digit level.

The findings of the present study are based only on what was revealed by the trade data for the five-year period of the study: 2003 to 2007. However, it remains that a change in the time period of the study may result in a significant alteration in the results.

It also deserves to be mentioned that the vulnerability of a particular item of export interest to India to any future border measure in the EU would not only depend on the the export scenario, but would also depend on the carbon intensity of the product, in case the EU decides to base the measure on the actual carbon intensity of import. This applies also to the issue of relative vulnerability of India in this particular item *vis-à-vis* other source countries of import into the

EU. However, due to a dearth of adequate data on carbon intensity, it would have been difficult to explore this issue at this juncture. Moreover, in case the EU decides to implement a carbon equalization system, it is not known as of now as to how such a system would be designed. For instance, instead of basing such a system on actual carbon intensity of import, the EU may decide to base it on some kind of averaging, or on the best available technology in the home market approach,⁴⁷ or some other method. Given all these difficulties in venturing into any analysis based on carbon intensity, the present study has confined its scope to determining the vulnerability of India to any future carbon equalization system in the EU only to the extent depicted by the trade flows.

VI. Concluding Remarks

This paper presents a detailed empirical exercise undertaken with the aim of addressing the following research questions: how vulnerable is India's trade to any future border carbon adjustment in the European Union and which sectors/items are most likely to be affected? The empirical exercise is based on the EU List released in December 2009 in which the bloc has identified 164 (sub)sectors as deemed to be exposed to a significant risk of carbon leakage. The study has been carried out in two parts. The first part is based on the 'Full EU List' comprising 164 (sub)sectors, whereas the second part undertakes a deeper assessment of the items corresponding to the 'Truncated EU List', which comprises only those 47 (sub)sectors from the 'Full EU List' that are more likely to come under the ambit of any future border measure in the EU.

In the first part, as many as 4010 HS 6-digit items have been identified as corresponding to the 'Full EU List'. The share of India's exports to the EU in these items in India's total exports to the EU, as well as the share of India's global exports in these items in India's total global exports was in the range of 82% to 84%. Although it is not known at this juncture as to which items would eventually come under the purview of any future border measure in the EU, given that the items corresponding to the 'Full EU List' comprise the lion's share of India's export to the EU, there is a very high likelihood of any future carbon equalization system having a considerable impact on India's exports to the EU.

In the second part of the empirical exercise, it is found that 1399 HS 6-digit items correspond to the 'Truncated EU List'. The value of India's exports both to the EU and the World in these items, as a whole, had shown a steady rise between 2003 and 2007. An upward trend could also be observed for the share of these items, as a whole, in India's total exports to the EU and also to the World. Moreover, the EU alone accounted for close to 1/5th of India's exports in these items as a whole, which implies a fairly high exposure of India to the EU markets for this export basket.

⁴⁷ According to some analysts, a border carbon adjustment would stand a better chance of being WTO-consistent if it is based on the 'best available technology in the home market' approach, rather than actual carbon intensity of imports (see for instance, Dhar and Das, 2009 and Ismer and Neuhoﬀ, 2004).

The study also explores the exposure of India's exports to the EU *vis-à-vis* the exports of other three BASIC countries (namely, Brazil, China and South Africa) to the bloc in respect of the items corresponding to the 'Truncated EU List'. The exercise indicates that should the EU decide to bring all the 1399 items corresponding to the 'Truncated EU List' under the purview of its carbon equalization system on future, India may turn out to be the least vulnerable among the BASIC countries in terms of the value of the EU's imports from these countries. When judged in terms of the shares of these items in the EU's respective total imports from these countries, however, India appears to be the second-most vulnerable, after South Africa.

In fine, even if the EU decides to apply border measures only on the items corresponding to the 'Truncated EU List', the overall vulnerability of India could be quite high.

In view of the significant vulnerability of India to any future carbon equalization system in the EU, the country must adopt appropriate domestic policies with a view to prepare itself well in advance to tackle any such impending measure in a better way. Some suggestions are provided below.

Identifications of the high risk items at HS 8-digit level:

The empirical exercise in this study has been undertaken at HS 6-digit level. However, for undertaking targeted policy measures, the identification of the high risk items should ideally be carried out at a more disaggregate (HS 8-digit) level, so as to allow for a more accurate identification of the most vulnerable items.

Improving data availability:

Given the dearth of adequate and appropriate data on carbon emissions in the Indian industries, the Government of India should undertake appropriate steps towards improving the availability of the relevant data on energy use and carbon emissions, particularly in the energy-intensive sectors. This will help the country in adopting a more informed strategy on tackling any future border measure in the developed countries.

Reducing carbon emissions in the energy-intensive sectors:

In view of the pledge India has made at the UNFCCC regarding a 20-25% reduction in the emission intensity of its Gross Domestic Product (GDP) by 2020 compared to the 2005 level, and the threat of impending border measures in the developed countries, the country needs to undertake appropriate policy measures with the aim of reducing carbon emissions in the energy intensive sectors as a part of its overall low carbon development strategy. The PAT (Perform, Achieve and Trade) scheme scheduled to be launched shortly also deserves a particular mention in this regard. The PAT scheme, to be implemented by the Bureau of Energy Efficiency, is a part of the National Mission for Enhanced Energy Efficiency, which is one of the eight national missions embodied in India's National Action

Plan on Climate Change released in 2008.⁴⁸ The PAT scheme will cover around 700 energy-guzzling installations spread over nine sectors—thermal power, cement, steel, fertilizers, aluminium, chlor-alkali, paper, textiles and railways.⁴⁹ It is important that this or any other measure aimed at the energy intensive sectors are designed and implemented in such a manner that they result in *real* reduction in carbon emissions in these sectors.

Particular attention should also be given to the special situation of the numerous small and medium enterprises, including those in the unorganized sector, while designing the strategies for dealing with any future border measures in the developed countries.

Diversification of export destinations:

The study indicates that India has a very high exposure to the EU markets in the HS 6-digit items that are potentially likely to come under the purview of any future border measure in the bloc. In this context, India needs to undertake appropriate policy measures for diversifying its export destinations in the high risk items as a step towards softening the potential adverse impacts of such measures on its economy at large. Overall, India's exports have shown some diversification in the recent past. In the 1990s, more than half of India's exports were directed towards the OECD markets, with the EU having around 28% share and the US accounting for roughly 15%. A look at the export data for the year 2007-08, however, reveals a decline in the share of both the EU and US compared to the previous decade. Nonetheless, the EU and US still accounted for a third of India's total global exports in 2007-08 (with 20% and 13% shares, respectively).⁵⁰ This indicates the need for further diversification of the export destinations. Notably, the Foreign Trade Policy 2009-14 of the Government of India has underscored this aspect⁵¹ and has also included several measures and incentives with this aim in view.

Inclusion of safeguard provisions in the post-2012 deal:

Given their vulnerability to any future border measure in the developed countries, it is imperative for India and other vulnerable developing countries to ensure that appropriate provisions are included in the final post-2012 deal prohibiting imposition of such unilateral measures. In the run up to the Copenhagen Summit, the G77 and China grouping as well as India, in fact, proposed several alternative texts towards this end. Subsequently, the BASIC countries also joined forces to oppose these measures. Even the Tianjin Negotiating Text included three alternative textual formations on unilateral trade measures. The Cancun

⁴⁸ Government of India (2008).

⁴⁹ 'Specific Energy Consumption' (SEC) targets will be fixed for the installations and credits, called 'Energy Saving Certificates' (ESCs) will be issued for those exceeding their goals. ESCs could be sold to installations, which failed to meet their required targets on energy efficiency, thereby forming a new market-based mechanism over a period of time.

⁵⁰ UNCTAD India (2009), pp.19-20.

⁵¹ It states that: '(i)t is important to take an initiative to diversify our export markets and offset the inherent disadvantage for our exporters in emerging markets of Africa, Latin America, Oceania and CIS countries' [Government of India (2009), p.vii].

Text, however, opted for not including any of these proposed texts, thereby virtually sidelining the issue. Given that the final deal is yet to come up, India, along with other like-minded developing countries must try and ensure that an appropriate provision that obligates developed countries not to undertake any unilateral trade measure becomes an integral part of the final deal.

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Annex 1: Chapter-wise Distribution of the 4010 HS 6-digit Items Corresponding to the 'Full EU List'

HS chapter	Chapter heading	No. of HS6 items under a chapter
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	447
29	Organic chemicals	340
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	270
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	181
72	Iron and steel	164
90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof	162
52	Cotton	127
62	Articles of apparel and clothing accessories, not knitted or crocheted	119
61	Articles of apparel and clothing accessories, knitted or crocheted	116
55	Man-made staple fibres	113
73	Articles of iron or steel	82
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	71
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	71
54	Man-made filaments	67
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal	66
39	Plastics and articles thereof	58
74	Copper and articles thereof	58
63	Other made up textile articles; sets; worn clothing and worn textile articles; rags	56
3	Fish and crustaceans, molluscs and other aquatic invertebrates	53
91	Clocks and watches and parts thereof	53
70	Glass and glassware	51
81	Other base metals; cermets; articles thereof	51
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin	47
38	Miscellaneous chemical products	46
44	Wood and articles of wood; wood charcoal	46
96	Miscellaneous manufactured articles	45
60	Knitted or crocheted fabrics	44

Contd...

HS chapter	Chapter heading	No. of HS6 items under a chapter
95	Toys, games and sports requisites; parts and accessories thereof	43
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	42
58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery	41
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	36
40	Rubber and articles thereof	36
76	Aluminium and articles thereof	36
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes.	35
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks	34
56	Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof	33
30	Pharmaceutical products	31
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	30
37	Photographic or cinematographic goods	29
64	Footwear, gaiters and the like; parts of such articles	29
69	Ceramic products	28
41	Raw hides and skins (other than furskins) and leather	27
31	Fertilisers	26
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	26
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	23
57	Carpets and other textile floor coverings	23
92	Musical instruments; parts and accessories of such articles	23
26	Ores, slag and ash	22
59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use	21
93	Arms and ammunition; parts and accessories thereof	21
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	20
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	20
22	Beverages, spirits and vinegar	17
75	Nickel and articles thereof	17
89	Ships, boats and floating structures	17
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	16
88	Aircraft, spacecraft, and parts thereof	16

Contd...

HS chapter	Chapter heading	No. of HS6 items under a chapter
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates	14
17	Sugars and sugar confectionery	14
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, "dental waxes" and dental preparations with a basis of plaster	14
23	Residues and waste from the food industries; prepared animal fodder	12
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	12
65	Headgear and parts thereof	10
78	Lead and articles thereof	10
79	Zinc and articles thereof	10
83	Miscellaneous articles of base metal	10
11	Products of the milling industry; malt; starches; inulin; wheat gluten	9
43	Furskins and artificial fur; manufactures thereof	8
50	Silk	8
80	Tin and articles thereof	8
49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans	7
66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof	7
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair	7
35	Albuminoidal substances; modified starches; glues; enzymes	6
45	Cork and articles of cork	6
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	5
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	3
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder	2
5	Products of animal origin, not elsewhere specified or included	1
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included	1
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	1
20	Preparations of vegetables, fruit, nuts or other parts of plants	1
21	Miscellaneous edible preparations	1
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations	1
All 84 chapters		4010

Note: The HS chapters have been arranged in descending order according to the number of HS 6-digit items corresponding to each chapter (that have been found to correspond to the 'Full EU list').

Source: Based on the concordance table prepared for the present study.

Annex 2: India's Exports to the EU in the HS 6-digit Items Included in the Various Lists Derived on the Basis of the 'Full EU List'

List	No. of HS6 items in a list	No. of corresponding HS chapters	Exports to the EU in the HS 6-digit items included in a list (US\$ million)					Exports to the EU in the HS 6-digit items included in a list as % of total exports to the EU				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
'3851 List	3851	84	11109.90	13757.50	18903.68	21730.05	26485.65	82.26	82.21	83.58	83.79	83.76
'Above 10' List	1227	64	9716.15	11526.78	16505.48	18154.68	21224.16	71.94	68.88	72.97	70.00	67.12
'Above 33' List	328	51	4388.54	5314.58	6830.46	7473.86	8702.71	32.49	31.76	30.20	28.82	27.52
'Above 50' List	96	31	1728.53	2100.44	2479.36	2757.03	3276.60	12.80	12.55	10.96	10.63	10.36

Data source: The UN Comtrade Database.

Annex 3: India's Exports to the World in the HS 6-digit Items Included in the Various Lists Derived on the Basis of the 'Full EU List'

List	No. of HS6 items in a list	No. of corresponding HS chapters	Exports to the World in the HS 6-digit items included in a list (US\$ million)					Exports to the World in the HS 6-digit items included in a list as % of total exports to the World				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
'3851 List	3851	84	49291.41	62835.61	83761.16	102161.64	121355.00	83.04	82.78	83.47	84.29	83.18
'Above 10' List	1227	64	33738.13	40114.58	54057.18	62362.20	72275.26	56.84	52.85	53.87	51.45	49.54
'Above 33' List	328	51	8879.22	10278.64	12977.07	14237.52	15957.13	14.96	13.54	12.93	11.75	10.94
'Above 50' List	96	31	2520.12	2962.29	3479.14	3908.71	4572.69	4.25	3.90	3.47	3.22	3.13

Data source: The UN Comtrade Database.

Annex 4: Chapter-wise Distribution of the 1399 HS 6-digit Items corresponding to the 'Truncated EU List'

HS chapter	Description	No. of HS 6-digit items under a chapter
29	Organic chemicals	266
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	176
72	Iron and steel	164
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	67
39	Plastics and articles thereof	58
74	Copper and articles thereof	58
81	Other base metals; cermets; articles thereof	51
52	Cotton	47
73	Articles of iron or steel	41
70	Glass and glassware	40
76	Aluminium and articles thereof	36
55	Man-made staple fibres	31
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes.	30
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks	30
44	Wood and articles of wood; wood charcoal	30
31	Fertilisers	26
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	24
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	20
38	Miscellaneous chemical products	19
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	19
22	Beverages, spirits and vinegar	17
75	Nickel and articles thereof	17
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	16
17	Sugars and sugar confectionery	14
40	Rubber and articles thereof	14
78	Lead and articles thereof	10
11	Products of the milling industry; malt; starches; inulin; wheat gluten	9

Contd...

HS chapter	Description	No. of HS 6-digit items under a chapter
79	Zinc and articles thereof	9
54	Man-made filaments	8
69	Ceramic products	8
80	Tin and articles thereof	8
35	Albuminoidal substances; modified starches; glues; enzymes	5
50	Silk	5
65	Headgear and parts thereof	5
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	4
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	3
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	3
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	2
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin	2
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	1
20	Preparations of vegetables, fruit, nuts or other parts of plants	1
21	Miscellaneous edible preparations	1
26	Ores, slag and ash	1
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	1
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	1
Total		1399

Source: Based on the concordance table prepared for the present study.

Annex 5: Chapter-wise Distribution of India's Exports to the EU in the 1321 HS 6-digit Items corresponding to the 'Truncated EU List'

HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the EU in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the EU in the 1321 HS 6-digit items (by chapter) as % of total exports to the EU				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	3	0.17	0.91	1.40	0.94	0.01	0.00	0.01	0.01	0.00	0.00
11	Products of the milling industry; malt; starches; inulin; wheat gluten	9	0.07	0.15	0.09	0.11	0.16	0.00	0.00	0.00	0.00	0.00
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	3	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
17	Sugars and sugar confectionery	13	13.78	6.68	8.69	30.85	68.81	0.10	0.04	0.04	0.12	0.22
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	1	0.04	0.12	0.12	0.10	0.16	0.00	0.00	0.00	0.00	0.00
20	Preparations of vegetables, fruit, nuts or other parts of plants	1	0.05	0.01	0.01	0.04	0.06	0.00	0.00	0.00	0.00	0.00
21	Miscellaneous edible preparations	1	0.00	0.07	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.00
22	Beverages, spirits and vinegar	16	2.09	1.62	1.59	3.27	15.85	0.02	0.01	0.01	0.01	0.05
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	20	17.98	4.95	7.47	7.43	8.52	0.13	0.03	0.03	0.03	0.03
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes.	22	421.01	541.71	2093.68	2174.28	3124.37	3.12	3.24	9.26	8.38	9.88
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	166	38.13	40.65	58.91	79.57	124.76	0.28	0.24	0.26	0.31	0.39
29	Organic chemicals	255	562.19	687.60	899.53	1216.42	1398.27	4.16	4.11	3.98	4.69	4.42
31	Fertilisers	24	0.60	0.98	1.51	0.49	2.68	0.00	0.01	0.01	0.00	0.01
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks	30	176.85	171.26	234.16	280.25	338.56	1.31	1.02	1.04	1.08	1.07
35	Albuminoidal substances; modified starches; glues; enzymes	5	7.66	14.13	13.60	15.66	36.21	0.06	0.08	0.06	0.06	0.11
38	Miscellaneous chemical products	19	26.06	30.60	52.90	47.12	64.15	0.19	0.18	0.23	0.18	0.20

HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the EU in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the EU in the 1321 HS 6-digit items (by chapter) as % of total exports to the EU				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
39	Plastics and articles thereof	58	56.94	142.46	144.07	181.22	254.59	0.42	0.85	0.64	0.70	0.81
40	Rubber and articles thereof	13	1.82	3.39	8.17	8.16	5.16	0.01	0.02	0.04	0.03	0.02
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	2	225.57	258.02	264.90	255.09	267.21	1.67	1.54	1.17	0.98	0.84
44	Wood and articles of wood; wood charcoal	30	4.02	5.87	6.25	7.08	7.11	0.03	0.04	0.03	0.03	0.02
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	15	0.06	0.14	0.01	0.09	0.57	0.00	0.00	0.00	0.00	0.00
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	65	9.57	12.11	20.77	26.09	33.29	0.07	0.07	0.09	0.10	0.11
50	Silk	5	3.63	5.08	7.23	5.61	5.84	0.03	0.03	0.03	0.02	0.02
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	16	11.74	25.70	26.29	27.95	35.97	0.09	0.15	0.12	0.11	0.11
52	Cotton	40	211.95	219.42	285.63	344.51	370.41	1.57	1.31	1.26	1.33	1.17
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	15	27.65	29.09	22.00	24.15	18.78	0.20	0.17	0.10	0.09	0.06
54	Man-made filaments	8	12.15	15.61	10.71	14.26	5.70	0.09	0.09	0.05	0.06	0.02
55	Man-made staple fibres	31	105.30	123.23	111.68	128.87	143.24	0.78	0.74	0.49	0.50	0.45
65	Headgear and parts thereof	5	1.23	1.28	1.41	1.46	1.65	0.01	0.01	0.01	0.01	0.01
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1	0.00	0.06	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	Ceramic products	8	1.21	1.10	1.30	1.67	1.48	0.01	0.01	0.01	0.01	0.00
70	Glass and glassware	40	16.84	16.24	18.61	39.12	33.50	0.12	0.10	0.08	0.15	0.11
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin	2	0.25	0.11	0.00	0.23	0.14	0.00	0.00	0.00	0.00	0.00
72	Iron and steel	154	222.56	835.01	755.70	1385.03	2082.03	1.65	4.99	3.34	5.34	6.58
73	Articles of iron or steel	41	65.43	117.85	163.43	196.19	295.04	0.48	0.70	0.72	0.76	0.93
74	Copper and articles thereof	58	58.15	85.04	110.95	192.27	154.42	0.43	0.51	0.49	0.74	0.49
75	Nickel and articles thereof	16	2.21	2.56	6.88	11.45	15.15	0.02	0.02	0.03	0.04	0.05

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HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the EU in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the EU in the 1321 HS 6-digit items (by chapter) as % of total exports to the EU				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
76	Aluminium and articles thereof	36	33.39	45.55	66.07	89.68	138.47	0.25	0.27	0.29	0.35	0.44
78	Lead and articles thereof	9	0.34	2.02	2.52	4.46	7.10	0.00	0.01	0.01	0.02	0.02
79	Zinc and articles thereof	9	1.23	2.65	7.33	282.24	208.93	0.01	0.02	0.03	1.09	0.66
80	Tin and articles thereof	8	2.21	3.34	2.18	13.39	1.52	0.02	0.02	0.01	0.05	0.00
81	Other base metals; cermets; articles thereof	42	1.60	3.79	7.56	14.31	17.14	0.01	0.02	0.03	0.06	0.05
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	1	0.30	0.70	0.37	0.09	0.35	0.00	0.00	0.00	0.00	0.00
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	4	2.71	1.61	1.67	6.64	9.78	0.02	0.01	0.01	0.03	0.03
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	1	0.16	0.26	0.08	0.25	0.41	0.00	0.00	0.00	0.00	0.00
Total		1321	2346.92	3460.75	5427.79	7118.15	9297.57	17.38	20.68	24.00	27.45	29.40

Data source: The UN Comtrade Database.

Annex 6: Chapter-wise Distribution of India's Exports to the World in the 1321 HS 6-digit Items corresponding to the 'Truncated EU List'

HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the World in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the World in the 1321 HS 6-digit items (by chapter) as % of total exports to the World				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	3	16.97	37.82	123.48	87.88	102.32	0.03	0.05	0.12	0.07	0.07
11	Products of the milling industry; malt; starches; inulin; wheat gluten	9	2.28	7.09	5.06	5.16	8.01	0.00	0.01	0.01	0.00	0.01
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	3	0.14	0.05	0.06	0.07	0.28	0.00	0.00	0.00	0.00	0.00
17	Sugars and sugar confectionery	13	400.24	61.23	56.08	654.48	1039.57	0.67	0.08	0.06	0.54	0.71
19	Preparations of cereals, flour, starch or milk; pastrycooks' products	1	0.57	0.69	1.46	1.17	1.34	0.00	0.00	0.00	0.00	0.00
20	Preparations of vegetables, fruit, nuts or other parts of plants	1	0.12	0.10	0.12	0.14	0.08	0.00	0.00	0.00	0.00	0.00
21	Miscellaneous edible preparations	1	2.79	2.25	2.08	2.33	1.71	0.00	0.00	0.00	0.00	0.00
22	Beverages, spirits and vinegar	16	23.22	26.09	45.14	58.71	72.09	0.04	0.03	0.04	0.05	0.05
25	Salt; sulphur; earths and stone; plastering materials, lime and cement	20	195.12	215.37	302.74	345.14	276.37	0.33	0.28	0.30	0.28	0.19
27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes.	22	3510.89	6016.78	10330.77	17742.27	23203.39	5.91	7.93	10.29	14.64	15.90
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	166	360.26	578.54	721.36	834.66	738.54	0.61	0.76	0.72	0.69	0.51
29	Organic chemicals	255	2030.17	2815.85	3880.65	5151.34	5663.31	3.42	3.71	3.87	4.25	3.88
31	Fertilisers	24	6.52	9.36	14.36	11.58	15.71	0.01	0.01	0.01	0.01	0.01
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks	30	567.71	583.34	707.50	846.60	1038.92	0.96	0.77	0.71	0.70	0.71
35	Albuminoidal substances; modified starches; glues; enzymes	5	56.25	65.26	112.02	102.92	183.72	0.09	0.09	0.11	0.08	0.13
38	Miscellaneous chemical products	19	55.09	59.76	108.02	100.81	146.83	0.09	0.08	0.11	0.08	0.10

HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the World in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the World in the 1321 HS 6-digit items (by chapter) as % of total exports to the World				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
39	Plastics and articles thereof	58	645.96	1238.75	1332.58	1619.23	1488.92	1.09	1.63	1.33	1.34	1.02
40	Rubber and articles thereof	13	12.92	11.05	28.23	26.26	22.45	0.02	0.01	0.03	0.02	0.02
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut)	2	291.34	333.86	341.95	325.70	333.07	0.49	0.44	0.34	0.27	0.23
44	Wood and articles of wood; wood charcoal	30	25.22	43.05	51.94	55.34	69.86	0.04	0.06	0.05	0.05	0.05
47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard	15	0.66	1.18	1.26	1.08	2.78	0.00	0.00	0.00	0.00	0.00
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	65	137.44	182.00	240.89	254.74	246.08	0.23	0.24	0.24	0.21	0.17
50	Silk	5	8.71	9.73	16.62	16.13	12.69	0.01	0.01	0.02	0.01	0.01
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	16	32.96	45.72	53.19	57.95	71.90	0.06	0.06	0.05	0.05	0.05
52	Cotton	40	1162.12	1341.58	1388.28	1615.14	1790.35	1.96	1.77	1.38	1.33	1.23
53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn	15	58.71	79.37	74.86	71.37	53.32	0.10	0.10	0.07	0.06	0.04
54	Man-made filaments	8	35.62	35.37	37.14	37.23	25.18	0.06	0.05	0.04	0.03	0.02
55	Man-made staple fibres	31	325.21	368.31	352.14	408.28	543.83	0.55	0.49	0.35	0.34	0.37
65	Headgear and parts thereof	5	3.91	3.16	3.16	3.01	3.85	0.01	0.00	0.00	0.00	0.00
68	Articles of stone, plaster, cement, asbestos, mica or similar materials	1	0.03	0.13	0.45	0.02	0.06	0.00	0.00	0.00	0.00	0.00
69	Ceramic products	8	32.78	26.03	30.78	47.41	53.30	0.06	0.03	0.03	0.04	0.04
70	Glass and glassware	40	125.93	112.61	107.04	134.33	170.35	0.21	0.15	0.11	0.11	0.12
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin	2	0.54	0.36	0.33	0.37	0.42	0.00	0.00	0.00	0.00	0.00
72	Iron and steel	154	2398.11	3491.25	4328.34	5180.85	5959.59	4.04	4.60	4.31	4.27	4.08
73	Articles of iron or steel	41	279.32	623.38	1035.20	1399.13	2233.58	0.47	0.82	1.03	1.15	1.53
74	Copper and articles thereof	58	504.39	846.57	1318.92	2801.00	2901.35	0.85	1.12	1.31	2.31	1.99
75	Nickel and articles thereof	16	5.91	7.57	17.93	23.70	28.94	0.01	0.01	0.02	0.02	0.02

Contd...

HS chapter	Chapter heading	No. of HS6 items in the 1321 List	Exports to the World in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the World in the 1321 HS 6-digit items (by chapter) as % of total exports to the World				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
76	Aluminium and articles thereof	36	359.65	410.61	657.00	770.07	1037.81	0.61	0.54	0.65	0.64	0.71
78	Lead and articles thereof	9	2.11	7.32	16.04	17.46	40.15	0.00	0.01	0.02	0.01	0.03
79	Zinc and articles thereof	9	9.45	32.19	28.36	514.04	382.95	0.02	0.04	0.03	0.42	0.26
80	Tin and articles thereof	8	12.20	8.21	10.19	30.80	17.20	0.02	0.01	0.01	0.03	0.01
81	Other base metals; cermet; articles thereof	42	5.86	13.70	21.73	37.55	31.97	0.01	0.02	0.02	0.03	0.02
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	1	0.78	1.28	0.98	0.41	0.93	0.00	0.00	0.00	0.00	0.00
87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof	4	80.37	99.59	213.99	226.92	342.62	0.14	0.13	0.21	0.19	0.23
94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings	1	0.80	0.66	0.35	0.48	0.98	0.00	0.00	0.00	0.00	0.00
Total		1321	13787.37	19854.14	28120.77	41621.26	50358.67	23.23	26.16	28.02	34.34	34.52

Data source: The UN Comtrade Database.

Annex 7: Top 20 Chapters in terms of India's Exports to the EU in 2007 in the 1321 HS 6-digit Items corresponding to the 'Truncated EU List'

HS chapter	No. of HS6 items in the 1321 List	Exports to the EU in the 1321 HS 6-digit items by chapter (US\$ million)					Exports to the World in the 1321 HS 6-digit items by chapter (US\$ million)					Share of the EU in the 1321 export basket of India (%)				
		2003	2004	2005	2006	2007	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
27	22	421.01	541.71	2093.68	2174.28	3124.37	3510.89	6016.78	10330.77	17742.27	23203.39	11.99	9.00	20.27	12.25	13.47
72	154	222.56	835.01	755.70	1385.03	2082.03	2398.11	3491.25	4328.34	5180.85	5959.59	9.28	23.92	17.46	26.73	34.94
29	255	562.19	687.60	899.53	1216.42	1398.27	2030.17	2815.85	3880.65	5151.34	5663.31	27.69	24.42	23.18	23.61	24.69
52	40	211.95	219.42	285.63	344.51	370.41	1162.12	1341.58	1388.28	1615.14	1790.35	18.24	16.36	20.57	21.33	20.69
32	30	176.85	171.26	234.16	280.25	338.56	567.71	583.34	707.50	846.60	1038.92	31.15	29.36	33.10	33.10	32.59
73	41	65.43	117.85	163.43	196.19	295.04	279.32	623.38	1035.20	1399.13	2233.58	23.42	18.91	15.79	14.02	13.21
42	2	225.57	258.02	264.90	255.09	267.21	291.34	333.86	341.95	325.70	333.07	77.42	77.28	77.47	78.32	80.23
39	58	56.94	142.46	144.07	181.22	254.59	645.96	1238.75	1332.58	1619.23	1488.92	8.81	11.50	10.81	11.19	17.10
79	9	1.23	2.65	7.33	282.24	208.93	9.45	32.19	28.36	514.04	382.95	13.02	8.24	25.85	54.91	54.56
74	58	58.15	85.04	110.95	192.27	154.42	504.39	846.57	1318.92	2801.00	2901.35	11.53	10.04	8.41	6.86	5.32
55	31	105.30	123.23	111.68	128.87	143.24	325.21	368.31	352.14	408.28	543.83	32.38	33.46	31.72	31.56	26.34
76	36	33.39	45.55	66.07	89.68	138.47	359.65	410.61	657.00	770.07	1037.81	9.28	11.09	10.06	11.65	13.34
28	166	38.13	40.65	58.91	79.57	124.76	360.26	578.54	721.36	834.66	738.54	10.58	7.03	8.17	9.53	16.89
17	13	13.78	6.68	8.69	30.85	68.81	400.24	61.23	56.08	654.48	1039.57	3.44	10.92	15.50	4.71	6.62
38	19	26.06	30.60	52.90	47.12	64.15	55.09	59.76	108.02	100.81	146.83	47.31	51.21	48.97	46.74	43.69
35	5	7.66	14.13	13.60	15.66	36.21	56.25	65.26	112.02	102.92	183.72	13.62	21.65	12.14	15.22	19.71
51	16	11.74	25.70	26.29	27.95	35.97	32.96	45.72	53.19	57.95	71.90	35.63	56.22	49.42	48.24	50.02
70	40	16.84	16.24	18.61	39.12	33.50	125.93	112.61	107.04	134.33	170.35	13.37	14.42	17.39	29.12	19.67
48	65	9.57	12.11	20.77	26.09	33.29	137.44	182.00	240.89	254.74	246.08	6.97	6.65	8.62	10.24	13.53
53	15	27.65	29.09	22.00	24.15	18.78	58.71	79.37	74.86	71.37	53.32	47.09	36.65	29.39	33.83	35.22
TOP 20 chapters	1075	2292.00	3405.00	5358.91	7016.56	9191.01	13311.22	19286.94	27175.14	40584.90	49227.38	17.22	17.65	19.72	17.29	18.67
Other 25 chapters	246	54.92	55.75	68.88	101.59	106.56	476.15	567.20	945.63	1036.36	1131.29	11.53	9.83	7.28	9.80	9.42
All 45 chapters	1321	2346.92	3460.75	5427.79	7118.15	9297.57	13787.37	19854.14	28120.77	41621.26	50358.67	17.02	17.43	19.30	17.10	18.46

Data source: The UN Comtrade Database.

Annex 8: India's Exports to the EU in the HS 6-digit Items Included in the Various Lists corresponding to the 'Truncated EU List'

List	No. of HS6 items in a list	No. of corresponding HS chapters	Exports to the EU in the HS 6-digit items included in a list (US\$ million)					Exports to the EU in the HS 6-digit items included in a list as % of total exports to the EU				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
'Truncated Above 10 List'	308	31	1903.44	2367.96	4491.06	4994.72	5676.27	14.09	14.15	19.86	19.26	17.95
'Truncated Above 33 List'	81	22	653.68	790.96	938.99	1105.81	1341.79	4.84	4.73	4.15	4.26	4.24
'Truncated Above 50 List'	21	10	269.72	313.07	343.2	349.05	379	2	1.87	1.52	1.35	1.2

Data source: The UN Comtrade Database.

Annex 9: India's Exports to the World in the HS 6-digit Items Included in the Various Lists corresponding to the 'Truncated EU List'

List	No. of HS6 items in a list	No. of corresponding HS chapters	Exports to the World in the HS 6-digit items included in a list (US\$ million)					Exports to the World in the HS 6-digit items included in a list as % of total exports to the World				
			2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
'Truncated Above 10 List'	308	31	6659.16	9967.18	15129.01	21563.22	24762.78	11.22	13.13	15.08	17.79	16.97
'Truncated Above 33 List'	81	22	1198.89	1471	1774.05	2062.28	2509.26	2.02	1.94	1.77	1.7	1.72
'Truncated Above 50 List'	21	10	365.85	421.04	467.79	472.81	511.02	0.62	0.55	0.47	0.39	0.35

Data source: UN Comtrade Database.

Annex 10: The EU's Imports from the BASIC Countries in the 1399 HS 6-digit Items corresponding to the 'Truncated EU List'

Source country	Sum of the EU's imports from a country in the 1399 HS 6-digit items (US\$ million)					The EU's total imports from a country (US\$ million)					Share of the EU's imports from a country in the 1399 HS 6-digit items in total EU imports from that country (%)				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
Brazil	3797.69	4768.90	5701.05	7931.37	10207.17	21581.30	27557.75	31089.52	35984.08	46996.52	17.60	17.31	18.34	22.04	21.72
China	5857.01	8757.44	10644.01	16516.96	27976.83	123852.66	169307.30	214131.78	263462.04	339741.02	4.73	5.17	4.97	6.27	8.23
India	2595.05	3851.44	4941.84	6755.66	9613.74	16463.14	21145.38	25038.34	30300.56	38225.39	15.76	18.21	19.74	22.30	25.15
South Africa	4480.51	6465.10	7495.02	7658.35	9032.52	15285.70	19388.22	21507.51	23820.73	29506.44	29.31	33.35	34.85	32.15	30.61

Data source: The UN Comtrade Database.