C MARKET STRUCTURE, EXTERNALITIES AND POLICY INTERVENTION

The proposition that trade liberalization (in this case, openness in product and factor markets) is of mutual benefit to countries depends, in part, on the efficient functioning of various markets. If product or factor markets are not competitive, or if market signals do not properly reflect social costs and benefits (i.e. externalities are present), the beneficial effects of openness may be reduced or negated. In some, but not all cases, policy interventions will be required to correct these shortcomings, since openness alone will often not be enough to create a competitive environment. Indeed, in some circumstances, openness may exacerbate inefficiencies or create new ones in the presence of externalities or market power.

The purpose of this Section is to identify complementary, essentially corrective policies and measures countries can take to promote competition and ensure that positive or negative externalities are fully taken into account. Emphasis will be placed on the choice of appropriate policies to deal with particular instances of market failure, as well as the political economy challenge of ensuring that putatively corrective policy interventions do not serve surrogate interests that undermine national welfare. Focus here will be on the contribution of competition policy in making markets more contestable. In the case of externalities, the Section will emphasize the need for policies to provide producers and consumers with prices that allow them to internalize externalities. None of the policy prescriptions and underlying analysis that follows is new – this report seeks, however, to place the discussion within the broad context of a coherent policy framework that promotes the fullest possible realization of the benefits from trade liberalization.

1. MARKET STRUCTURE, EXTERNALITIES AND THE ALLOCATION OF RESOURCES

(a) Efficiency in the allocation of resources

Economists have long argued that market exchange – where the choices of individuals reflect their own values and firms make choices to maximize their profits – will lead to an efficient allocation of scarce resources. Efficiency in this sense requires that individual buyers and sellers cannot affect the price at which exchange takes place in a market. In addition, markets must exist for all goods. If these conditions are met, markets are competitive and complete and there will be an efficient allocation of resources.[99]

In reality, these conditions are rarely met. The following are some examples of departures from these conditions:

- Some firms may have control over price, either because there are too few competitors or because the products they sell have significant brand names that allow the seller to exercise power over price. Firms can also exert control over prices if they act in a collusive manner.[100]

- Information flows may not be perfect. Asymmetric information between buyers and sellers, for instance, could lead to a drastic reduction in market transactions (the market for 'lemons' problem).[101]

- Sometimes the benefits of consuming a good may not accrue solely to the consumer. Others may also benefit. This is the case of positive externalities. Conversely, a firm may not be the sole bearer of the costs of producing a good – for example, environmental damage arising from production. In this case a negative externality arises as society's cost of producing that particular good is greater than the private cost.

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[99] This is when the price of a resource is equal to its marginal cost.

[100] It should also be noted that imperfect market structures do not necessarily nullify the gains from trade. Trade theorists have long recognised that scale economies are an important determinant of trade and can deliver gains from exchange such as an increase in product variety (Feenstra, 2004).

[101] The market for 'lemons' refers to the second-hand market for cars, where the seller (current owner) has better information about the quality of the car than a potential buyer. This asymmetry in information is likely to discourage many potential buyers from purchasing a second-hand car for fear of being stuck with a 'lemon'. See Akerlof (1970).

Even if there are no market failures, the workings of the economy may produce a distribution of income that is perceived as inequitable. Often, this is because of the unequal distribution of wealth and of unequal opportunities. Policies aimed at redistributing wealth and at creating equal opportunities (for example in education and health) would help achieve a more socially acceptable distribution of wealth without heavily distorting markets and incentives.

The kind of market failures noted above provide the necessary (but not sufficient) condition for public action. But public action needs to be informed and the effective design of policies and their interaction with trade is discussed next.

(b)   Policy coherence

In discussing issues of policy coherence in these areas, a number of themes need to be emphasized. First, increasing efficiency in resource allocation is the prism through which we view coherence in trade, competition and environmental policies. The effect of trade liberalization in perfect markets is to allocate resources to their most productive or efficient use. This takes place when countries specialize in producing those goods and services in which they have the comparative advantage. The principle aim of competition policy is to limit the exercise of market power by firms, otherwise the profit maximizing motivation of a firm could result in a wedge between the opportunity cost of a resource and the prices that consumers pay for them. The purpose of pricing environmental resources correctly is to make sure that people properly value these resources and do not treat them as free goods. Hence, coherence in trade, environmental and competition policy must ultimately be judged by the degree to which they contribute to efficiency in resource allocation.

Second, there is an international element to competition and environmental policies. In the case of cross-border mergers, for example, conflicts can arise from differences in competition frameworks and principles. Different approaches to merger review could result in different outcomes. Preventing this from disrupting global commerce may require international cooperation among competition authorities. International cooperation would also be required when the competition problem is global in nature, such as in the case of international cartels which determine prices affecting consumers in national markets. Where environmental externalities are global, rather than national in scope, international cooperation offers the most effective way of managing the problem. Left to their own devices, national authorities will not possess all the incentives to curb the harm to the global commons, since part of the cost is borne by foreigners. International coherence is also required to avoid conflicts between differing systems of international law, such as between multilateral environmental agreements and multilateral trade rules. Section IIE contains a more systematic analysis of the contribution of international cooperation to good policy and coherence.

Third, the whole is more than the sum of its parts. Trade, environmental and competition policies individually promote efficiency in resource allocation. But each, without the other policies in place, is less effective. A country will not reap the maximum benefits from open trade if domestic laws allow non-competitive behaviour by domestic firms. Needless to say, a country with the most stringent competition rules foregoes significant static and dynamic benefits if it is closed to foreign trade.

While the emphasis is on optimal policy interventions to complement openness to trade, public action is not a panacea for all ills. While market power by firms is, in general, undesirable in many cases it may be the only possible outcome given consumer taste or technological realities. Mergers, for example, can bring economic benefits due to economies of scale and sharing of know-how even as they might heighten the degree of market power enjoyed by the merged entity. Regulators may err on the side of caution and disallow such mergers. Regulation also imposes its own costs, not least of which is the possibility of regulatory capture by industry. In the case of externalities, the Pigouvian (environmental) tax imposes an excess burden, just like any other distortionary tax. Environmental regulations need monitoring and enforcement, which require resources to be expended. All of these costs of government action must be carefully considered when deciding on the extent of public intervention in dealing with externalities.

While the movement towards a more open economy will increase competition, the scope for anti-competitive practices by domestic and foreign firms may not necessarily diminish. Indeed, in some cases, defensive reactions by domestic firms facing competition may increase. Or foreign firms, in an attempt to penetrate a market, may behave in an anti-competitive manner. In either case, the argument for developing and enforcing an efficient competition policy is compelling. In the context of competition problems that are not within the jurisdiction of a domestic authority, the resort to trade instruments is not an efficient response. International competition problems increasingly require international solutions. The scope of such solutions, including whether or not they are legally binding, is still a matter of debate. There is little evidence to suggest that it is beyond the capacity of developing countries, with adequate provisions for technical assistance, to implement trade liberalization and effective national competition policies.

In the case of externalities, the thrust of policy is to face producers and consumers with the correct prices. In the case of a negative externality, such as the emission of pollutants, this would require environmental taxes or, in some cases, command and control measures if monitoring and enforcement costs as well as distribution concerns are to be taken into account. Trade measures are often a second- or third-best policy response to a local externality. They may only make sense in the context of multilaterally agreed covenants to address transboundary pollution problems, or perhaps as an enforcement mechanism within an international agreement. In the case of positive externalities, such as the creation of knowledge through R&D, appropriate measures could include public investment in basic research or the provision of R&D tax credits. This should not be seen as downplaying, in any way, the role of intellectual property protection and competition policy in fostering an environment conducive to the creation of new knowledge. Given the importance of trade as a conduit for the transmission of knowledge spillovers, there is a dynamic benefit (increase in productivity) from removing trade distortions, apart from the usual static resource allocation effects.

Finally, the need for complementary measures to make trade policy more effective does not mean that trade liberalization should not be attempted in their absence. Or that governments should wait until all the other complementary policies are in place before undertaking meaningful trade reform. Far from it. Time after time, the removal of protection even in the face of other distortions in the economy has created net benefits rather than costs. This discussion of market structure and externalities is in the framework of seeking to magnify the benefits from further trade liberalization.

2.   COMPETITION POLICY

The interaction and relationship between competition and trade policy has received considerable attention in the past decade.[102] There are good reasons for this, especially when one considers that both policies have the same objective of developing and promoting efficient and competitive markets. Trade policies achieve this through lower tariff and non-tariff barriers imposed by governments. Competition policy, on the other hand, has as its primary objective the discipline of actions by private firms that interfere with competition in a manner that imposes costs on society.

Recognition of the similarity and indeed, as will be shown below, the complementarity of these two policy areas is not new. The 1948 Havana Charter, which proposed an international organization, included provisions on restrictive business practices. An international complaints and investigation procedure was envisaged for an open-ended list of restrictive business practices. However, the stillbirth of the International Trade Organization meant that competition policy did not become part of the mainstream trade agenda. In more recent years, it has become part of the discussions in various fora including some components of the Uruguay Round negotiations.[103]

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[102]   See WTO (1997). The WTO Secretariat paper entitled "Study on Issues Relating to a Possible Multilateral Framework on Competition Policy" (WT/WGRCP/W/228) provides a comprehensive coverage of the issues relating to competition policy in an open economy.

[103]   See also United Nations Set of Multilaterally Agreed Equitable Principles and Rules for the Control of Restrictive Business Practices ("the Set") which was adopted by the General Assembly of the United Nations on 5 December 1980 (Resolution 35/63). In addition, there are competition related provisions in the General Agreement on Trade in Services and the Agreement on Trade Related Intellectual Property Rights. For more on competition policy and the Uruguay Round see WTO (1997).

The return of competition policy as part of international policy making is driven by continuing reductions in trade barriers and the increasing fragmentation of the production structure of the world economy. Both of these developments have taken place in the context of dramatic changes in information and transport technology, and the growth of the service sector in the world. These developments have contributed to a more competitive global economy and a very different trade policy environment compared to the immediate post-World War II period. A key issue is whether the benefits of continued trade liberalization can be nullified by the anti-competitive actions of private firms, despite an increasingly competitive global environment. Or, conversely, whether trade policy instruments can be used as an effective remedy against anti-competitive behaviour.

The discussion that follows of how competition policy can enhance the benefits of trade liberalization distinguishes among three scenarios in an open economy where anti-competitive practices may exist: where a domestic firm engages in anti-competitive practices in a domestic market; where a foreign firm engages in anti-competitive practices in a domestic market; and where foreign firms engage in anti-competitive practices in international markets that affect prices in a domestic market. The starting point for the analysis is an overview of the basic concepts of market structure. This is followed by a discussion of how competition policy addresses selected market failures. Finally, some conclusions are drawn on the interaction between trade policy and competition policy.

(a)   Market structure

The traditional approach to examining market structure is to measure the number and size distribution of firms. The larger the number of firms, the more competitive the industry. This approach changed during the 1980s with the development of more sophisticated thinking about industrial organization. Armed with tools borrowed from game theory, new insights into the behaviour of firms were developed. Instead of focusing on the number and size of firms in an industry, the focus shifted to their behaviour and, in particular, to market entry barriers.

In order to understand better the primacy accorded to entry barriers, consider the basic monopoly case. If only one firm was to operate in an industry it would restrict output and raise the price of the good that it sells in order to maximize its profits. Positive profits, however, would create an incentive for other firms to enter the industry. In the scenario where they do enter the industry, the incumbent monopolist would be forced to alter its pricing and production behaviour. Arguably, one could also reasonably expect an incumbent monopolist to alter its commercial behaviour pre-emptively if a new entrant was to credibly signal its intent to enter the industry.[104] The credibility of this signal would depend greatly on the level of barriers – the lower the entry barriers the stronger the credibility of the threat that a new entrant may emerge. Conversely, the higher the entry barriers, the lower the credibility.

In the absence of a precise definition of a 'barrier' *per se*, a widely accepted definition of a barrier is any condition that affects the mobility of capital into and out of an industry.[105] The emphasis in this case is the mobility of capital. There is also the case of a merger, which may not affect the mobility of capital, but may still affect the conditions of competition.[106] The overriding question is whether or not entry, or perceived entry, will bring market prices closer to the perfectly competitive price.

Two types of barriers to entry can be identified – regulatory and structural barriers. Regulatory barriers are often government policies designed to limit or control entry into an industry. These include requiring a permit or licence to participate in a particular market. In some cases, acquisition of a permit may be allowed, but the cost of doing so may be prohibitive. Another example of a regulatory barrier to competition is a measure that reduces or prohibits imports, such as tariffs or quantitative restrictions.

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[104] Baumol et al. (1982) developed this line of thought through the concept of 'contestable markets', where the credible threat of entry could lead to competitive outcomes even with a small number of firms in the market. As Gilbert (1989) points out, they either mimic perfectly competitive markets, or they act as perfectly regulated monopolies with (average) price equal to average cost.

[105] See Gilbert (1989) for the various definitions of barriers to entry.

[106] For example, a horizontal merger that would change ownership without a corresponding transfer of capital.

Not all barriers to entry are erected by governments. In many cases the barriers could be structural in nature. For example, sunk costs may be specific to an industry. In this case, the nature of the costs may be such that exit from a failed entry may be difficult, raising the risk of entry. In a similar way, but associated with entry, high fixed entry costs may deter entry. Other possible structural barriers include economies of scale and network effects.

Within the class of structural barriers to entry there is also the case where the structural barriers to entry are such that the market can only be efficiently supplied by one firm. Examples of such natural monopolies can be found in industries that require large-scale investments in distributive networks, such as power generation.[107] The policy response in this case is not to ease entry into the market, since this will have no consequence. Instead, the behaviour of natural monopolists needs to be regulated in such a way as to balance the public interest in the provision of the product to the market, with the commercial interest of the natural monopolist.

Another set of barriers to entry are those associated with the response of the incumbent. Even if regulatory and structural barriers were minimal, an incumbent firm could use strategies at its disposal to limit competition. Pricing policy, for example, could not only be aggressive in nature, but implemented in a predatory manner.

(b)   Objectives of competition policy

An effective competition policy is an important underpinning of an efficient economy. To date, there is no universally agreed approach to competition policy. Different approaches are used by different countries. Some have extensive legislation covering merger review, dominance and anti-competitive practices, while others have basic price surveillance legislations.[108] Competition policy should, therefore, be understood in a broad sense, and viewed as comprising not only antitrust policy, but also other policies that have an impact on market structure, business behaviour and economic performance. It should also be understood in a dynamic context. Indeed, in the context of trade policy a dynamic argument for protection is the infant-industry case, where the costs of production decline in the future. Krugman (1984) highlights this case as one where protection from competition, in this case imports, expands output to the point where the protected industry becomes internationally competitive.[109] Increasingly, the competition policies of many governments aim to promote dynamic as well as static efficiency gains, for example in the approach that they take to intellectual property licensing issues.[110]

Despite the different approaches used by countries, all competition policies have the ultimate common goal of maintaining and encouraging competition. However, in some cases the objectives as stated in the legal instrument are very broad (World Bank and OECD (1999); CUTS (2003). Nevertheless most of the legal instruments that were developed in the 1990s have the objective of 'promoting', or 'encouraging' competition. This is a marked shift in the intent of the instruments developed prior to the 1980s. A good example of this shift is the case of India, where its 1969 Act aimed at the "prevention of concentration of economic power that is or that may lead to the common detriment". The 2002 Act has various objectives, including to prevent practices having an adverse effect on competition, to promote and sustain competition in markets, to protect the interests of consumers, and to ensure freedom of trade.

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[107] In technical terms any given level of output can be produced at less cost by a single entity than by two or more firms. As a result, in a single product market the firm with the largest output would always be able to under-price any rivals.

[108] A summary of the basic content of national legislation on competition policy for 55 countries is contained in WTO document WT/WGTCP/W/128/Rev. 3, 27 November 2003. The document shows that the vast majority of competition policies have a number of common elements including those on horizontal and vertical restraints, abuse of dominant position and merger review.

[109] This case is explained in Feenstra (2004).

[110] See Anderson and Gallini (1998)

Some further examples of objectives from different competition policy instruments are stated below.

- maintenance of the competitive process or of free competition;
- freedom of trade, freedom of choice and access to markets;
- freedom of individual action;
- securing economic freedom;
- lessening the adverse effects of government intervention in the marketplace;
- prevention of abuse of economic power;
- achievement of economic efficiency.

As noted above, a competitive market may not deliver an equitable result. One view would be to include equity as an objective of competition policy. While understandable from the point of view of governments concerned with social justice, the reality is that broad and ambiguous mandates give rise to the possibility of inconsistent outcomes. In the extreme case, the absence of clear and concise objectives can lead to incoherence and perhaps the political capture of the competition authority.

The number of countries with competition policies has been steadily increasing (Table IIC.1). Most developed countries have had some type of competition legislation in place for sometime, so these new countries are predominantly developing countries. This is a positive development. It should be noted, however, that developing countries do not form a homogenous group. There are fundamental economic differences between them and one would not expect a high degree of homogeneity in their approach to competition policy. Yet at the same time there are a number of similarities, or core principles.

Table IIC.1
Number of jurisdictions enacting competition laws

Years	Number of jurisdictions enacting a competition law for the first time
1985-1990	8
1991-1995	25
1996-2000	16
Total for 1985-2000	49

Note: Excluding European Communities 80 jurisdictions were reported to have some form of competition law in 2001.
Source: WTO.

(c)   Competition and openness

It is sometimes argued that the objectives of competition policy can be met, at least in part, by open trade and investment policies. A small open economy, for example, may derive significant pro-competitive benefits in many markets by allowing foreign suppliers to contest those markets. Similarly, open investment policies may be expected to reduce opportunities for domestic industries to capture markets and extract monopolistic rents. The validity of the argument that open trade and investment policies can replace competition policies depends on the assumption that these external influences will eradicate anti-competitive market structures. This will not always be the case. Openness may not increase rivalry among firms – in fact the reverse might occur in some circumstances. This suggests a role for competition policy.
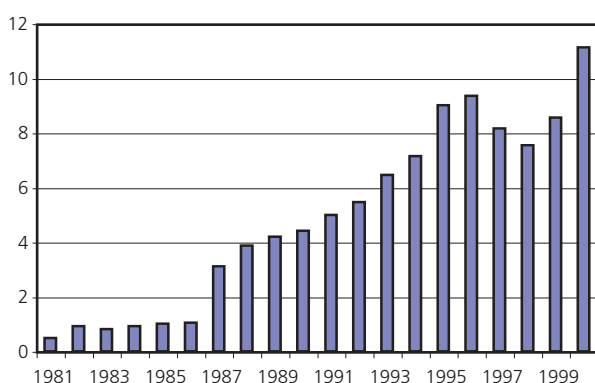
Some industries are simply less amenable to competition than others. Take, for example, network-based industries such as electricity or water supply. Huge sunk costs in such industries make entry difficult and the market is unlikely to deliver competitive structures, with or without foreign participation. In such cases, regulation is essential. Two further instances will be considered below where open trade and investment policies require a complementary competition policy in order to achieve the full benefits of openness. The first is the case of international cartels and the second is cross-border mergers.

(i)   International cartels[111]

Foreign exporters could be members of a cartel with the objective of reducing output and raising prices. Even if trade measures in the importing country are liberalized, the full benefits of the tariff reduction may not be passed on to consumers, due to the actions of such a cartel.

Empirical research seeking to estimate the costs of international cartels is still in its infancy. The work focuses on known cartels such as the ones that were prosecuted in the 1990s. These studies employ a basic methodology to estimate the overcharging to consumers. The resulting estimates fall in the range of 20-40 per cent.[112]

Chart IIC.1
Total imports of 12 cartelized products by developing countries, 1981-2000
(Billions constant 2000 $US)

Source: WTO Document WT/WGTCP/W/228.

These estimates shed some light on the relative magnitudes of the costs to national treasuries and the benefits of adopting multilateral provisions on cartels. The associated state outlays include: (i) the cost of drafting and enacting a cartel law, establishing the relevant enforcement agency, and developing the necessary expertise; (ii) the budgetary cost of enforcing a cartel law; and (iii) the costs to the private sector of any unwarranted bureaucratic harassment that may follow enactment of a cartel law. The benefits include: (i) any benefits to the national treasury associated with deterring the formation of bid rigging cartels in the first place; (ii) any benefits associated with deterring the formation of cartels that target private sector customers in the first place; (iii) any benefits to national treasuries that accrue from bid rigging cartels submitting lower bids in jurisdictions with active cartel enforcement regimes; and (iv) any benefits to private sector customers that accrue because cartel members set lower prices in jurisdictions with active cartel enforcement regimes.

Recent research has shown that benefit (iv) listed above may be sufficiently large to justify public outlays on anti-cartel enforcement and supports the view that there are likely to be sizeable benefits from implementing effective provisions on hardcore cartels, whether at the national and/or international level.[113] Moreover, to the extent that voluntary cooperation further strengthens the ability of competition agencies to successfully conduct investigations into hardcore cartels, then this will increase the deterrent effects on cartelization.

Evidence points to the possibility that the benefits of effective measures to tackle international hardcore cartels could exceed the welfare gains from liberalizing certain impediments to market access in the context of the Doha Round. For example, in the September 2002 edition of the IMF's World Economic Outlook, it is estimated that the increase in developing country welfare resulting from the liberalization of agricultural policies in industrialized economies would be approximately US$8 billion per annum.[114] Undoubtedly, this constitutes a sizeable potential benefit for developing economies. However, in 2002, developing countries imported merchandise worth $1,704 billion, and in order for disciplines on hardcore cartels to yield an $8 billion reduction in overcharges to developing countries, international hardcore cartels controlling as little as 1.8 to

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[111]   This Section is based on WTO Document WT/WGTCP/W/228 "Study on issues relating to a possible Multilateral Framework on Competition Policy", 19 May 2003.

[112]   Connor (2001), Levenstein and Suslow (2001), and OECD (2002a, 2002b).

[113]   It should also be added that to the extent private firms respond to stronger cartel enforcement measures by adopting price-raising but not cartel-like practices – such as collusion and price leadership – this may detract from the benefits of properly implementing national cartel laws. This concern is of special importance if the new practice is less easy to deter or prosecute under national competition law.

[114]   For comparative purposes, Chadha et al. (2000) estimate the gains for developing countries resulting from a 33 per cent overall reduction of agricultural tariffs to be $5.7 billion annually.

3.1 percent of developing countries' imports would have to be deterred or stopped by the implementation of such new disciplines.[115] This amounts to $28-48 billion of developing countries' merchandise imports in 2002, much less than the $81.1 billion of developing country imports that Levenstein and Suslow (2001) estimated might have been affected by international cartels prosecuted in the 1990s. These calculations suggest that disciplines on international cartels offer considerable benefits to developing countries.

Economic analyses of the harm done by anti-competitive practices, such as private international cartels, are becoming more sophisticated over time. In one such analysis, the overcharges on cartelized exports of vitamins was found to be much higher in Asian, Latin American and Western European jurisdictions that do not have vigorous cartel enforcement regimes. This finding highlights one of the important benefits of cartel enforcement – namely providing incentives to those cartels to limit the amount they overcharge customers in a given jurisdiction.[116]

When quantitative estimates of these benefits were compared to the costs of running an agency responsible for enforcing competition laws, considerable returns were found to investments in cartel enforcement activities. It remains to be seen whether further studies will bear out these conclusions. To the extent that they do, such research will reinforce the case for adopting and enforcing national cartel laws and associated measures at the international level that underpin the effective enforcement of national competition laws. The return on these investments in national cartel enforcement can be further enhanced by capacity building and technical assistance measures.

(ii) Mergers

The policy interest in mergers stems from the fact that, in some cases, they create conditions that are conducive to the exercise of market power. As indicated above, the correlation between market power and concentration has been eroded somewhat over recent years due to new theoretical insights. Mergers can bring economic benefits due such factors as economies of scale and the possibility of sharing of know-how. However, nowhere has the case been made that mergers should be not reviewed. Mergers can be classified into three categories: horizontal mergers that take place between firms that are actual or potential competitors, vertical mergers between firms at different levels in the chain of production, and conglomerate mergers which are neither horizontal nor vertical.[117] In the last case the two firms do not necessarily have a specific commercial relationship.

Concern about the potential anti-competitive effects associated with opening an economy has increased in the past five years as a result of the boom in cross-border mergers and acquisitions. If one considers the case of two countries and multinational corporations (in the form of affiliates and firms) there are six possible outcomes if cross-border mergers were to be allowed (UNCTAD, 2000). These are:

- a domestic firm in X acquires a foreign affiliate in X

- a foreign affiliate in X acquires another foreign affiliate in X

- a domestic firm in X acquires a foreign firm in Y

- a foreign affiliate in X acquires a domestic firm in Y

- a foreign affiliate in X acquires a domestic firm in X

- a foreign affiliate in X acquires a foreign affiliate in Y

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[115] These calculations assume that the price increase with international cartelization is between 20 per cent and 40 per cent, consistent with the findings of Levenstein and Suslow (2001).

[116] Of course, one of the other benefits of having a vigorous cartel enforcement regime is that it deters the formation of cartels in the first place.

[117] These categories are not necessarily mutually exclusive.

The first two cases are clearly restricted to the jurisdiction of domestic authorities. The resulting merger increases concentration in the domestic economy. Whether or not the merger is anti-competitive will depend upon the specifics of the case. In each of the other four cases, however, there is a cross-border competition issue in either country X or country Y. In each instance, the issue is not limited to the increase in concentration in either market, but the increase in concentration in the global market, which could lead to potential anti-competitive behaviour.

The scenarios are further complicated if a third country is added. For example, in this case the mergers outlined above could have an anti-competitive effect in country Z. Country Z, however, may not have a competition policy in place to address this situation. Or, even if it did, it may not have jurisdiction over the transaction since the new merged entity may not have a presence in country Z.

Concern about the potential anti-competitive effects of mergers stems either from a unilateral or coordinated effect, or both.[118] In the case of unilateral effects, the concern is that the reduction in rivalry may alter the incentives for the new firm to behave in a competitive manner. The consequences of unilateral effects are no different from those of a large firm in a domestic market. The coordinated effect relates to the reduction in transactions costs that may be incurred when colluding.

In these cases, the existence of domestic competition regulations on price-fixing arrangements (or cartels) and on mergers would limit the impact of anti-competitive behaviour on international trade and increase benefits for consumers.[119] This suggests that unless the liberalization of trade measures is complemented with competition regulations, the full benefits of trade liberalization may not be realized.

While an increase in concentration can signal anti-competitive behaviour, this is not always the case. Recent empirical and theoretical work has shown that efficiency considerations can provide a justification for mergers in certain cases.[120] The economic argument in this case is that minimum efficient scale could be a limiting factor in allowing many firms into a market. In the extreme case, consider two firms, both of which compete in their closed domestic market. Once trade liberalization takes place the market expands, but due to increasing returns to scale, per unit costs decrease as output increases. Consequently, the firm with the smaller output will not find it profitable to compete. Combining the two firms will increase the output of the single firm, which will further decrease the costs of production. In the end, the market will have one firm, supplying the global market, but at a lower resource cost than in the case of two domestic firms. This scenario is applicable to a number of cases. Restructuring in the international airline industry is a good example of the need to have a broader interpretation in merger review cases that admits efficiency defences.

(iii) The role of trade policies

The previous Sections have argued that trade and foreign investment liberalization can give rise to pro-competitive and anti-competitive outcomes. These outcomes raise the question whether restrictions on trade and investment policy could be used in order to mitigate the anti-competitive effects of liberalization. Different answers to this question provoked a heated debate about trade policy in the 1980s. Until then, the predominant view of trade policy was that open trade should be the only policy pursued by governments. The catalyst for the change in the approach to trade policy was the shift away from perfectly competitive models of trade determination to ones that were based on increasing returns to scale and imperfect competition.

The principal trade policy result derived from these models is the role for government policy to increase welfare. This result is driven largely from the assumed departure from perfect competition, or the existence of a 'second best' world. In such a world, it is possible to improve welfare through government intervention.[121]

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[118]   World Bank and OECD (1999).

[119]   As previously noted in Section IIC.1.(c).

[120]   World Bank and OECD (1999).

[121]   See Vousden (1990) and Feenstra (2004) for an exposition of these arguments.

In the trade context, this proposition is best exemplified by the development of the strategic trade policy literature, which emphasized the role of government policy as a means by which to extract rents. In its simplest form, a government can use a protectionist instrument to shift rents from foreign firms selling in their market to domestic firms. Similarly, the 'optimal tariff' argument for the large country case, which is widely regarded as one of the few departures from the optimality of free trade, has been expanded in an imperfectly competitive framework. The intuition behind this result is that in a world where producers enjoy some market power arising from brand strength, a tariff or an export tax can be used to change the terms of trade in favour of the importing country.

Despite the strength and appeal of the strategic trade policy literature, an overall general policy prescription was never developed. The principal problem in generalizing the results was the specificity of the circumstances when government intervention would be welfare-improving. It is widely acknowledged that only a few industries could be identified, such as the market for large passenger aircraft, that would meet the required assumptions.

Another part of the difficulty is the existence of welfare-deteriorating cases under similar assumptions about welfare-improving trade policy. Strategic interaction takes many forms. The extent to which it occurs also depends on assumptions about firm behaviour. In a world with asymmetric information, government intervention could change key market parameters, which would induce anti-competitive practices. For example, consider the case of a quantitative restriction on imports. In this case, the level of sales in a domestic market by foreign firms is fixed. A domestic firm operating in the same market can then decide to choose its level of output with full knowledge that the foreign firm will not be able to react by increasing its output. In this sense, trade policy could act as a 'facilitating' device for anti-competitive behaviour.[122]

(d)   International cooperation and competition policy

The discussion above has shown that competition policy can have a role to play in ensuring that trade liberalization is not undermined by anti-competitive behaviour.[123] Anti-competitive action arising out of power exercised by affiliates may be effectively addressed, but domestic competition policy is likely to encounter limits when it comes to 'international' problems such as cartels.

The issue of how best to approach competition policy in an international setting has been a hotly debated topic. The debate revolves around three broad approaches:

• harmonizing national competition laws and practices (convergence);

• improving cooperation among national competition authorities;

• creating a multilateral framework.

Each approach has its potential merits and limitations. It should be pointed out that the harmonization of national competition laws and practices is not called for in the recent proposals for a multilateral framework on competition policy. Rather, the proposals aim at: i) promoting effective measures against international cartels; ii) clarifying the application of core WTO principles of transparency, non-discrimination and procedural fairness in this area; iii) promoting voluntary cooperation among national competition agencies; and iv) expanding current technical cooperation and capacity-building efforts. The principal point to be made regarding competition policy in an open economy is that some degree of international coordination and cooperation is required for two reasons outlined in previous sections. Anti-competitive problems arising out of the behaviour of foreign firms within a country's borders can be difficult to resolve in the absence of interaction with foreign competition agencies. The extent of that cooperation can vary. For some countries, such as Australia and New Zealand, there is a great deal of cooperation. For others it could involve 'comity', which is a term used to describe factors and issues that a competition authority in one country takes into account when deciding to pursue a case against subjects in another jurisdiction. The degree of international cooperation on competition policy issues is clearly on the increase (Table IIC.2).

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[122]   Harris (1985); Krishna (1989).

[123]   See Anderson and Holmes (2002) for an overview of competition policy in the context of openness.

Table IIC.2
Cooperation on competition policies in selected countries

	Australia	Brazil	Canada	Chile	China	Denmark	EC	France	Germany	Iceland	Israel	Japan	Kazakhstan	Mexico	New Zealand	Norway	Papua New Guinea	Russian Fed.	Taipei, Chinese	USA
Australia	-		2000**												1994 & 2000**		1999		1996	1982 & 1997
Brazil		-																		1999
Canada	2000**		-	2001			1999 & 2000							2001	2000**					1995
Chile			2001	-																
China					-								1999					1996		
Denmark						-				2001**						2001**				
EC			1999 & 2000				-													1991 & 1998
France								-	1984											
Germany								1984	-											1976
Iceland						2001**				-						2001**				
Israel											-									1999
Japan												-								1998 & 1999
Kazakhstan					1999								-							
Mexico			2001											-						2000
New Zealand	1994 & 2000**		2000**												-				1997	
Norway						2001**				2001**						-				
Papua New Guinea	1999																-			
Russian Fed.					1996													-		
Taipei, Chinese	1996														1997				-	
USA	1982 & 1997	1999	1995				1991 & 1998		1976		1999	1998 & 1999		2000						-

** denotes tripartite arrangement.
Source: WTO.

Comity and coordination are useful concepts when it comes to cases involving at least one firm within the jurisdiction of a competition authority. But it is a different matter when foreign consumers pay the cost for anti-competitive behaviour in another jurisdiction. In such a case, similar to some of the environmental problems to be discussed later, the problem is 'international' in nature and calls for international solutions.

(e)   Conclusions

Over the past decade there has been considerable research into the linkage between competition policy and the liberalization of trade and investment policies. This research is summarized in a recent paper which identified a number of complementarities and tensions arising from the application of competition law in an open economy setting.[124] Two tensions of note are the possibility of exacerbating distortions in markets other than the goods market, in particular labour and financial markets. Inefficiencies in these markets may not necessarily be attenuated through the application of competition law. The second tension relates to the point about national champions. A larger market allows efficient firms with increasing returns to scale technology to produce at a lower cost. Smaller firms, or firms operating in a small economy prior to opening up to the world economy, may not necessarily have access to the scale of production required to compete in a global economy.

Two additional issues that may contribute to a negative perception of competition policy in an open economy setting are miscalculation on the part of competition authorities and atypical production structures. In the first case, the introduction of international competition will act to discipline anti-competitive practices. However, there is the need to guard against the establishment of competition policy structures that risk bureaucratic capture, without corresponding precision in terms of appropriate interventions. The second issue concerns atypical consumer preferences. A larger market will lead to an increase in production, but if product preferences are specific to countries, a reduction in product variety arising from openness could lead to welfare losses.

Despite these reservations, the overwhelming evidence is that openness and competition policy will promote efficiency, innovation and growth. In fact, modern approaches to competition policy increasingly take account of atypical market structures and other circumstances in which the application of competition law needs to be tempered. As noted, these approaches attach much importance to the promotion of dynamic efficiency gains. The 'tailoring' of competition policy to respond to these situations is, in fact, an important element of the overall application of competition law.

3.   ENVIRONMENT-RELATED EXTERNALITIES

(a)   Introduction

This Section will deal with the subject of trade and negative externalities, with a specific focus on environmental externalities. The policy challenge is to ensure that producers and consumers make decisions on the basis of correct environmental resource prices. This will ensure optimality in the allocation of resources. With the right environmental policies in place, trade liberalization can generate benefits without needlessly jeopardizing the environment. While the traditional focus of economists has been on environmental taxes, it shall be seen that interventions often also mean command and control measures. The literature on computable general equilibrium (CGE) simulations of trade and the environment is reviewed to see what insights it offers regarding combinations of liberalization and environmental policies that increase incomes and improve the environment. Finally, we examine the appropriateness of trade instruments as measures to correct environmental externalities.

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[124]   WTO document WT/WGTCP/W/228.

(b)   Trade and environmental externalities

Suppose an economy faces both trade-related distortions and environmental externalities. What can be said in general about the effect of removing the trade distortions through liberalization? Since producers and consumers do not face the full cost of their actions, and treat environmental resources as free goods, one possibility is that trade could result in a greater than optimal scale of economic activity and produce environmental damage. The other possibility is, that in spite of these negative externalities, the removal of the trade distortion improves welfare because the benefits of liberalization exceed the costs of additional environmental damage. Since two distortions are present, there may be no definite answer and it will often be an empirical matter (Lipsey and Lancaster, 1956).

Based on recent econometric studies (Antweiller, Copeland and Taylor, 2001; Frankel and Rose, 2002), the concern with the negative environmental impact of trade liberalization may be exaggerated. Antweiller, Copeland and Taylor (2001) have estimated a model of trade and air pollution for a sample of 43 countries over the period 1971-96. The form of air pollution studied was sulphur dioxide, which is a noxious gas produced by the burning of fossil fuel and is primarily emitted as either a direct or indirect product of industrial production. The estimated model allowed the authors to separate the environmental impact of trade into scale, composition and technique effects.[125]

The study arrives at two striking results. One is that technique effects are quite large and tend to dominate the scale effect. Second, for the sample of 43 countries, the composition effect of trade resulted in a decrease in air pollution. The study finds that the composition effect tended to worsen air pollution in capital-intensive countries, which had a comparative advantage in "dirty industries", while it improved air quality in more labour-intensive countries. Still, the net effect of these changes for the countries in the sample was an improvement in air quality. Overall, the study concludes that a process of trade liberalization which raises GDP per person by 1 per cent can reduce sulphur dioxide emissions by 1 per cent.

Using a gravity model, Frankel and Rose examined what effect a country's degree of trade openness has on various measures of environmental quality.[126] Their use of a gravity model seeks to preclude the possibility of reverse causation (i.e. of countries with better environmental quality trading more, thus tainting the econometric results). They find that trade has a beneficial effect on air quality, with more open economies seeing reduced levels of nitrogen oxide and sulphur dioxide levels. They do not find as strong an effect of trade on other environmental indicators, but neither do they find that trade causes any harmful effects on them. The positive effect on the environment arises from trade's impact on output or income and the working of the Environmental Kuznets curve. For every one percentage point increase in openness (exports plus imports as a share of GDP), the authors find that output is increased by 1.6 per cent. Beyond a certain per capita income level, these increases in income lead to an improvement in environmental quality.

These results, for a large and wide sample of countries, are important. In the specific case of air quality, greater openness is associated with declines in harmful emissions. This suggests that countries faced with both trade and environmental distortions can make headway in addressing both – increasing incomes and improving the environment – through greater openness. While these results are important for continuing with trade liberalization, it does not reduce the need for governments to adopt policies that appropriately value environmental resources.

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[125]   The scale effect refers to the environmental consequences of increased output or economic activity which results from more trade. An increase in output will result in more pollution or degradation of environmental resources. The composition effect refers to the way that trade liberalization affects relative prices and changes the composition of output between polluting and non-polluting sectors. The composition effect will be positive for the environment if the expanding sector is less pollution-intensive than the contracting sectors and vice-versa. Finally, the technique effect reflects the increased demand for a better environment as trade liberalization leads to higher incomes. With higher incomes, citizens demand better environmental quality from governments and they are able to afford more easily the resulting abatement costs. Increased demand for environmental standards or regulations has to be supplied by national governments.

[126]   Standard gravity models explain a country's bilateral trade pattern by using, in addition to GDP, a host of geographical indicators – distance to trade partner, whether a country is land-locked, common borders, linguistic links, and so on. These geographical variables are plausibly exogenous and when aggregated across all bilateral trading partners are highly correlated with a country's overall trade. Thus they make good instrumental variables of trade or openness.

(c) Optimal interventions

(i) Bargaining solution

While the focus in this Section is on public policy towards environmental externalities, it is important to recognize that the existence of externalities does not automatically call for government intervention. If there are no transactions costs, (i.e. the parties involved can readily make and enforce contracts), bargaining among the parties would lead to the socially-desirable allocation of resources (Coase, 1960).

There are two key ideas which will allow us to better understand this result. The first is the reciprocal nature of an externality. A negative externality is the outcome of a joint decision.[127] A rancher has such a large herd of cattle that a few of them always manage to stray and trample part of his neighbour's crop. But his neighbour would not have suffered the loss if his farm was located a greater distance away from the ranch. Thus, the location of the farm contributes to the existence of the externality.

The second idea is that the optimal outcome requires that the externality be dealt with at the lowest cost possible. Suppose that the cost of the externality (damage to the farmer's crop) is $4,000. Suppose also that the negative externality can only be dealt with in three ways. Either the rancher reduces his herd of cattle (which would have been the 'Pigouvian solution');[128] or a fence should be built around the farm; or the farmer should stop farming. Suppose that the cost of each option is $5,000, $1,000 and $10,000 respectively. In the absence of transactions costs, the rancher and the farmer would be able to bargain their way to the least-cost solution – building a fence.[129] To confirm this, note that the first outcome would not be acceptable to the rancher (he would rather give $1,000 to the farmer to build the fence). The third option would not be acceptable to the farmer (he might as well build the fence himself or even allow some of his crops to be trampled upon). Finally, doing nothing (letting the externality continue and cause $4,000 worth of damage) is not feasible because one option, e.g. building the fence, is always cheaper for the farmer. Who bears the cost of the fence, i.e. the distributional issue, will depend on the bargaining position of the parties but will not affect the optimal allocation of resources.

One other aspect is worth mentioning. If the least-cost option for removing the negative externality costs as much or more than the externality itself, then the best course of action is to do nothing. Suppose that the fence will cost $4,500 to build, then society will not be made better off by correcting the externality. This is one reason why even in the presence of positive transactions costs, there will be instances when government intervention will still not be required and the socially desirable outcome would be to live with the externality. In addition, government intervention imposes its own costs (e.g. monitoring and enforcement costs) all of which must be factored in when considering the desirability of regulatory action.

(ii) Environmental taxes

With transactions costs large enough to preclude bargaining among the concerned parties, the prescribed solution to correct negative externalities is the application of a tax on the activity causing the externality at a rate equal to its marginal environmental damage. This tax is called the Pigouvian tax.

Suppose that a plant discharges noxious fumes in the process of smelting copper. The fumes cause breathing problems among people who live downwind from the plant, and the health costs associated with the activity of the smelter is estimated at x dollars per ton of copper output. Since the owner of the plant does not pay for that cost, it is not included in his private calculation of profit and loss. Hence, the amount of copper smelted is increased to the point where the sum of its marginal cost, and the associated health cost of the pollution becomes greater

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[127] As Coase points out, this key insight was always understood by lawyers who had centuries of litigation experience of such cases, but it was apparently unknown to most economists.

[128] It is named after the economist A. C. Pigou (1920), who first developed this prescription for managing externalities.

[129] Incidentally, this example demonstrates that the optimal solution to a negative externality (building a fence) may not be the Pigouvian solution (taxing the rancher).

than the value attached to the additional copper by consumers. The outcome is socially inefficient. The Pigouvian tax rate should be set equal to the marginal environmental damage at the socially optimal level of production. In this example, it is x dollars per ton of copper output. With this tax, producers of the externality face the full costs of their activities and would therefore set their volume of production to the socially-optimal level.

This discussion has been carried out in the context of an optimal tax on the dirty production good. But the analysis is really much more general than this. While the Pigouvian tax is normally conceived of as an output tax, this need not always be the case. The fundamental principle is that the Pigouvian tax should be applied directly to the activity which generates the negative externality. Hence, the Pigouvian tax could also be an input tax if it is the use of the input which generates the negative externality (e.g. think of a firm that uses coal as its source of power). In this case, it would not be efficient to apply the tax on the output of the firm, as that would result in a much larger reduction in production than necessary to lower emission levels. In this context, it would be too blunt an instrument. A tax on the input (coal) is much more efficient since the firm can then adjust by using other cleaner inputs as substitutes to produce a given level of output. We shall come back to this general principle of dealing with the externality at the source when considering the question of command and control instruments and trade measures, and their use in dealing with environmental externalities.

Since Pigouvian or environmental taxes generate revenues, it has led to the intriguing conjecture that environmental taxes create a "double dividend" for society (Pearce, 1991; Poterba, 1993; Oates, 1991). Not only do the taxes correct an externality (the first dividend), they also allow governments the possibility of reducing other distortionary taxes and the excess burden associated with them (the second dividend).[130] However, the theoretical basis for this conjecture turns out to be quite weak. The reason for this is that if we ignore the first dividend (the correction of the negative externality), an environmental tax imposes distortions on the economy no differently from other taxes. Hence, the imposition of the environmental tax adds to the excess burden created by the tax system.[131] Returning tax revenues to citizens through cuts in other taxes can create a second dividend only if the excess burden associated with the environmental tax is less than that from other taxes. Otherwise, we would simply be restoring the excess burden from the tax system to where it was before the environmental tax was imposed. Whether there is a second dividend or not is an empirical question.

One final and related point needs to be made about Pigouvian taxes. If the distortions created by the tax system are taken into account, the appropriate tax to apply to a negative externality should actually be set below the marginal environmental damage (Bovenberg and de Mooij, 1994). The reason for this is that the excess burden of the tax system creates a wedge between the revenue raised and the monetary value of the utility lost by the consumer.[132] The imposition of another tax, whether it be an environmental tax or not, widens the wedge. The policymaker therefore has to trade off the welfare gain from correcting the externality against the welfare loss suffered by increasing peoples' (already high) excess burden.[133] This balancing act will result in an environmental tax rate that is less than that required to correct fully the externality.[134]

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[130] This proposition is the strong form of the "double dividend" hypothesis. The weak form states that using revenues from an environmental tax to finance reductions in marginal rates of an existing distortionary tax achieves cost savings relative to the case where the tax revenues are returned to taxpayers in lump-sum fashion.

[131] The excess burden of a tax refers to the welfare loss faced by consumers, the monetary value of which is larger than the revenue generated by the tax. In other words, the collection of a $1 distortionary tax results in a welfare loss for consumers which is in excess of $1. This excess burden is created by the 'forced' substitution of consumption away from the taxed good.

[132] This can be calculated by using either equivalent variation or compensating variation, both of which are money-metric welfare indicators.

[133] This result should not be surprising since it arises out of a general equilibrium setting with two sources of distortions in the economy: the excess burden from taxes and the environmental externality. Pigou's analysis only considered one distortion – the environmental externality.

[134] West and Williams (2004) arrive at a different conclusion with respect to Pigouvian taxes on gasoline. They argue that because gasoline and leisure are complementary in demand, the Pigouvian tax on gasoline should be set above the marginal environmental damage.

(iii) Regulation as an alternative to taxes

Despite the central role played by Pigouvian taxes in economic theory, governments tend not to make widespread use of environmental taxes. Most prefer to pursue their environmental objectives through command and control measures, such as performance standards or mandated technologies, licenses, permits, zoning regulations, registration, and other regulations. This need not mean that the traditional focus on Pigouvian taxes is necessarily misplaced, since it serves as an important reference or benchmark with which other measures can be compared.
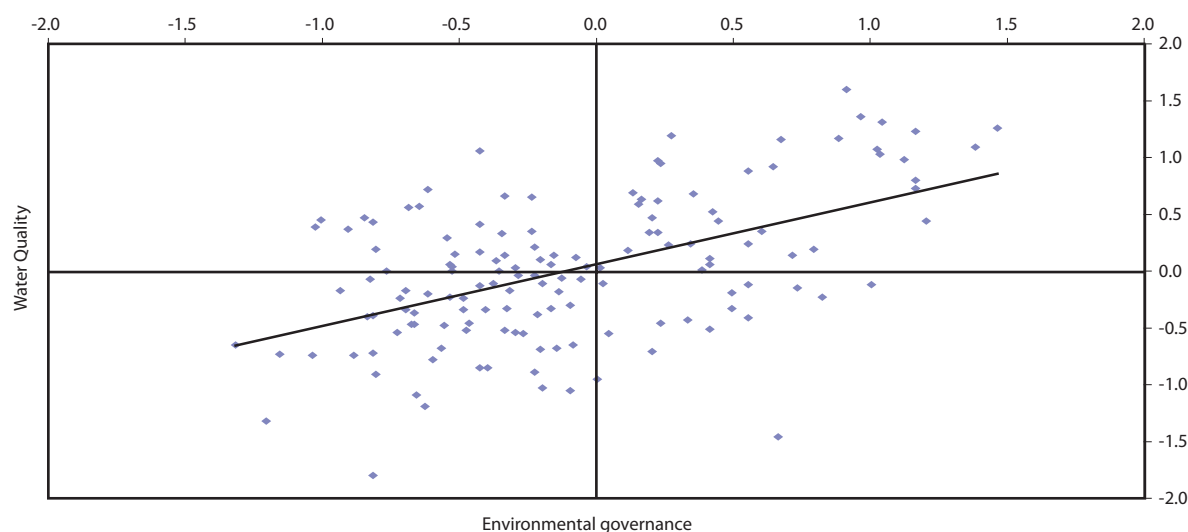
Despite their widespread use, command and control measures are less efficient than taxes. This is because they tend to be "one size fits all" instruments, prescribing the nature of the technology, inputs and performance standard to meet, leaving producers little or no room to reduce environmental damage at the lowest cost possible to them. However, it turns out that there are other compelling reasons why governments prefer regulations to emission taxes. These include distributional concerns, uncertainty about the costs and benefits of abatement and the costs of monitoring and enforcement involved (Bovenberg and Goulder, 2001).

Governments may be reluctant to saddle households and firms with the distributional consequences of an environment tax. For example, the application of environmental taxes will tend to reduce the incomes of the owners of the factors of production which are involved in the production of goods which create the negative environmental externality. The resulting increase in the relative prices of environmentally-dirty goods will also affect the distribution of gains and losses to consumers if households differ in their preferences for these goods (some households place a higher value on the environment than others). There may be no other fiscal measure (e.g. transfers) available to the government to correct for the distributional effects of the environment tax.

Typically, the main cost of pollution is the increased toll it takes on people's health. The cost of congestion on the roads is the value of the additional time spent by commuters in getting to and from their places of work. While an increasingly wide set of methods is being applied by social scientists to measure the monetary value of these costs – including hedonic pricing (paying the price for a pleasurable outcome), contingent valuation, etc. – there continues to be a great deal of uncertainty about the exact magnitudes, and hence about the calculation of the benefits and costs from pollution abatement. But this is precisely the information required to calculate optimal environmental taxes.
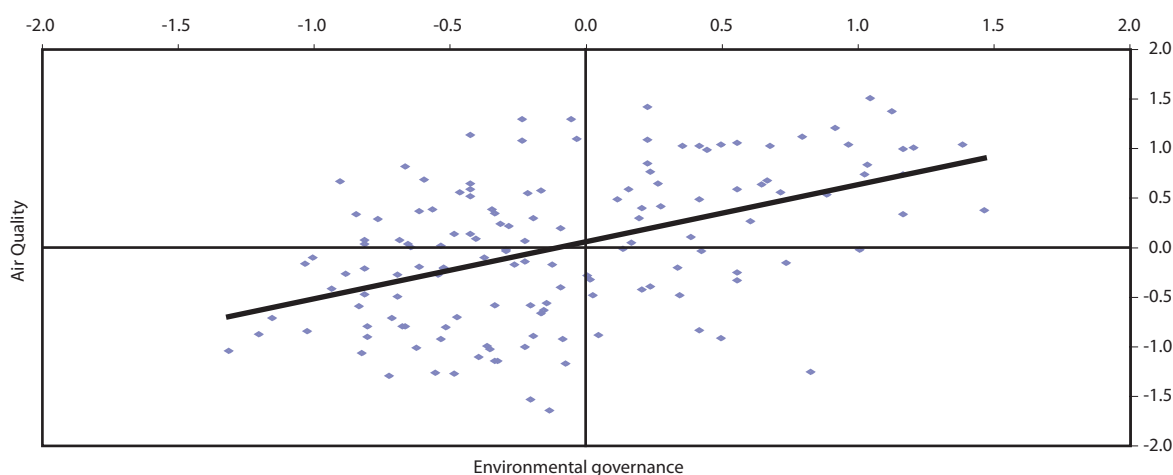
Perhaps the most important reason why governments use command and control measures instead of Pigouvian taxes is the cost of monitoring and enforcement. As noted above, calculating the Pigouvian tax rate is not a straightforward exercise. It requires knowledge of the cost of the pollution (monetary value of the increase in mortality or morbidity) at the optimal level of production. Command and control measures, such as mandated technologies, are much easier to monitor and enforce. Requiring that all motor vehicles be fitted with catalytic converters and enforcing this requirement through the motor vehicle registration system is far simpler than taxing emissions from motor vehicles.

Chart IIC.2
Environmental governance and water quality

Source: 2002 Environmental Sustainability Index.

Chart IIC.3
Environmental governance and air quality

Source: 2002 Environmental Sustainability Index.

Some evidence is available of the impact of sound environmental policies on the environment, be they emission taxes or command and control measures. In recent years, the Global Leaders for Tomorrow Environment Task Force of the World Economic Forum has attempted to measure environmental sustainability in one summary indicator and to rank countries on the basis of this index. As part of this exercise, the Task Force constructs indices which measure not only the health of the environmental system in a country (the quality of air, water, land and biodiversity), but also the quality of environmental governance. This is an indicator that depends on a number of variables including the percentage of land area under protected status, taxes on gasoline, the number of sectoral environmental impact assessment (EIA) guidelines, measures to reduce corruption, Forestry Stewardship Council (FSC) accredited forest area as a percent of total forest area, etc. Charts IIC.2 and IIC.3 have been compiled using this measure of environmental governance and indicators of air and water quality for about 141 countries. There is a statistically significant and positive relationship between the index of environmental governance and the quality of air and water. Countries that measure well on the governance scale generally have better water and air quality.

(d)   Trade when externalities are internalized

Facing consumers and producers with the correct prices or costs allows for the efficient allocation and use of society's resources. It ensures that society places a value on environmental resources and does not treat them as free goods. It enhances the prospects that trade liberalization will increase incomes without putting undue stress upon society's environmental resources.[135] This does not mean that pollution and environmental degradation will disappear or that they will never increase. While society places a value on both consumption (of goods and services) and the environment, the process of economic growth and development will require trade-offs to be made between more consumption and a better environment. The internalization of environmental externalities only means that society makes the trade-off at the maximum feasible level of production in terms of available choice, and not at some lesser level of output.[136]

At the same time, there is a need to recognize that as countries adopt more stringent environmental measures they can also cause trade frictions. This is because such measures apply not only to domestically produced goods but also to imported ones. The scope of these measures is quite wide, encompassing labelling, performance or emission standards, recycling, provisions for disposal, etc. Their application will raise production costs for domestic firms and may also do so for foreign producers who export to the country. The importance of ensuring coherence between the objectives of environmental protection and multilateral trade rules deserves

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[135]   See Bagwell and Staiger (2004). They have argued that the Subsidies and Countervailing Measures Agreement creates a tension with multilateral liberalization. By constraining the ability of governments to take domestic measures (such as subsidies and environmental taxes) to correct market failures, the Agreement would also limit the desire of those governments to reduce and bind tariffs at the multilateral level.

[136]   In economists' parlance, the choice is made on the frontier of the production possibility curve and not on some inefficient point within it.

emphasis. Policymakers will need to be sensitive to differences in environmental standards or preferences across countries. In practical terms, this may mean consulting closely with foreign suppliers in the process of drawing up environmental measures, particularly in sectors where imports represent a significant part of domestic use or consumption. More importantly, environmental measures will need to conform to basic trade obligations such as national treatment and they must not be more trade restrictive than necessary.

In what follows, a survey is undertaken of the results of simulations examining how trade liberalization, singly or in conjunction with appropriate environmental measures, affects the environment. These studies tend to confirm that coupling trade liberalization with appropriate environmental measures leads to higher incomes and improved environmental quality. In recent years, notable progress has been made in building computable general equilibrium models that include economy-environment interactions.[137] A number of key challenges have been solved in these models. They include linking changes in output and product composition to pollution emission levels, introducing endogenous technical change (which allows society to lower pollution intensities or increase energy efficiency over time), incorporating environmental policy measures (environmental taxes, tradable permits, command and control measures) into the models, allowing for substitution between various dirty inputs or between dirty inputs and primary factors of production, and introducing feedback from pollution on labour productivity, health and the welfare of the consumer.

The CGE models with an environmental focus can be broadly classified into three main groups. The first includes models developed to examine greenhouse gases and the potential threat of global warming. A non-exhaustive list of these models includes the OECD's General Equilibrium Environmental (GREEN) model[138], the Dynamic Integrated model of Climate Change[139], the Regional Integrated Model of Climate Change[140], the Model for Exchanging Regionalised Geographic Entities or MERGE[141], and G-Cube.[142] These models simulate the effects of aggregate economic activity and energy use on the emission of greenhouse gases and climate change, and examine the cost effectiveness of various measures, national and international, to curb these emissions.

There is a second and more eclectic group of models. They examine the impact of environmental regulations or environmental standards[143] and two-way links between the environment and the economy.[144]

A final group of CGE models are those in which the environmental impacts of various trade liberalization scenarios are considered. These include variants of the OECD General Equilibrium Environmental (GREEN) model[145], various applications employing the Global Trade Analysis Project or GTAP model[146], and models by Espinosa and Smith (1995), Lee and Roland-Holst (1997) and Reiner and Roland-Holst (2001). The simulations have been done for a range of countries, a number of them developing countries such as Costa Rica, Indonesia and Mexico, as well as regional trade agreements such as NAFTA (see Box IIC.1 for details of some of the simulation results).

[137]   Conrad (2002) has the most current survey of computable general equilibrium models incorporating economy and environment linkages.

[138]   Burniaux, Martin, Nicoletti and Martins (1992); van der Mensbrugghe (1994).

[139]   Nordhaus (1992).

[140]   Nordhaus and Boyer (2000).

[141]   Manne, Mendelsohn, and Richels (1995).

[142]   McKibbin and Wilcoxen (1992).

[143]   Conrad and Schröder (1993); Goulder et al. (1999); Jorgensen and Wilcoxen (1990).

[144]   Nordhaus (1994); Vennemo (1997); Bergman and Hill (2000); Conrad and Heng (2000).

[145]   Beghin, Roland-Holst, and van der Mensbrugghe (1995); Dessus and Bussolo (1998).

[146]   Tsigas, Frisvold and Kuhn (1997); and Strutt and Anderson (1999).

Box IIC.1: Simulating the environmental impact of trade liberalization

This box contains a summary of the results of recent CGE simulations of trade and environmental reforms.

Mexico: Beghin, Roland-Holst, and van der Mensbrugghe (1995) calibrated the OECD GREEN model for Mexico and used it to model the environmental impact of three policy scenarios: trade liberalization, implementation of piecemeal environmental policies (i.e. abatement taxes to reduce emissions), and trade liberalization *cum* emission reduction. These scenarios are compared to a twenty-year baseline, which projects the path of economic growth and environmental outcomes in Mexico, in the absence of the policy interventions. Adoption of abatement taxes lead to decreases in major pollutants, but reduced GDP and trade. Trade liberalization leads to a significant increase in trade and GDP, but also to an increase in all major pollutants. But when trade liberalization is accompanied by pollution abatement measures, GDP growth is accompanied by a decline in pollution emissions. The overall conclusion drawn from the study is that growth with an outward-oriented trade strategy can be sustainable because pollution emissions can be significantly mitigated over time.

Indonesia: Strutt and Anderson (1999) employ the Global Trade Analysis Project (GTAP) to examine the environmental impact on Indonesia of the implementation of the Uruguay Round agreements and APEC liberalization. These scenarios are to be compared to a baseline where Indonesia's economy and its level of air pollution, water pollution and water usage is simulated up to 2020. The simulations show that implementation of the Uruguay Round agreements actually reduces air pollution in Indonesia, primarily as a result of the product composition effect (reduction in trade and transport sector compared to the baseline). However, APEC liberalization adds a small increase to air pollution levels. Water use declines in both the Uruguay Round and APEC scenarios, primarily because paddy rice production declines as a result of trade liberalization. Most water pollution indicators decline with Uruguay Round implementation, although the effect of APEC liberalization is more mixed, with some indicators increasing and others declining.

Indonesia: Lee and Roland-Holst (1997) analyse the environmental impact of trade liberalization in Indonesia. Changes in the volume and composition of industrial production generates pollution. The pollution load is calculated using the pollution coefficients from the World Bank's Industrial Pollution Projection System and is linear in production. The emissions include air, water, and toxic pollutants. The paper simulates the effect of removing all of Indonesia's import tariffs. Trade liberalization results in an expansion in Indonesia's trade of about 6 per cent and a corresponding increase in GDP of about 0.9 per cent. But liberalization also leads to pollution rising at a rate greater than the increase in output. This is because liberalization leads to Indonesia specializing more towards environmentally 'dirty' industries. The paper then simulates both trade liberalization and implementation of a uniform emission tax to reduce pollution. The simulation shows that Indonesia is able to achieve both an increase in output (0.3 per cent) and a reduction in emissions.

Costa Rica: Dessus and Busolo (1998) employed a CGE model based on the OECD's GREEN model and calibrated for Costa Rica. It is a dynamic model (simulated over a horizon of 18 years, from 1992 to 2010) with 10 household categories, 40 production sectors, 16 types of labour and 13 different polluting emissions. An initial benchmark was created where the path of the Costa Rican economy over the 1982-2000 period was simulated. The paper then considered three major policy scenarios. First, pollution abatement, with each of the 13 polluting emissions being reduced by 25 per cent from the benchmark scenario over the period. Second, gradual trade liberalization with all of Costa Rica's trade barriers being eliminated by 2020. Third, combining trade liberalization with progressive reduction of emissions. Three main conclusions emerged from these simulations. First, abatement policy (an emissions tax) does not seem to involve any major cost in terms of reduced output. This is because pollution is reduced not through a decrease in output but through a change in the composition of output towards environmentally 'cleaner' sectors and because of substitution away from polluting intermediate goods towards the use of more primary factors of production - labour and capital. Second, trade liberalization increases Costa Rica's growth rate and expands trade by 30 per cent. But it also results in more pollution in Costa Rica with the scale, composition and technique effects all contributing to increased pollution. And third, the optimal policy for Costa Rica would involve a mixture of

liberalization and the tightening of environmental measures. Combining the two leads both to higher GDP growth, compared to the baseline, and to a reduction in emission levels.

United Kingdom: The paper by Espinosa and Smith (1995) is notable for incorporating the negative externalities associated with air pollution into a CGE model. They allow for emissions of sulphur dioxide, nitrogen oxide and particulate matter to affect morbidity and mortality rates. Increases in morbidity and mortality rates reduce societal welfare in two ways. Morbidity increases the subsistence levels of health expenditures in their Stone-Geary demand systems, while each death results in a deduction from the welfare measure equal to the monetary value of a statistical life. The paper considers the environmental effect in the UK of two alternative policies. One is a 50 per cent reduction in trade barriers in UK durables manufacturing. The other is the same reduction in trade barriers accompanied by an exogenous rise of 25 per cent in air pollution emissions. Reducing trade barriers in durable manufacturing in the UK still results in an overall increase in welfare despite the rise in morbidity and mortality from more emissions. The increase in morbidity and mortality rates from increased air pollution reduces welfare by only 0.09 per cent of GDP. This is exceeded by the efficiency gains from trade liberalization so that overall, welfare still increases by 0.19 per cent of GDP compared to the baseline.

Overall, the results from the trade and environment simulations suggest that the optimal policy is a mix of greater openness and more stringent environmental measures. Trade liberalization creates economic gains from exploiting a country's comparative advantage. However, some of these gains may be accompanied by increased emissions or pollution; hence, mitigating measures need to be taken to curb these effects. Nevertheless, the gains from liberalization will be more than sufficient to pay for these additional curbs or abatement measures so that increased incomes and an improved environment are both within reach.

(e)   Use of trade measures to address externalities

But what if there is no coherence in national policies and countries do not correct environmental externalities? Could not trade measures (tariffs, quotas or prohibitions) be used to correct the environmental damage? There are a number of multilateral environmental agreements which employ trade measures to deal with endangered species and ozone-depleting substances. What would be the benefits and costs of using a trade measure to address environmental externalities?

Recall that if environmental externalities were geographically confined to the territory of a country, then a trade measure (whether applied by that country or by its partners) would constitute a second-best policy response. The first-best option is still to apply a corrective measure to the source of the externality. As seen earlier, this principle removes the externality at the least cost to society in terms of foregone output. What is more, dealing with the problem by targeting some intermediate link such as trade may give with the impression that the externality has been managed, while leaving the underlying problem to fester.

Will the welfare evaluation change if the externality is transboundary or global in nature? It must be admitted that if a country is manufacturing a dirty good which damages the global commons, its authorities do not have the incentives to reduce fully the scale of manufacturing output since part of the cost is borne by foreigners rather than by its citizens. If there was a global regulator or a global government, it would have imposed environmental taxes on the country's industry equal to the marginal environmental damage it caused. This would have made sure that the country's industry took the damage to the global commons into account. In the absence of a global regulator, governments have often negotiated binding agreements limiting production of the dirty good. In some of these multilateral environmental agreements, trade measures are central to realizing the objectives of the agreements. While acknowledging the benefits that can arise from these conventions, the trade provisions in these agreements are still second-best policy responses that fail to address the sources of the environmental threat, whether these be to endangered species or to the ozone layer. In many countries, these threats that impact the global commons are symptoms of poverty or underdevelopment. It can thus be argued that there is a far more legitimate role for provisions such as financial transfers or technical assistance in these agreements, which alleviate the underlying causes of the environmental threat and do not carry the costs associated with restrictive trade measures.
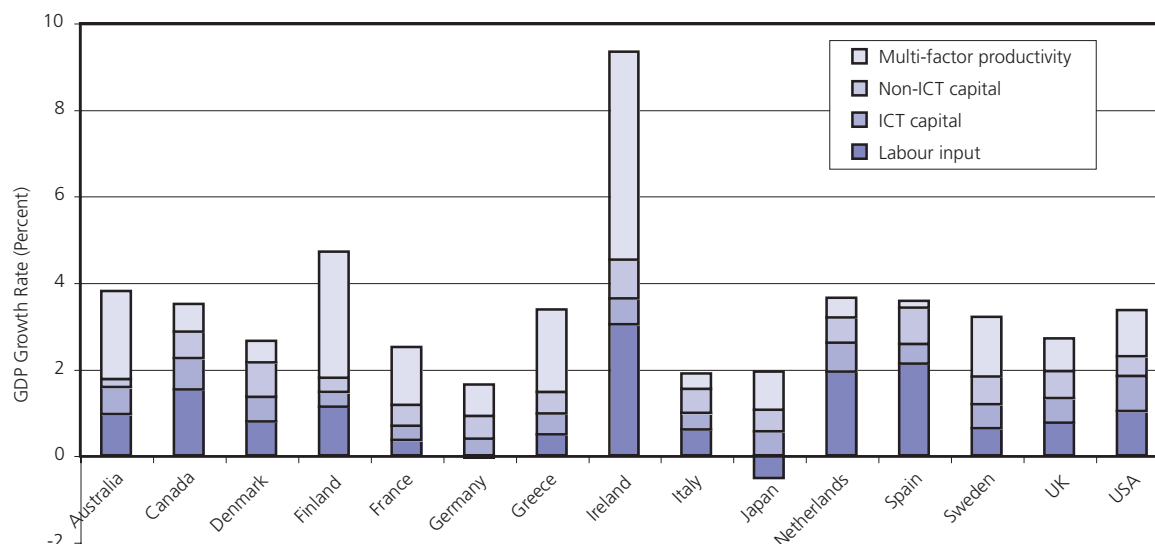
4. KNOWLEDGE AND POSITIVE EXTERNALITIES

This Section continues the discussion of positive externalities in the context of knowledge. The topic has received renewed attention in recent years as a result of endogenous growth theory[147], in the context of which knowledge creation plays a central role in explaining the long-term growth path of countries. Because consumption of knowledge is non-rival[148], it gives rise to an externality. This externality may not only be local or national in character, but knowledge can be diffused across national borders. The extent of this international diffusion may be important in determining how far per capita incomes, which vary widely now, will converge in the long run. In the absence of public intervention, these "goods" would be underprovided by the market, leading to less than the socially optimal levels of supply of knowledge. This Section will also consider the nature of optimal interventions and the role of trade policy in that mix.[149]

(a) Knowledge as an externality

Economic growth depends on the accumulation of capital and labour but more fundamentally on improvements in productivity. It is impossible to account for the massive increases in living standards in modern economies simply on the basis of capital accumulation.[150] The importance of productivity growth can be seen from its estimated contribution to the growth of selected OECD countries in the last decade (Chart IIC.4). In many of these countries, productivity is the single most important source of growth, explaining on average a little over 40 per cent of GDP growth.

Chart IIC.4
Contributions to growth of GDP, selected OECD countries, 1995-2001
(In percentage points)

Source: OECD, Productivity Database and Database on Capital Services, June 2003.

But productivity does not arise out of nothing. Resources such as capital and skilled labour need to be devoted to the production of knowledge and its transformation into products that will be demanded in the market place. This process takes place in the R&D sector of the economy, which could be considered as an industry on its own, but with a unique output. In 2001, the OECD countries spent about $645 billion (in current PPP terms) on R&D, representing some 2.3 per cent of their combined GDP.[151] About 70 per cent of this investment is undertaken by business enterprises. The leading investors in R&D as a proportion of GDP were Sweden

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[147] Romer (1986, 1990); Lucas (1988).

[148] This means that one person's use of knowledge does not affect another person's use of the same knowledge.

[149] See also WTO (2003a) which has a longer discussion of the role that trade plays in enabling countries to share more knowledge.

[150] The original conclusion arose from Solow's (1956, 1957) work in growth accounting.

[151] OECD (2003h).

(3.7 per cent), Finland (3.4 per cent) and Japan (3.1 per cent). While there is far less information available for non-OECD countries, the picture that emerges from what is available indicates that they generally spend less than 1 per cent of their GDP on R&D (Table IIC.3).

Since the richer countries tend to invest a larger proportion of their output on R&D, the bulk of R&D spending in absolute terms is accounted for by the developed countries. This points to the very skewed distribution of R&D spending in the world. Even among OECD countries, Japanese and US spending on R&D represent over 61 per cent of the total.

An important feature of the R&D process is that the quantity of new knowledge produced depends not only on the amount of resources, scientific manpower, laboratories, equipment, etc. that are funnelled to the activity, but also on the existing stock of knowledge. Knowledge creation involves a positive externality. Not only does a firm's investment in R&D increase the probability of generating new and useful knowledge for itself, it also increases the stock of knowledge, which will indirectly make other firms in the industry or even beyond more productive.

As already noted, the reason why knowledge generates a positive externality is that its consumption is non-rival.[152] Once knowledge is discovered, its use by some does not lead to a reduction in the ability of others to use it for a similar or different purpose. This does not prevent society, however, from devising principles of exclusion (such as intellectual property rights) for some forms of knowledge. In this case, while the use of the discovery itself is non-rival, the nature of societal and economic institutions may make its use excludable.

Table IIC.3
R&D spending as a per cent of GDP: selected OECD and non-OECD countries
(Percentage)

Countries	2000[a]
Low income	
India (1995)	0.64
Kyrgyz Republic (1995)	0.29
Madagascar (1995)	0.18
Moldova (1995)	1.13
Uganda (1995)	0.59
Ukraine	0.95
Lower middle income	
Bolivia	0.29
China	1.00
Colombia	0.25
Cuba	0.49
Egypt, Arab Rep.	0.19
Macedonia, FYR (1995)	0.52
Romania	0.37
Russian Federation	1.00
Thailand (1995)	0.13
Tunisia	0.45
Upper middle income	
Argentina	0.45
Brazil	0.77
Chile	0.54
Estonia (1995)	0.62
Latvia (1995)	0.52
Venezuela	0.34
High-income non-OECD	
Israel (1995)	2.24
Singapore	1.88
Slovenia (1995)	1.68
OECD	
Australia	1.53
Canada (2001)	1.94
Czech Republic (2001)	1.30
Finland (2001)	3.40
France (2001)	2.20
Germany (2001)	2.49
Hungary (2001)	0.95
Italy	1.07
Japan (2001)	3.09
Korea, Rep. (2001)	2.96
Mexico (1999)	0.43
Netherlands	1.94
Poland (2001)	0.67
Slovak Rep. (2001)	0.65
Sweden (2001)	4.27
Switzerland	2.63
Turkey	0.64
United Kingdom (2001)	1.90
United States (2001)	2.82

[a] Data for most recent year available.

Source: OECD MSTI Database (May 2003); World Bank World Development Indicators.

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[152]   Nelson (1959); Arrow (1962).

Table IIC.4
Estimated social rates of return to R&D

Study	Social return (per cent)	Number of observations (industries)	Years
Sveikauskas (1981)	17	144	1959-69
Griliches (1994)	30	143	1978-89
Griliches and Lichtenberg (1984b)	34	27	1969-73
Terleckyj (1980)	107	20	1948-66
Scherer (1982)	103	87	1973-78
Griliches and Lichtenberg (1984a)	71	193	1969-78

Note: The dependent variable is average TFP growth in an industry over the years indicated, except for Scherer (1982), who uses labour productivity growth in the capital-labour ratio as a regressor.

Source: Jones and Williams (1998).

This means that the returns from R&D include not only the additional revenues earned by the firm on its investment, but also the consequent increase in productivity experienced by other firms in the industry or the economy. There is an extensive literature estimating the social return from investment in R&D. Table IIC.4 gives a sample of the estimates from a number of key studies in this large empirical literature. Despite the wide range of these estimates (from a low of 17 per cent to a high of 107 per cent) the overall message is that spillover effects are important.

(b) International Spillovers

The externalities associated with knowledge and knowledge creation do not necessarily stop at a country's borders. The empirical evidence of technology diffusion seems to be strong. Eaton and Kortum (1996) developed a specific general equilibrium model of the inventive and technology process and estimated it using the OECD countries for their sample. They found strong evidence of international diffusion although the rate was about half as strong as domestic diffusion. They estimated that with the exception of the United States, all other OECD countries derived the bulk of their knowledge-based growth from inventive activity conducted in other OECD countries. Focusing on the five leading research economies (United States, Japan, Germany, United Kingdom and France), they found that the United States and Japan were the source of at least two thirds of the growth in each of the countries in their sample.[153] Keller (2002) also found evidence that technology diffusion is becoming more international. Using a partial equilibrium approach, he estimated that between 1983 and 1995 the contribution of technology diffusion from five countries (United States, Japan, Germany, United Kingdom and France) constituted almost 90 per cent of the total R&D effect on productivity in nine other OECD countries.

There are a number of possible conduits for the international spillover of knowledge including international trade, the movement of natural persons (particularly, but not limited, to scientific personnel) and cross-border direct investments. In studies conducted so far, the evidence of spillovers has been strongest with respect to foreign direct investments and trade.

There are a number of reasons why FDI can be an important vehicle of technological spillovers. A large part of the stock of FDI comes from the most technologically advanced countries. In 2002, the United States, Japan, United Kingdom, France and Germany accounted for about 60 per cent of global FDI stock.[154] The flows of technology to affiliates of MNCs dominate all other types of formal technology transfers between countries.[155] Workers employed by foreign firms can accumulate knowledge which could be transferred when they move to domestic firms. MNCs who locate in less advanced economies can create positive spillover effects if domestic firms copy their best practice technology and management practices.

But the early empirical literature on spillovers tended to produce mixed results. Haddad and Harrison (1993) cast doubt on the existence of these spillovers in their study of MNCs in Morocco. Aitken and Harrison (1999) found no evidence of a spillover effect in their study of over 4,000 firms in Venezuela. Meanwhile, Larrain, Lopez-Calva, and Rodriguez-Clare (2000) concluded that Intel's investment in Costa Rica generated substantial benefits for the local economy.

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[153] Eaton and Kortum (1999).

[154] Based on data from UNCTAD (2003c).

[155] Bloomstrom, Kokko and Zejan (1994)

However, the more recent empirical studies have tended to provide more evidence about positive spillover effects from FDI. Blomstrom and Sjoholm (1999) found strong evidence that MNC presence in Indonesia has benefited domestic establishments by increasing labour productivity. Haskell, Pereira and Slaughter (2002) estimated that a ten percentage point increase in foreign presence in a UK industry raised the total factor productivity (TFP) of that industry's domestic plants by about 0.5 per cent. Keller and Yeaple (2003) found an even greater impact of FDI spillovers. They estimated that about 14 per cent of productivity growth in US firms between 1987 and 1996 could be accounted for by FDI. In the case where both the source and host countries are developed countries, there seems to be a suggestion of two-way spillovers. Using patent citations as a measure of technological spillover, Branstetter (2000) found evidence that Japanese FDI in the United States increased the flow of knowledge spillovers both from and to the investing Japanese firms.

In the case of international trade, several channels have been identified which could explain how productivity is spread across countries.[156] One is the availability through trade of intermediate products and inputs which a country could not have produced on its own. Second is the opening of channels of communication that allow learning of production methods, design, and marketing from advanced countries. Third, international trade increases the opportunities for the copying or reverse-engineering of foreign technologies. Lastly, the learning made possible by international economic relations reduces the cost of future innovation and imitation.

Empirical work to link the international diffusion of technology with international trade has had mixed results. Studies which have examined more specific categories of trade, e.g. capital goods, have been more successful in linking trade flows with technology diffusion and its impact on productivity.

Initially, Coe and Helpman (1995) and Coe, Helpman and Hoffmaister (1997) included a variable representing the foreign stock of knowledge (mainly the R&D stock of industrial countries) in total factor productivity regressions and showed that this had a positive and significant effect. The variable was constructed as a weighted sum of the R&D expenditures of the country's trade partners where the weights are given by the bilateral import shares. This particular construction implied that the magnitude of the R&D spillover effect depended on the volume of a country's trade with those industrial countries undertaking the R&D. However, Keller (1998) later showed that the same positive effect on productivity could be reproduced by a measure of R&D stock which had import weights that were randomly chosen. Hence, while some indicators of foreign R&D still affected a country's productivity, the impact did not depend on how much it traded with those foreign countries.

However, the analysis was conducted at a high level of aggregation using total imports as weights in the measure of foreign R&D. Subsequent research has sought to focus on imports of specific products which could more readily embody foreign R&D activity, e.g. capital goods. Xu and Wang (1999) obtained stronger results by using as weights the import share of capital goods instead of total imports. Eaton and Kortum (2001) also found a role for capital goods trade in explaining productivity differences across countries. They found significant differences in the relative prices of equipment, about half of which they ascribed to barriers to trade. They were able to attribute about 25 per cent of cross-country productivity differences to this variation in the relative price of equipment.

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[156]   Grossman and Helpman (1991); Helpman (1997).

(c)   Public policy

Given that technology spillovers have both a national and international dimension, policy interventions necessarily have to contain elements of both. The problem that arises from the existence of the externality is that firms contemplating investments in R&D do not profit from the increased productivity of other firms. On their own, firms will underinvest in R&D and create less than the socially optimal amount of knowledge. The failure of markets to provide enough incentives for firms to undertake the right amount of investments in R&D has led to public funding of basic research (whether in government institutes or universities), patent protection laws and R&D tax credits. There are, of course, other measures not directly targeted at R&D, such as competition policy, which may have also have an impact on the level of R&D investment by private firms.

Public sector investment in R&D averages about 0.3 per cent of GDP in the OECD countries. Typically, public money has been spent supporting basic research, since there is a presumption that while the social returns are high, they are less appropriable by business enterprises than other more commercially-oriented research. Public support may also be necessary due to the intrinsic riskiness of basic research (one is never sure how useful the outcome will be) and the long gestation periods between the conduct of the research and the development of commercially viable outputs. In many cases, the public sector not only allocates funding among competing research proposals but actually carries out R&D in state universities, laboratories and research institutes.

The business sector also undertakes a substantial part of basic research and this seems to contribute significantly more to the productivity of firms than publicly supported basic research.[157] This raises the question of how well the public sector chooses among competing basic research projects. Since the difficulty for firms to appropriate the social returns from basic research is the problem, an alternative way to support basic research is to subsidize what is done by the private sector. The subsidies could take the form of R&D tax credits. This may make better use of available public resources, since the private sector will have a better feel for which research topics are likely to contribute more to increasing their future productivity than government bureaucrats.

In the case of foreign investments, greater receptiveness to FDI is obviously called for. Host country and host industry characteristics combined with the policy environment in which multinationals operate appear crucial for facilitating spillover effects.[158] Policies that encourage domestic market competition can increase the pace of technology transfer from MNCs as they strive to maintain their edge.[159] Improving the educational levels and skills of the domestic labour force may also encourage higher technology transfers and increase the likelihood of positive spillovers.[160] This reflects the concern that spillovers may not materialize if the technological gap between the host environment and the foreign firm is too large.

There is also a suggestion of a differentiated approach to encouraging the diffusion of knowledge from external sources. The differentiation is based on a stylized story of technological development, where countries progress in steps up a technology ladder, from being technologically backward, to imitation and finally to innovation. Hence, for countries that have weak absorptive capacity (low-income countries), the focus may be on maintaining a liberal trade and investment regime, investments in education, and basic IP protection and standards. For countries who may be at the imitation stage, IPRs can be further strengthened by adopting standards for patentability, novelty, and utility that are more than those found in the industrial countries.

Finally, the role of international trade as a conduit for knowledge-related externalities points to the very high dividends from trade liberalization. Countries not only derive (static) benefits from trade liberalization through the increased efficiency in resource allocation, they also obtain the (dynamic) benefits of increased productivity which increases the rate of economic growth. This means that the benefits of liberalization are not confined to a once-and-for-all increase in welfare but are sustained over time.

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[157]   Griliches (1986).

[158]   Blomstrom and Sjoholm (1999).

[159]   Wang and Blomstrom (1992).

[160]   Blomstrom and Kokko (1995).