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ENVIRONMENT, TRADE, POLITICAL ECONOMY AND IMPERFECT INFORMATION – A SURVEY

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Abstract

The last ten years have seen an upsurge in interest in the nexus of trade and environmental policies. In part this reflects the need to deal with major global pollution problems, and in part a concern that globalisation may have adverse impacts on the environment. Environmentalists worry that globalisation may trigger a race-to-the bottom in environmental standards. While they would like to see upward harmonisation in environmental standards, they are sceptical about the ability of supra-national agencies to achieve this. Industrialists also raise concerns about the need for a 'level playing field' in environmental regulations because of fears about the impact of environmental regulations on competitiveness. On the other hand, developing countries question whether disputes over differences in environmental regulations simply reflect a covert form of 'green protectionism'. In this paper we review what light recent developments in economic analysis (conceptual and empirical) can shed on these concerns. We begin with conventional trade models in which government bodies have perfect information and are welfare maximisers, and show that this analysis does not provide much support for the concerns or proposed policy recommendations. We then turn to models of political economy and imperfect information to see whether they provide a better explanation for the concerns and policy recommendations.

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ABSTRACT

The last ten years have seen an upsurge in interest in the nexus of trade and environmental policies. In part this reflects the need to deal with major global pollution problems, and in part a concern that globalisation may have adverse impacts on the environment. Environmentalists worry that globalisation may trigger a race-to-the bottom in environmental standards. While they would like to see upward harmonisation in environmental standards, they are sceptical about the ability of supra-national agencies to achieve this. Industrialists also raise concerns about the need for a 'level playing field' in environmental regulations because of fears about the impact of environmental regulations on competitiveness. On the other hand, developing countries question whether disputes over differences in environmental regulations simply reflect a covert form of 'green protectionism'. In this paper we review what light recent developments in economic analysis (conceptual and empirical) can shed on these concerns. We begin with conventional trade models in which government bodies have perfect information and are welfare maximisers, and show that this analysis does not provide much support for the concerns or proposed policy recommendations. We then turn to models of political economy and imperfect information to see whether they provide a better explanation for the concerns and policy recommendations.

Keywords: trade and environment, environmental dumping, green protectionism, harmonisation, asymmetric information, political economy, lobbying, environmental policy coordination.

JEL Classification: F18, F02, F42

1 Introduction

The links between environmental policy and international trade have been a very prominent item in public policy debates over the last decade. This prominence was fuelled by a number of concerns. The first was probably the increasing awareness of transboundary or even global environmental problems such as acid rain, ozone depletion and climate change. To deal with such problems required international environmental agreements (IEAs) and it was recognised that standard free-rider problems might make it difficult to get effective agreements. However, in the presence of increasing international trade these difficulties might be exacerbated by the 'leakage' problem: action to regulate pollutants by any group of countries (or individual country) might encourage production and associated pollution to switch to unregulated countries. This led to the call to back IEAs with trade measures, which raises the question of how such measures would be viewed by GATT/WTO.

A second concern was that even with purely local pollution problems, liberalisation of trade and capital flows might pose a threat to the environment. The increasingly vociferous campaign against globalisation has argued that trade liberalisation would first expand production, consumption and transport of goods, exacerbating damage to the environment and second make governments more concerned about the loss of competitiveness if they set tougher environmental policies than other countries. Governments might then set weaker environmental standards than warranted by environmental damage costs ('environmental dumping'), causing a 'regulatory chill' or even a 'race-to-the-bottom' in environmental standards as governments competed to attract internationally mobile capital (Esty (1994)). It was argued that countries that wanted to set tough environmental standards should be able to protect themselves against weaker standards elsewhere by imposing countervailing trade measures, but, at least if these involved production and process methods (PPM), such measures would be outlawed by GATT (as confirmed by the famous tuna-dolphin case). Fears about 'environmental dumping' led to a call for some supra-national agency to coordinate and even harmonise environmental standards across countries, although many

environmentalists were sceptical about a body such as WTO playing this role, fearing it had been captured by transnational companies, and would always privilege free trade over the environment. The call for harmonisation of environmental standards was supported by industrialists arguing for a 'level playing field', but strongly opposed by developing countries who saw this as a form of 'green protectionism', denying them an ability to exploit one source of comparative advantage – a relatively undamaged environment.

Finally there have been a large and growing number of trade disputes over national product standards. The typical pattern is, that a country implements a new product regulation, which it argues to be necessary for either consumer or environmental protection, while importers to that market challenge the regulation as a "disguised barrier to trade" or simply "green protectionism". The EU and the United States have, for example battled intensively over imports of genetically modified food into the EU and have spent a decade in court over hormones found in US beef exports to Europe. Supra-National Institutions, such as the WTO and the European Court of Justice, were forced to rule on such trade disputes and have frequently struck down the contested national regulations as unnecessarily trade restrictive. This has left environmentalists with the conviction that in our increasingly globalised world national environmental standards are at the mercy of politically unaccountable supra-national institutions, which they suspect to be willing to promote international trade at the expense of sound environmental protection.

Alongside this public debate there has been a substantial growth in the economics literature on trade and the environment. In part this reflected the natural wish for researchers to address issues of current concern, but also the development of new tools with which to address the issues[1]. There are already a number of surveys of this literature including some written by ourselves (Dean (1992), Wilson (1996), Ulph (1997a,b), Rauscher (2001), Schulze and Ursprung (2001), Sturm (2002)). However in this survey we shall give more emphasis to recent work, including some of our own, which stresses

[1] There is now a new JEL- code for this field– F18.

the importance of political economy aspects and informational problems, and the difficulties these might pose for resolving environmentally driven trade disputes. In the next section we give an overview of the conventional literature, which assumes welfare-maximising governments and perfect information. In section 3 we introduce informational problems, in section 4 political economy issues, and in section 5 we argue that it is the interaction between informational problems and political economy that poses the real challenge.

2 Environmental and Trade Policies with Welfare Maximising Governments and Perfect Information

In this section we begin by looking at what economic analysis has to say by asking what would be the optimal trade and environmental policies in the absence of any constraints. We then turn to second-best environmental and trade policies if there are constraints on policies. In considering optimal policies we shall need to distinguish between what might be optimal from the perspective of an individual country acting in its own self-interest from what might be globally optimal. We shall do this successively for models of a small open economy, a large open economy, imperfect competition, and mobile factors or plants. For ease of exposition we concentrate on pollution linked to production (PPM); in the main one can address pollution linked to consumption by reversing the roles of exports and imports. Finally we survey the empirical literature.

However before doing so we state a central theme. In the 1970s and 1980s, with a few exceptions we shall mention, there was little interaction between environmental economics and international economics. This did not reflect academic blinkers. It stemmed from a central tenet in economics: the importance of policy targeting. This states that if policy-makers need to address a number of issues, then an efficient response requires they use at least as many policy instruments as the number of problems they are trying to tackle, that they should target specific instruments to deal with specific problems, and the most efficient instrument is likely to be one that focuses directly on the problem it addresses. In the context of trade and environment this means trade policies

should address trade issues and environmental policies should address environmental issues[2]. If environmental policies are set to deal appropriately with environmental problems, then one can discuss the setting of trade policies without considering their effect on the environment; similarly if trade policies are set appropriately to meet trade objectives, then one can discuss the design of environmental policies without considering their impact on trade. As we shall see the major linkages between these policy areas arise when constraints are imposed on policies in one or other arenas, and one needs to ask seriously how real these constraints are.

As a related point it is worth setting out the economists' benchmark of the ideal, or first-best, global allocation of resources. This can be supported by competitive markets, free trade, and, what are called, Pigouvian environmental regulations, which ensure that, at the margin, environmental damage costs just equal the cost of abating pollution, and these marginal abatement costs are the same for all polluters. For a global pollutant, like CO2 emissions, the relevant marginal damage costs are the total additional costs aggregated across all countries in the world. This first-best allocation illustrates the targeting principle: free trade is what trade economists argue for in the absence of any consideration about the environment and Pigouvian environmental policies are what environmental economists argue for in the absence of any consideration about trade. We shall be interested in whether a government sets too lax environmental policies (marginal abatement costs below marginal damage costs), which is sometimes called 'environmental dumping', or too tough environmental policies (marginal abatement cost above marginal damage cost) which is sometimes called 'environmental protectionism'.

2.1 Small Open Economy.

The natural starting point for examining trade and environment linkages is the small open economy model of perfectly competitive markets, countries which are too small to influence world prices and welfare maximising governments (Baumol (1971), Pethig

[2] A good illustration of this principle can be found in the discussion in Anderson (2000) of how 'multifunctionality' of agriculture should be handled in relation to WTO rules.

(1976), McGuire (1982), Merrifield (1988), Krutilla (1991), Copeland (1994), Neary (2000) amongst others).

With no transboundary pollution, optimal policies for each country would be to have free trade and Pigouvian environmental policies, for the obvious reason that the only market failure in such a world is the environmental externality and government policy should correct this efficiently. Note that this is true for each country irrespective of whether other countries pursue such policies. Comparative advantage applies: amongst countries with the same relative endowment of other factors, those which are well-endowed with environmental resources (in a general sense – see Rauscher (2001)) will export goods which are on average 'dirty' goods, while those which have relatively scarce environments will export 'clean' goods. But technologies may be such that 'dirty' goods are also capital intensive in production, and so which countries actually produce 'dirty' goods will depend in a more general way on factor endowments[3]. In general there is no reason to believe that countries will set the same environmental standards.

Turning to second-best policies, if, for some reason, a country had an irremovable tariff in place, this would affect environmental policy. If the tariff encouraged too much production of the dirty good, then environmental policy should be made tougher than Pigouvian to offset this trade distortion. Similarly if there was inadequate environmental policy it might be desirable to adjust trade polices; if there was inadequate internalisation of environmental damages on a good that was exported it might be better to have a tariff on exports. But trade policies will rarely be even second-best policies for dealing with environmental damage. If pollution emissions are linked to production then if it not possible to tax emissions directly it will be better to tax production, rather than taxing exports. Trade policies may even be counter-productive: preventing exports of timber products may so reduce the value of forests that it encourages land clearance for agriculture (WTO (1999)).

[3] There may also be production externalities from environmental damages which affect productivities, and these could dominate factor endowment effects (Copeland and Taylor (1999)).

Another way of stating these results is to consider trade liberalisation. Provided environmental policies properly internalise environmental damages, trade liberalisation benefits all countries. If there are inadequate environmental policies, trade liberalisation may not be beneficial to some countries, but, as argued, trade instruments are unlikely to be second-best ways of dealing with environmental policy failures. What about the impact on the environment? Following Grossman and Krueger (1993), Antweiler, Copeland and Taylor (1998) this can be decomposed into 3 effects. The *composition effect* says that countries will change the mix of goods they produce to reflect comparative advantage; if environmental policy is set by an emission tax and this remains unchanged, the composition effect will worsen the environment in countries with a comparative advantage in producing dirty goods and improve it in countries with a comparative advantage in producing clean goods. Second, there will be an adjustment in environmental policy which will affect will affect how goods are produced – the *technique effect*. In the country exporting dirty goods, environmental policy will need to be tightened, and relaxed in countries importing such goods. Finally there is a *scale effect*. Trade liberalisation will raise income in all countries, which will induce expansion of demand for all normal goods, including the environment. So this could both increase demand for dirty goods while leading to a further tightening of environmental policy. The net impact of all three effects is ambiguous, and so it is an empirical matter how trade liberalisation affects the environment. With a strong enough income effect on demand for a cleaner environment, it is possible that trade liberalisation will not only raise welfare in all countries, but also lead to a cleaner environment in all countries.

Finally we consider what happens if there is transboundary pollution. Countries acting non-cooperatively in their own self-interest will again choose free trade and environmental policies which fully internalise their own *domestic* damage costs, but will ignore the effects of their pollution on other countries. For transboundary pollution it is global damage costs that matter, so this outcome will not be globally efficient. However, because countries are small they cannot affect world prices and hence cannot affect pollution generated in other countries, so there is nothing that can be done through trade

policies to affect this outcome. The only solution is for countries to cooperate through an IEA.

To summarise, in this kind of world many of the concerns outlined in the introduction do not arise. Trade liberalisation brings welfare benefits to all countries provided environmental damages are internalised through environmental policies. Whether this translates into a cleaner environment in all countries is an empirical matter but it is not precluded. There is no reason to believe governments will engage in either environmental dumping or environmental protectionism. Environmental policies are quite likely to differ across countries and this is not damaging to competitiveness, it is a reflection of the playing out of comparative advantage. There is no case for harmonising environmental policies or even coordinating them for purely domestic environmental issues. The only area where there is a need for supra-national intervention is to deal with transboundary pollution.

2.2 Large Open Economy.

We now suppose that some countries are large enough to be able to influence world prices in some markets (see Markusen (1975), Rauscher (1997), Neary (2000)). How does this change the previous analysis?

In the absence of transboundary pollution, the optimal policies from the point of view of an individual country acting independently is to use trade policies to exploit market power and Pigouvian policies to deal with environmental problems (the policy targeting principle again). Trade policies will consist of an optimal tariff on exports (to drive up the price the country receives for its exports at the expense of foreign consumers), or an optimal tariff on imports to drive down the price it pays for imports (at the expense of foreign producers). As this implies, these attempts by a country to change the terms-of-trade in its favour damage other countries, so this outcome is not globally efficient. Some, and maybe all, countries will be worse off than if they could commit to free trade. Global efficiency is again secured by free trade and Pigouvian environmental policies.

Turning to second-best policies, if a country has a tariff which it cannot adjust and which differs from the optimal tariff, it will want to adjust its environmental policy to reflect this. So if, say because of trade liberalisation, it cannot impose tariffs, then where it is an exporter and has market power it will set environmental policies which are tougher than Pigouvian (to restrict domestic supply and hence drive up the world price it receives), while if it is an importer it will set policies weaker than Pigouvian (to expand domestic supply and hence drive down the world price it pays). There is no reason to believe there will be a systematic tendency for all countries to engage in either environmental dumping or environmental protectionism. On the other hand if a country, for some reason, is unable to set Pigouvian environmental policies, there may be a case for adjusting trade policies to reflect this, in the way analysed in the small economy case, but again it is unlikely that trade policies are even second-best policies to address environmental problems.

However there is now a possible additional argument for adjusting trade policy (see Rauscher (2001)). Suppose a foreign country was not fully internalising its environmental damage costs[4] in its export sector (so it was engaging in environmental dumping). This will encourage excessive exports and drive down the terms-of-trade against the exporter[5]. A countervailing import tariff equal to the (implicit) subsidy set by the exporter will re-establish global efficiency, and give a further improvement in the terms of trade to the importer. This is just the analogue of standard anti-dumping arguments. But notice it is a pure terms-of-trade argument. It has nothing to do with protecting the domestic environment (which may actually worsen).

[4] This is *not* the same thing as having a weaker environmental policy than another country; it is a policy weaker than the Pigouvian policy appropriate for that country.

[5] It is not clear why the foreign country would do this, since, as just noted, its optimal policy is to set too tough an environmental policy for terms-of-trade reasons. A similar argument could be made if the foreign country was, more plausibly, engaging in environmental dumping in its import competing sector. This would move the terms-of-trade in favour of the foreign country. The home exporting country would then have to subsidise its exports to correct for this, but this would further move the terms-of-trade in favour of the foreign country.

Turning to trade liberalisation, the arguments are as before. If countries use Pigouvian environmental policies to control pollution then trade liberalisation improves welfare in all countries. Note there is now a need for some supra-national agency to help achieve trade liberalisation since it is not in the self-interest of individual countries to impose free trade (see Maggi (1999), Bagwell and Staiger (1999) for analyses of why something like the WTO is necessary). Since we know that, if trade instruments are banned, countries with market power will want to set environmental policies that differ from Pigouvian, trade liberalisation may not make all countries better off than autarky. However we can use a variant of an argument by Walz and Wellisch (1997) (to be discussed in the next section) to suggest that countries may be better off with free trade and optimally chosen non-Pigouvian environmental policies than with optimally chosen trade policies and Pigouvian environmental policies. The argument is that in both cases, attempts by countries to shift terms-of-trade in their favour, whether directly by trade policies or indirectly by environmental policies, impose externalities on others, and if these are mutual externalities, then, as said earlier it is possible that all countries are worse off than in the first-best of free trade and Pigouvian taxes. But distorting environmental policies imposes a direct welfare cost on countries, whereas using trade instruments does not (this ignores costs of raising public funds), so there will be less distortion if countries use environmental policies than if they use trade policies. So while neither outcome is globally efficient, it may be possible to rank them, and favour the outcome with trade liberalisation.

In terms of the effect of trade liberalisation on the environment, the analysis in terms of composition, technique and scale effects is still applicable, although the actual effects will be rather different for the reasons set out above. In particular the technique effect may need to reflect the fact that environmental policies will not be adjusted in a Pigouvian manner.

Finally, we consider what happens if there is transboundary pollution. As in the small country case, a country acting non-cooperatively in its own self-interest will ignore the effect of its emissions on other countries. But it needs to consider the impact of their

pollution on its own environment. In the small country case there was nothing it could do about it. In the large country case it can, by acting to lower world prices and so discourage foreign production and pollution (Markusen (1975), Baumol and Oates (1988), Rauscher (1997)). Using trade policies it can do this by subsidising exports or taxing imports. If trade policies are not allowed, it can do this by weakening domestic environmental policies. In both cases it is accepting a bit more domestic pollution for a reduction in foreign pollution. Of course these interventions by individual countries are not globally efficient. The globally efficient policy is again free trade, and Pigouvian environmental policies, with IEAs to ensure that for transboundary pollution problems countries set policies to balance domestic abatement costs against global damage costs. This is just the policy targeting principle.

To summarise, some form of supra-national intervention may be necessary to secure free trade, to ensure that countries do not distort domestic environmental policies as a proxy for trade policies and to deal with transboundary pollution problems. But there is no suggestion that there will be a race-to-the bottom (or the top) in environmental policies; nor will it be generally desirable to harmonise environmental policies[6].

2.3 Imperfect Competition and Strategic Policy Making.

In the previous sub-sections it was assumed that there were sufficient firms in each market for markets to be treated as perfectly competitive. We now consider how arguments might differ if, because of scale economies relative to market size, there are relatively few firms competing internationally. The prototypical model that has been used is a variant of the famous Brander-Spencer (1985) model where a small number of firms, each located in a different country, produce a homogeneous good which is exported to another set of countries. The firms compete by setting quantities, taking as given the outputs produced by their rivals. Brander and Spencer showed that governments would have incentives to set export subsidies, to lower the costs of their domestic producer and

try to increase the market share of their domestic firm and hence get a bigger share of the industry profits ('rent-shifting'). Of course if all countries do this, it just expands industry output and drives down industry profits.

The variation is to have production generate pollution which might be abated, at a cost (see Conrad (1993), Barrett (1994), Kennedy (1994), Ulph (1996a)). Optimal policies from the perspective of each government would be to set a Brander-Spencer export subsidy and a Pigouvian environmental policy. But the interesting second-best policy arises when trade policies are not available. Now it will pay all governments to set weaker environmental policies than Pigouvian, because this will act like the missing export subsidy to lower domestic production costs. So now we have a model which could explain 'environmental dumping' by all governments. But it is not a 'race-to-the bottom' in the sense that environmental policies are abandoned. Indeed, as Barrett (1994) notes, assuming that export subsidies are costless to raise, the extent of implicit subsidisation using environmental policies will be less than with trade policies, because relaxing environmental policies has a real welfare cost. This is what underlies the argument by Walz and Wellisch (1997) referred to in the last section. When all governments try to get greater market shares for their producers, they end up with self-defeating policies in which industry output is expanded, industry profits reduced, and, if they use environmental policies, increased environmental damage. But because the extent of subsidisation is less when governments are restricted to environmental policies than when they can also use trade policies, all the producing countries can be better off when trade policies are restricted.

If there is transboundary pollution, then, as in the large country case, countries have an interest in reducing foreign production and hence pollution, and this just increases the size of the export subsidy (whether direct or indirect through a weakened environmental policy (Kennedy (1994)).

[6] The only situation where there may be a case for harmonised policies is where there is a uniformly mixed global pollutant such as CO2 emissions, where efficiency would require all countries an emission tax equal

While it looks as if this provides a basis for environmentalists' concerns about environmental dumping, the problem is that the conclusions are by no means robust to changes in assumption, of which we mention just three. If firms compete in price, rather than quantity, then the incentive is for governments to impose an export tax, or, if that is outlawed, to set environmental policies tougher than Pigouvian (Barrett (1994), Ulph (1996b)). The reason is that firms are undercutting each other in price. And whereas, when firms compete in outputs, if one firm did expand output others would reduce their output, when they compete in price if one firm raised its price, other firms would do likewise. The strategic incentive for a government is to get firms in other countries to raise their prices, and they do this by inducing the domestic firm to raise its price by driving up its costs, either through an export tax or environmental policies than Pigouvian[7]. This also means that the collective actions by governments will raise market price and hence industry profits. But for the same reason given by Barrett (1994), the extent to which prices rise will be less when governments use environmental policies than when they use trade policies. So, as Sturm (2000) shows, this can reverse the Walz and Wellisch (1997) conclusion that producing countries will be better off when they are restricted to using only environmental policies as opposed to also using trade policies.

A second modification to the prototypical model is to have several firms located in one country (Barrett (1994), Althammer and Bucholz (1995)). The government is now concerned both with competition between domestic producers and foreign rivals, for which an export subsidy or a weak environmental policy would be needed, and about competition between domestic producers, which leads to excessive domestic production, for which an export tax or a strong environmental policy would be needed (the analogue of the argument for a large exporting country discussed in the previous section). The mix of these arguments can go either way.

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to global marginal damage cost, which by definition is the same for all

[7] Note that in this case we do not get environmental dumping in the sense of having environmental policies weaker than Pigouvian. But it is still the case that because countries are acting non-cooperatively, they will not set environmental policies as tough as they would set if they acted co-operatively.

Finally, the previous papers assumed that only governments can strategically manipulate markets to reduce foreign production. But producers themselves will have incentives to try to do that, by, for example, investing in more capital or R&D than would otherwise be warranted in order to reduce operating costs and hence obtain a strategic competitive advantage. Does this reduce or even reverse governments' incentives to weaken environmental policy? This question is closely related to the 'Porter hypothesis' (Porter (1991)): that tough environmental regulations, far from harming competitiveness, may actually boost it by encouraging domestic firms to invest in 'green technologies' ahead of their rivals. However a careful analysis of these issues (Ulph (1996b,c), Ulph and Ulph (1996)) shows that the results are ambiguous. On the one hand, while strategic investment by firms is a substitute for government strategic policy, and hence reduces the direct need for strategic manipulation of trade or environmental policies by governments, the strategic investments made by firms can in turn be manipulated by governments. Moreover, it is not generally true that tougher environmental regulations always increase the incentives for firms to do more 'green R&D', and even if it does this may not justify governments setting environmental policies tougher than Pigouvian, because there are still rent-shifting arguments for relaxing it. In short, in the absence of other policy instruments, environmental policies may be tougher or weaker than Pigouvian when account is taken of firms' own strategic behaviour.

Finally we note again that first-best allocations of resources would be sustained by free trade, Pigouvian environmental policies, and competition policies which dealt with the consequences of imperfectly competitive markets. Suppose one just wanted to improve the outcome with environmental dumping by keeping free trade and trying to eliminate environmental dumping. WTO (1999) noted that in the US, when it was suspected that the states were not setting tough enough environmental policies because of strategic trade considerations, the federal government took more control of environmental policy. This reflects the fact that environmental dumping arises because national governments acting non-cooperatively set weaker environmental policies than if they cooperated, and one mechanism for cooperation is to move authority to a supra-national level. But WTO (1999) also noted that in the US case this meant the imposition of uniform environmental

standards across all states. But, again, because of comparative advantage, it will in general be efficient for countries to set different environmental standards. Overcoming environmental dumping does not require harmonisation of environmental standards.

As noted by Ulph (1999), if a supra-national agency announced it was going to impose harmonised environmental standards, then there may be no policy which makes all states better off than if they did not cooperate, so states will not volunteer to give up their powers to such an agency. It is sometimes thought that a better approach is to set minimum environmental standards, so that some states can set tougher standards if they wish, and so one can ratchet up environmental standards in all states. But Kanbur, Keen and van Wijnbergern (1995), and Ulph (1999) also showed that minimum standards may suffer the same problem as harmonisation: at least one state might be made worse off and so would veto the use of this approach to dealing with environmental dumping. By the definition of environmental dumping just given, there will exist a range of efficient policies which will make all countries better off than with environmental dumping, but these cannot be achieved by harmonisation or minimum standards and they will generally involve different standards for countries with different environmental endowments. It is one of these policies which a supra-national agency should select.

In summary, while it is possible to construct arguments why governments might all engage in environmental dumping, the extent of such dumping is likely to be less than would occur with trade policies. More importantly, the arguments are not robust, and one can construct equally plausible arguments why governments may set too tough environmental policies to give their domestic producers a strategic competitive advantage. Taking the more general definition of environmental dumping – states acting non-cooperatively set weaker policies than if they act cooperatively – there may be a need for a supra-national agency to bring about this cooperative outcome, but this does not involve harmonisation of environmental standards.

2.4 Mobile Factors or Plants.

It might be argued that the previous analysis does not really capture the concerns of environmentalists or industrialists, which are mainly with the implications of reducing barriers to capital mobility. So the main concern by industrialists is that tougher environmental legislation in one country will just encourage capital or firms to move to other countries, and the concern of environmentalists is that governments' reactions to such possibilities will make them reluctant to raise environmental standards or even to want to cut them. Space precludes a detailed discussion of this issue (see Wilson (1996), Ulph (1997a,b), Rauscher (2001), and Sturm (2002) for more detailed surveys).

Oates and Schwab (1988) is the classic reference on policy competition with mobile capital. There are a large number of countries with immobile labour competing to attract mobile capital. Markets are competitive. Governments can impose capital taxes or emission standards. Higher emissions raise the return to capital but harm domestic residents. They show that optimal policies involve no tax on capital and Pigouvian environmental policies. The argument, which is really the same as the simple open-economy model in section 2.1, is that there is only one distortion here, and it should be optimally regulated. If capital taxes are constrained to be positive, then governments will optimally offset that by relaxing environmental policies. Other kinds of second-best scenarios can be constructed – for example assuming that governments need tax revenues for public goods and that labour taxes are distorting. Then second-best policy may involve environmental policies laxer than Pigouvian, because this will attract capital which reduces the distortion from labour taxes (Kim and Wilson (1997))

Hoel (1997) provides a useful illustration of what can happen if firms are mobile (see also Rauscher (1995)). He considers a simple model where there are two countries, a single, monopolist, firm which serves consumers in both countries, generates pollution, and can costlessly relocate to any country, and a single government policy instrument – an emission tax. If the firm's location was fixed, then the government of that country would set an emission tax which reflected four elements of the 'surplus' it might make:

consumer welfare, firm profits earned by domestic shareholders, emission tax revenues and environmental damages. This tax need not be Pigouvian because there are other distortions (there is monopoly power, which would justify setting too weak environmental policy to expand firm output, although some of these benefits go to the other country; some profits may go outside the country, which would justify too tough an environmental policy as a means of taxing foreign shareholders). The firm will locate wherever it faces the lower tax. Governments need to consider what surplus it makes with and without the firm (note that the first two elements of surplus are independent of firm location). There are three possible outcomes: in some cases the government in which the firm locates will be able to set its optimal environmental policy. In other cases there will be a race-to-the-bottom in which emission taxes are driven down to the point where each government is indifferent between having the firm or not. Finally there can be a race-to-the-top where environmental damages are so high relative to emission tax revenues that countries are better off if the firm is located in the other country. This can lead to an inefficient 'NIMBY' outcome where each government sets such high environmental standards that the firm closes down, despite the fact that it would be in their collective interest for the firm to locate and operate in one of the countries.

Introducing several firms and transport costs complicates the model (Markusen, Morey and Olewiler (1993, 1995), Ulph and Valentini (1997, 2001a,b) but the basic conclusion remains the same as with imperfect competition with fixed locations: there is no robust argument that competition for mobile firms necessarily results in a race-to-the-bottom; one can just as plausibly get a race-to-the-top. Ulph and Valentini (2001a) also show that, with more than one firm, even if there is environmental dumping, it may be less when firms are footloose than when their locations are fixed (as in section 2.3). So the presumption made at the start of this subsection, that it is the possibility of relocation of firms that generates the real threat of environmental dumping, is not correct.

2.5 Empirical Evidence.

The analysis of the previous sections shows that (i) there is no general conclusion whether liberalisation of trade in goods and capital is good for welfare or the environment, although provided Pigouvian environmental policies are in place and other distortions addressed by appropriate policies, then the usual arguments for trade liberalisation go through; (ii) there is no robust conclusion whether competition between states will lead to a race-to-the-bottom in environmental policies. So many of these issues have to be resolved empirically.

Lack of space prevents a detailed survey – see Rauscher (2001) and WTO (1999) for good recent surveys. In terms of the impact of environmental regulation on trade and factor movements, this is approached in a number of stages. First there is the question of how tougher environmental regulations affect factor productivities and profits. Most studies have found that tougher environmental regulations have reduced factor productivities and profitability, as conventional theory suggests, though there is some support for the Porter hypothesis from Biorn, Golombek, and Raknerud (1998) who found that Norwegian firms in pollution intensive industries which were subject to environmental regulation were less likely to exit the industry than non-regulated firms. Second, there is the question of how environmental regulations affect trade patterns. Tobey (1990) and Murrell and Ryterman (1991) conclude that environmental regulations have little effect on trade patterns. Finally there is the question of how environmental regulations affect the location of firms. Much of the empirical evidence comes from analysis of location decisions across US states. Earlier studies suggested little impact of environmental regulations on location decisions (Jaffee at al (1995), Levinson (1997)). More recent studies (List and Co (2000) and List and McHone (2000) which model more carefully how US legislation has been implemented (distinguishing between attainment and non-attainment areas) suggest that location decisions of producers in pollution-intensive industries are significantly affected by environmental regulations, but this only occurs for significant differences in policies: small differences in regulations have no effect on location.

Turning now to the effects of trade liberalisation on the environment, we argued that these could be broken down into composition, technique and scale effects, and Antweiler, Copeland and Taylor (1998) analysed these effects empirically. They found that the composition effect had mixed results as expected, with developed countries and the poorest developing countries expanding production of pollution intensive goods while middle income developing countries reduced their production of such goods. The scale effect had a negative component, with a 1% increase in income leading to a 0.3% increase in demand for pollution-intensive goods. But the technique effect, which they also link to increases in income, meant that a 1% increase in income also led to demands for a cleaner environment which reduced pollution by 1.4%. This latter effect they found to be strongest so that trade liberalisation improved the environment. Cole, Rayner and Bates (1998) analysed the impact of the Uruguay Round and found that it had led to global increases in a range of pollutants by between 0.1 and 0.5%, with the bigger increases in global pollutants. However they argued that the benefits of trade liberalisation ($200-500bn annually) would be much greater than the additional abatement costs that would have been needed to offset these increases in emissions.

Finally there is the question of whether countries have engaged in environmental dumping or environmental protection, this is inherently difficult to analyse because it requires calculating what the Pigouvian environmental standards would be. Levinson (1999) has studied taxes on hazardous waste movements in the US and suggests that the increases that have been experienced in such taxes 1988 – 93 can be explained by NIMBY behaviour. There is some case study evidence that suggests that trade liberalisation has led countries to moderate their environmental regulations for fear of competitiveness effects (Esty and Geradin (1998)), but one of the examples they quote is the failure of some industrialised countries (EU, US, Japan and Australia) to adopt energy taxes to deal with climate change, but this could be explained by conventional free rider arguments rather than strategic trade arguments. For reasons given, it is difficult to get systematic evidence on whether environmental dumping is in practice a serious issue.

To summarise: the empirical evidence does not suggest that there are significant effects of environmental policy on trade or that trade liberalisation has a serious impact on the environment. Of course the empirical evidence has limitations, particularly the difficulty of getting reliable indicators of both environmental stringency and environmental damage, and it does appear from some of the US studies on location effects that as researchers have got better ways of measuring differences in environmental stringency so the effects on location decisions have become more significant. So it could be premature to conclude that trade and environment linkages are weak.

There are a number of other arguments why these effects have turned out to be much smaller than the public debate suggests. The usual one is to note that pollution abatement costs are a relatively small proportion of production costs (1%-5% is the usual range – see WTO (1999)) so could not be expected to have a major impact on trade. Second, firms take a long-term view of environmental regulations and even if regulations are low now in one country they expect some longer-term convergence[8]. Even if firms thought that differences in environmental stringency were significant and sustainable, this might still not influence their decision on where to locate or the environmental standards to set, because there are costs to maintaining different kinds of plants or products designed to meet different standards. They may prefer to design plants and products to meet the highest foreseeable standards. Even if regulations differed significantly across countries, firms may be sensitive to the views of consumers or shareholders about attempts to exploit such differences. Finally, it is argued that one reason firms have not been more responsive to differences in environmental regulations is that they have negotiated offsetting packages of concessions in the form of subsidies or trade protection. We take up this argument in later sections.

[8] This relates to some theoretical arguments (Ulph and Valentini (2001b)) that the literature on the impacts of environmental policy on location assumes that countries can make long-term commitments to environmental policies that cover the life of a plant, but do not explain the source of such commitment powers.

2.5 Conclusions from Conventional Models.

Our review of the conventional economic models and empirical evidence leads to the conclusion that there are neither strong conceptual nor empirical arguments to support the many of the concerns or policy recommendations that we outlined in the introduction. However this analysis has been based on the assumptions of welfare maximising governments and perfect information, for example about environmental damage costs in different countries. In the rest of this paper we see how far these conclusions need to be modified when we allow for asymmetric information and governments which are influenced by special interest groups. We address these issues first in isolation and then together.

3. Information Problems

To illustrate one of the information issues we are going to be concerned with, suppose we are dealing only with domestic pollution, we take as given that there is trade liberalisation, so we know that in both the large country case and the imperfect competition case welfare-maximising governments acting non-cooperatively will seek to distort their environmental policies away from Pigouvian to try to gain some advantage. So there is a case for some supra-national agency to try to coordinate environmental policies to overcome the inefficiencies caused by non-cooperation. We have emphasised in the last section that comparative advantage means that it will be efficient for countries with different environmental endowments, broadly defined, to set different environmental standards. So simply observing different environmental standards tells us nothing about whether countries are distorting their environmental policies. A supra-national agency would need to know damage costs in different countries both to decide whether there are any distortions and to compute appropriate efficient cooperative environmental standards.

But standard subsidiarity arguments suggests that countries may have much better information about their local damage costs than a supra-national agency might have. If

this is correct[9], does this informational asymmetry mean that it would be better to just leave environmental policy-making at the national level, or that if we do set policy at a supra-national level the supra-national agency should just set uniform standards, which has the advantage of simplicity and not having to justify why it sets different standards in different countries? Maybe this explains why, as noted earlier, that when the US increased federal responsibility for setting environmental standards they were uniform across states.

A negative response to these questions was given in Ulph (2000) in a model of local pollution. The context was a federal system where imperfect competition meant that states acting non-cooperatively would engage in environmental dumping (in both senses). States know their own damage costs, but not others, and the federal government knows only the distribution of possible damage costs, which is the same for each state. There are three possible ways environmental standards could be set. They could be set at the state level, which has the advantage that this exploits the good information held by states, but causes environmental dumping. They could be set by the federal government based just on their best guess about damage costs in each state – which in this case would be expected damage costs and would be the same for each state, so standards would be harmonised. Or they could be set by the federal government in such a way that states have incentives to truthfully reveal their information. In this setting, states with high damage costs have incentives to pretend they have low damage costs, to get weaker standards and hence higher output[10]. To overcome these incentives to lie the federal government sets environmental standards which differ less between states with different damage costs than it would with full information, but this does not mean harmonisation.

[9] Of course this might not be true. Economies of scale or scope in collecting information may mean that a supra-national agency might be better placed to collect good damage cost data than individual national agencies. But this would just reinforce the argument for having a supra-national agency set policy. For a discussion of informational problems and the optimal level of decentralisation of environmental policies for watershed management in developing countries see Coxhead (2002).

[10] Bigano (2002) extends the model of Ulph (2000) to include transboundary pollution. He shows that if this is sufficiently important this may reverse the incentives to misreport. A state with low damage costs would claim to have high damage costs in order that the federal government would impose tough environmental policies on other states whose pollution affects this state. However it remains the case that more sophisticated policies to induce states to reveal their information will be preferred to simple harmonisation.

It turns out that having the federal government set standards in this sophisticated way is always the best policy, so the benefits from overcoming environmental dumping outweighs the losses caused by asymmetric information. Moreover, if the federal government uses harmonisation, then if damage costs have more than a moderate variance, harmonisation is worse than setting the policy level. So information problems cannot justify harmonisation as a means of overcoming environmental dumping. We shall return to this problem in section 5.

4 Political Economy

So far we have assumed that governments seek to maximise overall welfare of all its citizens. In this section we consider the implications of assuming that governments are prey to capture by special interest groups. Why might we be interested in this approach? As Anderson and Blackhurst (1992) note, the nexus of trade and environmental policies "have an above average risk of being exploited by special interest groups" so this might be a more realistic description of how policies get set. But the more interesting questions are how would using this approach change the conclusions we have reached so far, and are there issues we can address with this approach that we can not answer assuming welfare-maximising governments? There are five sets of questions we are going to be interested in.

First, we know from the work of Buchanan and Tullock (1975) that there may be good reasons why various interest groups would lobby to have inefficient environmental policies in a closed economy. In brief, existing producers would prefer to have a given level of emissions reduction implemented through quantity constraints in which existing producers get grandfathered entitlements to emit pollution. The reason is that this effectively cartelises the industry and protects it from new entrants. One interesting question is how these arguments carry over to an open-economy setting.

Second, it would be important to know to what extent and under which circumstances the interests of environmental and industry lobby groups converge. It is certainly easy to find

examples for situations in which the interests of environmental and industrial lobby groups are opposed. However, as noted in the introduction it is also frequently the case that both industrialists and environmentalists support a policy of harmonisation of environmental policies. To what extent can political economy models illuminate the mechanisms behind these observations?

Third, our analysis of welfare maximising governments suggested that, as trade is liberalised, there are no robust predictions that countries will systematically weaken environmental policies to compensate. Yet there are strongly held views that this is a significant risk. Moreover recent empirical work by Barrett and Graddy (2000) suggests there is a negative correlation between environmental standards and an index of corruption. Would political economy models give a more robust prediction that trade liberalisation will result in environmental dumping?

Fourth, there is a large gap between the analytical and empirical findings of section 2 that environmental policy has little impact on competitiveness and the public perception. WTO (1999) quotes the example of a Wall Street Journal poll in 1990 in which a third of respondents believed that their jobs were at risk from environmental regulation, when data showed that between 1987 and 1990 only about 0.1% of US layoffs could be attributed to environmental regulations. There are two ways political economy models might account for this. One is that the potential impacts on competitiveness are indeed small, and that this gap in perception just reflects the success of lobby groups in creating a public fear to influence policy. A more subtle explanation is that impacts on competitiveness are potentially larger than the data suggests, but that industrialists have been successful in ensuring that where relatively tough environmental regulations are introduced these are accompanied by other forms of subsidy or protection which mitigate most of the effects.

Finally, we have already argued that the introduction of a supra-national organisation that co-ordinates national policies could be an obvious way to overcome the inefficiencies that are created, if national policy making results in environmental dumping. However,

such a new institution would also be the subject of lobbying efforts of both environmental and industrial groups. Environmentalists are, for example, opposed to the idea that the WTO could play this role in the area of environmental policy, fearing that the WTO is prone to be captured by multinational companies. An important challenge is therefore to determine how lobbying will shape the policies of a supra-national agency and how these policy outcomes compare to national policy making.

There is now a small literature which applies political economy models to the study of trade and environment issues. Before we review this literature we briefly describe the ways in which political considerations have been integrated into environment and trade models. The most frequently used approach in the literature have been lobbying models, which portray the political process as a strategic interaction between the government and various special interest groups, while elections do not play an explicit role. In a number of contributions the influence of lobby groups is, for example, captured through the *political support function* approach, which assumes that an incumbent has an objective function which is a weighted sum of welfare and the contributions of different interest groups. A recent rigorous reformulation of this approach was given by Grossman and Helpman (1994) in the context of trade protection and has been used extensively in the trade and environment literature.

Alongside the lobbying approach there are also a number of alternative political economy approaches, which explicitly consider the role of elections. One such approach is the familiar *median voter model*, which is really a way of aggregating diverse individual preferences, but without explicit behaviour by special interest groups. Another approach is the *electoral competition model* in which candidates for political parties first select what platform to stand on, and then campaign contributions influence the probabilities of different candidates being elected. Finally there is the political agency approach, which views the political process as a principal-agent relationship in which the voters as principals have to provide incentives for their political agent through elections. We now address the five questions set out above.

4.1 Efficiency of Environmental Policies

In an early, and relatively informal, analysis, Hoekman and Leidy (1992) and Leidy and Hoekman (1994) argued that the normal incentives for producers to favour inefficient forms of environmental regulation (quantity-based with grandfathering of pollution permits for existing producers as opposed to an emission tax) as a means of cartelising an industry, would be reinforced in an open-economy setting. They point out that getting the industry to cooperate in this cartel manner would strengthen the industry's ability to press for trade protection to offset the 'injury' caused by increased imports resulting from the tougher environmental regulations.

Using more rigorous models of lobbying behaviour based on the Grossman and Helpman (1994) model of the political support function, Aidt (1998) and Schleich (1999) reach different conclusions. Schleich (1999) considers a model in which the government can use either production or consumption taxes/subsidies to deal efficiently with environmental damages linked directly to either production or consumption, or they can use trade policies, which are inefficient. Furthermore the government is lobbied by a number of industry lobby groups. An important property of the Grossman and Helpman (1994) approach is that the government effectively maximises a weighted sum of lobby contributions and social welfare. An important implication of this assumption is that the government has an interest in using instruments efficiently. This mechanism drives the finding of Schleich (1999), that governments only use their efficient production or consumption taxes to internalise the environmental damages, rather than inefficient trade taxes. The trade policy instruments are only used to redistribute income between the different lobby groups. Aidt (1998) considers a very similar model in which the government faces the choice between a tax on a polluting input and output taxes and subsidies. He also shows that only the efficient tax on the polluting input will be used to correct the environmental damages in the political equilibrium.

4.2 Commonality of Interests

In general, the interests of environmentalists and industrialists are likely to be opposed, simply because reducing emissions reduces profitability, particularly of industry-specific capital. However this need not always be the case. Hillman and Ursprung (1992, 1994) consider commonality of interests in an electoral competition model in which the only policy instrument is trade policy and the choice is between a free-trade candidate and a protectionist candidate (who would impose a prohibitive tariff on imports). Governments can be lobbied by domestic and foreign firms and by domestic environmentalists, and the question asked by Hillman and Ursprung is how environmentalists will vote. If pollution is caused by production, and environmentalists care only domestic pollution, then environmentalists vote for free trade, since that reduces domestic production and hence pollution. If pollution is related to consumption, or environmentalists care about pollution in both countries (Hillman and Ursprung refer to these groups as 'supergreens') or the environmentalists can coordinate their lobbying, then they will vote for protection**.** Rauscher (1997) using a political support function approach shows that if only one policy instrument is available then the interests of environmentalists and industrialists generally diverge, but they will converge if policies (either trade or environmental) are targeted at foreign polluters. He also allows for the possibility that there may be some kinds of specific capital, say pollution abatement capital, whose returns are increased by tougher environmental policies.

4.3 Trade Liberalisation and Environmental Dumping

We now turn to the question whether political economy models suggest that governments will respond to a trade liberalisation by lowering environmental policies and how the predictions of political economy models differ from the policy choices of a welfare maximising government. Explicit consideration of the impact of trade liberalisation is provided by Frederiksson (1999) also using a Grossman-Helpman political support function approach. In his model there is a numeraire sector and a single import-competing polluting industry, and two lobby groups – an environmental group and a

group representing an industry-specific factor whose return is increasing in the level of emissions, so the interests of industrialists and environmentalists are opposed. There is an exogenously given import tariff, so, as we saw in section 2, a welfare-maximising government would impose environmental policy tougher than the Pigouvian tax to correct for the excess domestic pollution resulting from the tariff. His main finding is that in the political equilibrium the environmental policy could be higher or lower than the welfare-maximising policy and that trade liberalisation has an ambiguous effect on environmental policy that emerges in the political equilibrium. The intuition for this result is that the reduction in domestic output in response to the trade liberalisation reduces the incentives for both groups to lobby. So depending on parameters environmental policy could get weaker or tougher and environmental quality could get worse or better in the wake of a trade liberalisation.

Bommer and Schulze (1999) argue that Frederiksson's results depend on his assumption that lobbying is concentrated on the importing sector, while the exporting sector remains unorganised. In their model there are two sectors which differ in their pollution intensitiy. Both sectors use a specific factor, which organises as a lobby group. The trade liberalisation is assumed to increase the relative price of the dirty good, which expands output of the dirty sector and, with constant emission tax, increases pollution and also increases the return on the dirty specific factor and reduces the return on the clean specific factor. They present some evidence that this assumption is a good characterisation of most OECD countries. We saw in section 2 that in addition to this *composition effect* of a trade liberalisation there would be technique and scale effects in which a welfare maximising government would tighten environmental policy in response to both the increase in emissions and an increase in income. Bommer and Schulze using a political support function, but without the Grossman-Helpman micro-foundations, argue that there will be a further reason why a government may tighten environmental policy as trade is liberalised – to offset the distributional effects of trade liberalisation on the return to the specific factor in the clean industry.

Both Frederiksson and Bommer and Schulze assume competitive industries. Johal and Ulph (2001a,b) use a Barrett-type model of imperfect competition in which, if trade liberalisation outlaws trade instruments, welfare-maximising governments will engage in environmental-dumping. They introduce special interest groups in an electoral competition model in which there are 'green' and 'brown' parties who give, respectively, too high or too low a weight to environmental damages relative to social welfare, and so, *ceteris paribus*, would set too tough (lax) environmental policies relative to welfare-maximising governments. There are environmental and industrial special interest groups who can give campaign contributions to parties of their own type at home or abroad. Johal and Ulph show that if countries act non-cooperatively then in a political equilibrium lobbying increases the probability of electing *green* governments. There are two reasons. First, although environmentalists are assumed to care only about domestic pollution, they share with industrialists an interest in having the foreign government set tougher environmental standards, and this gives incentives for environmentalists, but not industrialists, to lobby abroad as well as at home. Second, as we saw in section 2, having weak environmental policies in all countries actually reduces industry profits, and this reduces the incentive of industrialists to lobby for brown governments.

So in none of these papers do we find support for the notion that introducing political economy models unambiguously increases the prevalence of environmental dumping.

4.4 Environmental Policies and Competitiveness.

We have already seen that Hoekman and Leidy (1994) argued informally that in an open-economy industrialists were more likely to press for inefficient forms of environmental regulation, since this would strengthen their ability to press for compensating trade protection. They conjecture that this could be one reason why there has been so little evidence of the impact of environmental policy on trade. They provide some evidence for this conjecture by pointing out that in the US the industries that have the highest abatement costs as a proportion of total costs account for a very high proportion of anti-dumping cases, and claim that the same is true of the EU and Australia.

The idea that political economy forces might ensure that sectors which have to bear high pollution abatement costs will be compensated through other policy instruments is pursued further in Eliste and Frederiksson (2001). They use Grossman-Helpman type model to show that stricter environmental policy for a sector and result in an endogenous increase in transfers to this sector. They test this prediction on a cross-country dataset which provides information on the stringency of pollution control in the agricultural sector and transfers to farmers. They find that stringent environmental policy is positively correlated with larger transfers to farmers.

4.5 Policy Coordination.

In section 2 we saw that in the case of either large-country models or models of imperfect competition, welfare-maximising governments acting independently may have incentives to set environmental policies which differ from Pigouvian to secure some trade advantage, but, even without transboundary pollution, these policies impose externalities on other countries. Indeed all countries can end up worse off by these beggar-thy-neighbour policies. So there is a case for coordination of such policies. This is reinforced if there is transboundary pollution. But how is this argument affected if agencies in either states or some supra-national coordinating agency are prone to capture by special interest groups?

We know that with transboundary pollution individual states acting non-cooperatively will set too weak environmental policies, both because of free-riding problems and, in the large-country case, to reduce leakage. It is sometimes argued that the activities of green lobby groups may help to overcome this failure of coordination, by inducing governments to set tougher environmental policies than if they were welfare maximising. Conconi (2000), using a Grossman-Helpman-type model of political lobbying within large countries shows that this presumption is only true if countries can use trade instruments to deal with leakage effects. Then indeed green lobby groups press for higher emission taxes, and uncoordinated environmental policies may give a better outcome than

coordinated policies. However, if countries are unable to use trade taxes to deal with leakage effects (because of trade liberalisation), then green lobby groups concerned about leakage effects may induce lower emission taxes than when non-cooperative governments are welfare maximising, and so this strengthe ns the case for coordination of environmental policies.

Conconi assumes there are only green lobbyists. Similar results are found by Schleich and Orden (2000), who extend the analysis of Schleich (1999) to consider two large countries, but with lobby groups who also press for support for industries. When governments act non-cooperatively, then the outcome is as in Schleich: governments act efficiently, using environmental policies to deal with externalities and trade policies to exploit terms-of-trade; but they will give discounts to organised sectors at expense of unorganised sectors. Because there is transboundary pollution, countries impose two kinds of externalities on each other: through transboundary pollution and through terms-of trade effects. If the governments set policies cooperatively, this will affect the political equilibrium. Surprisingly they show that with cooperation there may more environmental damage than without. The fact that governments no longer try to exploit terms-of-trade effect has ambiguous effects on environmental policies, while the fact that they internalise the damage caused in other countries unambiguously toughens policies. But these effects would apply with welfare-maximising governments. The additional effect that comes through political models is that because cooperation brings about efficiency gains this means governments can satisfy lobby groups at a lower cost to other lobby groups. They increase output and hence specific factor returns in organised sectors, and this effect on environmental damage may outweigh other effects.

Johal and Ulph (2001a,b) also consider what happens when governments coordinate their policies, in this case to overcome environmental dumping and, in the second paper, transboundary pollution. However they model various asymmetries in lobbying behaviour designed to capture some of the concerns of environmentalists; there are differences in ability to influence electoral outcomes between lobby groups from different countries (e.g. northern countries have more influence than southern countries)

between lobby groups of different types (e.g. industrialists have more influence than environmentalists) or between different levels of government (national and supra-national – to reflect 'democratic deficit' at supra-national level). They show that despite these asymmetries, it is always better to have policies coordinated at the supra-national level. So the benefits of dealing with policy externalities outweigh the costs of political distortions.

5 Information and Political Economy

We now put together the concerns of the last two sections. To see why this might be necessary, we could ask the simple question – if members of the public know that politicians are likely to be influenced by special interest groups, why do they not take steps to prevent this? One way of doing this is through the election process. Politicians who blatantly stood for policies that favoured narrow sectional interests should not get elected. Politicians who are subsequently found to have swayed their policies in the interests of certain groups may not get re-elected. If politicians value a career in politics and if elections are relatively frequent, this could act as a reasonable discipline. But of course this depends crucially on voters being able to tell when politicians have acted to favour special interests. We argued in the last section that even in political economy models, there are incentives for efficient choices of policies. But that assumes perfect information. It is frequently argued informally that one reason why governments may choose inefficient policies is because it is easier to hide the fact that they are acting to favour certain interests. Crudely, it may be easier to give certain industries trade protection on the grounds that it is offsetting potentially serious competitive effects from environmental policies than to give them protection outright.

Another way voters may try to limit the scope for special interest groups to gain favours is to limit the power of politicians. In the limit voters could just mandate politicians to implement welfare maximising policies. But that again requires voters to be able to work out what welfare-maximising policies would be and to know whether or not politicians have implemented them. If politicians in office get access to information that is important

in designing welfare-maximising policies, then restricting their scope for manoeuvre in advance will mean that policies may not be based on the best available information.

Thus, it can be argued that information problems play an important role in understanding how the political process operates and institutions might be designed to deal with these problems (see Laffont (2000) for a general discussion).

As far as we are aware the only papers that have sought to ad dress these issues in the context of trade and environmental problems are by ourselves. Sturm (2001) considers the case of trade disputes over products whose consumption causes potential damage to health or the environment. One example of such a dispute would be EU/US dispute over growth hormones in beef. The paper develops a simple two-country model. Suppose that one of the goods that the home country imports from the foreign country can cause some environmental or health da mages, if it is consumed. For simplicity it is assumed that the risk of damages can either be high or low and that only units of the good which have been produced in the foreign country can cause damages. Furthermore observing the ex post damages does not reveal perfectly what the ex ante level of the risk was. A crucial assumption is that only politicians in power know the true value of the risk, and this is common to both countries, so there is no *underlying* scientific dispute between the countries.

The governments face a decision whether or not to impose a product standard on the foreign product. Imposing the standard in the home country reduces consumer surplus, raises domestic profits and eliminates the risk of damage; in the foreign country it has similar effects but lowers foreign profits. The parameters of the model are chosen in such a way that if governments were welfare maximisers, they would both agree to implement the standard if the risk was high, and not implement it if the risk was low. This ensures that any dispute is purely political. More generally there will be range of risk values for which, in terms of expected welfare, the home country would want to impose the standard but the foreign country would not, so there could be genuine welfare differences.

In the political context, the median voter cares only about social welfare. Politicians can be either 'good' or 'bad'. Good politicians will just pursue welfare maximising policies – imposing the standard only if the risk is high. Bad politicians want to favour producers of the good. The efficient way to do this would be by a lump-sum transfer. But voters could detect that, and would not re-elect them, which politicians care about, and so will not do this. The other, inefficient, way of favouring producers is, in the home country to implement the product standard even in the low risk state ('green protectionism'), and in the foreign country not to implement the standard even in the high risk state ('environmental dumping'). Of course voters know that bad politicians will do this. But voters do not know what the true risk is. All they can observe is whether or not politicians in the two countries have implemented the same policies or not. But this is a very imperfect signal. If there is a trade dispute, then all voters can tell is that at least one of the politicians must be bad. But they cannot tell whether it is a high risk state with a bad foreign politician not implementing the standard, while the home politician, who could be good or bad, does implement the standard; or a low risk state with a bad politician at home implementing the standard while the foreign politician, who could be good or bad, does not. Equally the absence of a trade dispute does not mean that both politicians are good – at least one must be good, but voters cannot tell which. So although voters will use their observation of whether or not a trade dispute has taken place to decide whether or not to re-elect politicians, Sturm shows that there can be political equilibrium in which the threat of not being re-elected is sufficiently low, given the fuzziness of the signal, that bad politicians will indeed choose to act in the way described above.

So this paper gives a very nice formal demonstration of how environmental trade disputes can arise through the failure of the political process, which allows politicians who want to favour certain groups to use inefficient means of doing so because this is how they avoid detection and hence punishment at the ballot box. Sturm goes on to discuss other possible mechanisms for overcoming these problems. One mechanism often suggested is mutual recognition of standards, which would mean that the home (importing) country would have to impose the same standard as the foreign (exporting) country. This would

eliminate 'green protectionism' by bad home politicians; it would not eliminate 'environmental dumping' by bad foreign politicians and so may not increase welfare in the home country. Another possible mechanism is harmonisation. It is not clear what this would imply in this context. Given that only politicians in power know the true state it would not be possible for some supra-national agency to implement the first-best policy of imposing the standard in both countries only in the high-risk state, which, in the special model, is what both countries agree is welfare-maximising. Given that the standard is either applied or not, there is no intermediate level of policy on which countries could be harmonised. The way Sturm interprets harmonisation is that voters require politicians to agree on a common policy and punish them with reduced re-election probabilities if they do not agree. However this does not reproduce the social optimum, because it does not rule out bad politicians in both countries agreeing to either both impose the standard in the low-risk state or both not impose the standard in the high-risk state.

However Sturm does not consider the question of whether expected welfare in both states might be higher with harmonisation than without. This is the question posed in Johal and Ulph (2001c,d). These papers extend the analysis of Ulph (2000) in which state governments acting non-cooperatively engage in environmental dumping which can be overcome by passing responsibility for environmental policy to a federal government, but, as in Sturm, only governments in power in the states know their own damage costs. The federal government could either set harmonised policies based on expected damage costs, or could use a more sophisticated policy to get states to reveal the information. Ulph(2000) assumed welfare-maximising governments and, as noted in section 3, showed, not surprisingly, that the more sophisticated policy dominated harmonisation, and that, for moderate levels of uncertainty about damage costs, harmonisation may be worse than leaving states in charge of environmental policy.

The extension made by Johal and Ulph (2001c,d) is to incorporate the political set-up used in Johal and Ulph (2001a,b), discussed in section 4, in which there are elections between green and brown governments at state and federal levels, and where, in Johal

and Ulph(2001d) the probabilities of electing green governments are influenced by campaign contributions by environmentalists and industrialists. The role of harmonisation is now very different. Society has to make a constitutional choice. Should it allow environmental policies to be set by political parties once they are in power and know their true damage costs? This has the merit of using information that becomes available, but at the cost of having parties who do not maximise welfare. Or should it restrict politicians' discretion by mandating them to implement policies that maximise welfare, but based only on the information available at that time, namely expected damage costs. Since Johal and Ulph assume expected damage costs are the same in each state this implies harmonisation. Harmonisation has the cost that the policies adopted will not be fine-tuned to the actual damage costs states incur, the usual inefficiency argument. But it has the benefit of preventing capture of politicians, and, because the rule cannot be manipulated, reduces the scope for wasteful lobbying activities. This choice between harmonisation or allowing political discretion can be made whether policy is set at state or federal level. Johal and Ulph (2001c,d) show that, not surprisingly, harmonisation will be preferred when the difference between high and low damage costs is small relative to the difference between the weights different political parties attach to damage costs (i.e. the degree of political polarisation). More interestingly, they show that harmonisation will only be preferred when policy is set at the federal level if it had been preferred at the state level. So one cannot use the argument that policy is being moved from state to federal level to overcome environmental dumping as the rationale for imposing harmonisation.

One important implication of the above analysis is that when one considers problems of imperfect information in a political setting (and we argued that the two are intimately linked), one finds not just that politicians may choose inefficient policies because that is a means of exploiting poorer information held by voters, but that overcoming the attempt by politicians to serve special interests may also involve the use of policies, such as harmonisation, which are criticised by economist as being inefficient, on the assumption of welfare-maximising governments.

The above discussion has been entirely theoretical. Is there any empirical support for these models of environmental policy setting with political economy and imperfect information? Sturm and List (2002) use a model very similar to Sturm (2001) outlined above in which politicians may have private preferences for the environment (which may reflect their desire to benefit certain interest groups) which differ from those of potential swing voters. Faced with the prospect of re-election, politicians will trim their policies to suit those of the swing voters. But if a politician faces a binding term limit (and is therefore a lame duck), she is free to set policies which reflect her own preferences. This suggests that environmental policies should change when politicians enter a lame duck phase. In the US term limit legislation constrains governors of a substantial number of states to serving no more than two terms in office. Sturm and List (2002) tests their model on US data on state environmental policies and find substantial support for the view that environmental policy changes during years in which a governor is a lame duck

6. Conclusions.

In this paper we have outlined a number of concerns that have been expressed about the nexus of policies linking trade and the environment and reviewed some of the recent literature by economists to see what light it sheds on these concerns. In section 2 we reviewed the 'conventional' literature, mainly theoretical but also empirical, and showed that it did not lend strong support either to the concerns or some of the policy recommendations. In particular, while there is danger that if further trade liberalisation rounds succeed in preventing governments using conventional trade instruments they may distort their environmental policies for trade purposes, there are no robust arguments for saying that this will imply environmental policies are too lax – they may be too strong. While the empirical evidence suggests that trade liberalisation has not had a major damaging effect on the environment, nor that environmental policies have had a marked impact on trade, for reasons stated, there is no systematic empirical evidence that we are aware of on whether environmental policies are too weak or too strong. One strong conclusion from this literature was that harmonisation was unlikely to be desirable.

We then reviewed a much smaller literature on what we believe to be key issues in sorting out trade and environment issues – information problems and the possible capture of politicians by special interest groups. The models are too disparate at this stage to allow us to draw firm conclusions, but we would argue that they do not provide any stronger basis for the concerns outlined in the introduction. In particular they give no more reason for believing that in a world of trade liberalisation there will be a systematic race to the bottom in environmental standards.

What does this imply for the discussions that will be taking place over the next few years about whether or how environmental considerations should be built into the next round of trade liberalisation? Bierman (2001) argues that what is called for is an Authoritative Interpretation of Article XX which clarifies the role of trade measures in support of multilateral environmental agreements, allows countries to protect themselves against imports of goods whose consumption causes environmental damage, provided this is done in a non-discriminatory fashion, and rules out unilateral use of trade measures against countries who have different environmental standards for production and process methods. Unless multilateral environmental agreements are interpreted very widely, it is not clear that this addresses the issue of countries distorting their environmental policies for trade or political reasons.

The fundamental challenge, as we have set out in the last half of this survey, is to discriminate between differences in environmental standards that arise through comparative advantage and differences that arise from attempts to exploit market power or favour special interests. In facing this challenge it is crucial to recognise that local governments are likely to have much better information about local environmental damages than supra-national agencies, but also that they will use this informational advantage to favour interest groups. Using expert scientific panels may resolve some aspects of environmental disputes, though as Sturm (2001a) notes bodies of scientific experts may not be sufficiently isolated from political pressure, and in any case the disputes may be much more about how different countries value a given environmental impact. Similarly, looking for inconsistencies in the way governments apply

environmental standards in areas exposed to trade and areas not exposed to trade will be a useful reality check. But governments can apply environmental policies consistently and in a non-discriminatory manner and still be engaging in either environmental dumping or green protectionism. The challenge is to design mechanisms that both get local politicians to reveal information truthfully and limit their scope for exploiting it to favour special interest groups. In some cases this may lead to adopting what normally look like inefficient policies, and we gave the example of harmonisation, but stress this is just an example and does not mean we are endorsing harmonisation. What the best intervention will look like needs a lot more careful analysis than the research to date has provided.

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