International Trade in Natural Resources: Practice and Policy

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Abstract

Natural resources account for 20% of world trade and dominate the exports of many countries. Policy is used to manipulate both international and domestic prices of resources, yet policy is largely outside the disciplines of the WTO. The instruments used include export taxes, price controls, production quotas, and domestic producer and consumer taxes (equivalent to trade taxes if no domestic production is possible). We review the literature and argue that the policy equilibrium is inefficient. This inefficiency is exacerbated by market failure in long-run contracts for the exploration and development of natural resources. Properly coordinated policy reforms offer an avenue to resource-exporting and resource-importing countries to overcome these inefficiencies and to obtain mutual gains.

1. INTRODUCTION

Approximately one-fifth of global merchandise trade is in natural resources.[1] Fuels, of which two-thirds of world output is traded across international borders, are the largest element. This trade is particularly important for many producing countries whose exports are undiversified: 21 countries have more than 80% of their exports in natural resources, and for 9 of these countries resource exports are more than 50% of GDP.[2] It is also crucial for importers who may have no local supply and for whom resources are an essential input to their economies. For the world economy as a whole, resource price variations are both a barometer and a determinant of macroeconomic performance.

Trade in natural resources has a number of features that make it distinctive and that bear on policy in the sector. Uneven geographical distribution of resources means that some countries are dominated by resource production, whereas others have none; more than 90% of proven oil reserves are in just 15 countries. Resource supplies are immobile, so incentives to use policy to relocate production are largely absent. Exhaustible resources may carry large rents, and the division of these rents between producers and consumers is contentious. Trade often occurs on organized commodity exchanges and involves both spot and futures transactions. Prices that come out of these exchanges are volatile, creating a major source of disruption in the world economy. Subsoil assets are typically state owned, and their extraction incurs sunk costs in long-lived projects subject to high levels of uncertainty arising from price volatility, geological uncertainties, and political risk. Often projects are financed by foreign direct investment (FDI) involving a variety of types of contract between foreign investors and domestic government. All these factors create complex incentives for policy, yet at the same time most of the trade policy instruments used are outside the disciplines of the World Trade Organization (WTO). We suggest in this article that this situation has led to an inefficient outcome and that attention needs to be paid to extending trade and investment disciplines into this area.

This article provides both a survey of the issues and development of this argument. First, in Section 2 we outline some facts about trade in natural resource, discussing both trade patterns and price movements. Then, in Section 3 we turn to policy, looking first at trade rules and then at the motives for resource exporters and importers to use trade policy measures. We suggest that, given the rather weak WTO disciplines in place, the ensuing trade policy equilibrium is inefficient. Section 4 turns to long-run issues of exploration, development, and foreign investment in the sector, suggesting that there are major market failures and inefficiencies that could be addressed through the international system.

2. TRADE IN RESOURCES

2.1. Trade and Production

The share of natural resources in world trade increased dramatically between 1900 and 1955 and then declined for several decades before increasing again (**Figure 1**; see color insert). A number of factors contributed to the long-run expansion of resource trade,

[1]Data presented define natural resources as nonrenewables (minerals and fossil fuels) plus forest products and fisheries. Our discussion focuses on nonrenewables, although where issues overlap, we extend discussion to forests, fisheries, and agricultural products.

[2]See IMF (2007).

including industrialization, population growth, and falling transportation costs. Some of the variation comes from the fact that natural resources may be exported in their raw form or embodied in manufactured goods (and so are not classified as resources). The former proportion probably increased dramatically through the twentieth century with the rise of new oil-producing countries. However, fluctuations in commodity prices, especially in oil prices, account for much of the variation, in particular from the 1970s on. In the ten years that preceded the global financial crisis, the dollar value of world exports of natural resources increased more than sixfold, reaching 3.7 trillion US dollars in 2008 before falling back. Fuels represent the lion's share of total world resource exports, reaching 2.9 trillion US dollars in 2008. In the same year, trade in other extractive resources, such as ores and other minerals and nonferrous metals, was 360 billion US dollars. The value of trade of other resources such as fish and forestry, although more limited, has also increased over time, reaching, respectively, 98 and 106 billion US dollars in 2008.

On the supply side, the volume of oil produced doubled between 1965 and 1980 and then increased a further 30% by 2010. The ratio of reserves to annual production now stands at 46, up from 30 in 1980. The share of oil production traded internationally increased from 51% in 1980 to 66% in 2010.[3] On the demand side, the main changes have been the surge in import demand from emerging economies. Between 2000 and 2008, the value of natural resources imported increased at an annual average rate of 30% in China, 25% in India, 22% in Singapore, and 17% in Korea (**Table 1**). The total value of oil consumed in the Asia-Pacific region overtook that consumed in North America in 2006. As is discussed below, the balance between changing world demand and an inelastic supply of natural resources has important implications for price volatility in these sectors.

Table 2 reports the leading exporters of natural resources. Although this group includes both advanced economies such as Canada and the United States and less-developed economies such as Saudi Arabia or Venezuela, a distinctive feature separates advanced and developing exporters. Within the latter group, resource sectors often have a dominant position. For the Middle East, Africa, and the Commonwealth of Independent States (CIS), resources represent a share of total merchandise exports of 74%, 73%, and 70%, respectively, whereas for North America, Asia, and Europe, this proportion is less than 20%. **Figure 2** (see color insert) shows the share of resources in exports for the sample of countries with the least-diversified exports (i.e., the highest concentration of exports[4]). The high correlations between these two variables can be easily detected: With very few exceptions, countries with the least-diversified exports are resource exporters.

These disparities in natural endowments play an important part in explaining international trade.[5] As traditional trade theories emphasize, trade improves economic efficiency by allowing natural resources to move from areas of excess supply to areas of excess demand. These static effects, however, need to be evaluated against the dynamic effects that trade has on the exhaustibility of natural resources.

[3]See BP (2011), IEA (2009).

[4]The concentration index is the share of the products in the standard international trade classification at the three-digit level that exceeds 0.3% of a given country's exports (values closer to 1 indicate greater concentration of exports).

[5]This is an obvious implication of the Heckscher-Ohlin model. Leamer (1984) finds results consistent with the predictions of this theory. More recently, variables such as education, infrastructure, and institutions have also been observed to affect sectoral patterns of natural resource trade (Lederman & Xu 2007). Hence, natural resource endowments are best seen as a necessary but not sufficient condition for the production and export of resources.

Table 1 Leading importers of natural resources, 2008 (billion dollars and percentages). From WTO (2010)

	Value	Share in world	Share in total merchandise	Annual percentage change		
				2000–2008	2007	2008
World	**3345.6**	**100.0**	**27.5**	**17.9**	**14.2**	**33.0**
European Union (27)	766.6	22.9	33.6	18.1	11.0	31.9
United States	583.4	17.4	27.0	15.0	6.9	27.9
Japan	350.2	10.5	45.9	13.9	9.2	40.6
China	330.3	9.9	29.2	30.0	32.5	43.0
Republic of Korea	182.0	5.4	41.8	17.3	13.4	37.0
India	135.4	4.0	42.9	25.1	20.8	52.5
Singapore	95.1	2.8	29.7	22.3	16.0	60.0
Chinese Taipei	83.1	2.5	34.5	18.6	18.1	29.3
Canada	67.3	2.0	16.5	15.2	10.1	30.1
Turkey	50.7	1.5	25.1	22.3	22.5	33.4
Thailand	49.9	1.5	27.9	20.9	5.1	37.4
Brazil	42.8	1.3	24.7	19.1	29.3	47.5
Mexico	40.5	1.2	13.1	19.4	22.7	35.1
Indonesia	37.7	1.1	29.1	20.5	16.3	44.6
Australia	34.8	1.0	18.2	20.5	17.1	43.8
Above 15	**2849.8**	**85.2**	—	—	—	—

There is a substantial literature on the dynamic effects of international trade in renewable resources such as forestry or fish. Several studies point out that, when resources suffer from open-access problems that result from weak property rights, trade may exacerbate the depletion of the resource (Chichilnisky 1994; Brander & Taylor 1997, 1998; Karp et al. 2001).[6] However, Copeland & Taylor (2009) argue that trade pessimism may be overstated. The strength of the property rights regime depends on a variety of factors, including the ability of a government to monitor supplies, the technology for harvesting and for regulating, and the economic benefits from poaching the resource. An increase in the price of the natural resource brought about by trade affects each of these factors in different ways. Such a price increase may lead to increased monitoring effort or higher penalties for poaching, both of which would strengthen the property rights regime and limit resource depletion.

The literature on trade in nonrenewable resources, such as fuels and minerals, is more fragmented and reaches less clear-cut conclusions. A first set of studies, summarized in

[6] An example of how the combination of open trade and weak property rights can lead to resource depletion in the exporting country is the near extinction of the Great Plains buffalos in the United States in the nineteenth century (Taylor 2011).

Table 2 Leading exporters of natural resources, 2008 (billion dollars and percentages). From WTO (2010)

	Value	Share in world	Share in total merchandise	Annual percentage change		
				2000–2008	2007	2008
World	**3247.3**	**100.0**	**27.7**	**18.5**	**15.3**	**32.8**
Russian Federation	341.2	10.5	72.9	23.1	16.2	34.1
Saudi Arabia	282.0	8.7	90.0	18.8	9.9	35.7
Canada	177.7	5.5	39.0	13.0	13.6	24.9
European Union (27)	176.6	5.4	9.2	18.5	16.8	28.2
United States	142.5	4.4	11.0	17.3	17.5	42.4
Norway	130.6	4.0	77.8	14.0	8.4	23.7
Australia	114.3	3.5	61.1	19.3	13.6	54.3
United Arab Emirates	109.4	3.4	52.1	17.6	8.9	33.5
Iran	95.5	2.9	84.2	18.0	38.4	27.1
Kuwait	82.9	2.6	95.2	20.9	11.5	39.7
Venezuela	79.8	2.5	95.8	14.1	7.4	27.8
Algeria	78.4	2.4	98.8	17.4	10.3	31.7
Nigeria	75.4	2.3	92.2	13.7	−12.5	48.2
Singapore	67.7	2.1	20.0	23.8	17.6	44.2
Angola	67.1	2.1	100.0	No data	No data	No data
Above 15	**2021.0**	**62.2**	—	—	—	—

Kemp & Long (1984), looks at whether the predictions of the Heckscher-Ohlin theory are sustained in a setting à la Hotelling (1931), where producers take into account the opportunity cost of depleting the resource. This approach, however, neglects some salient features of markets for finite resources, such as their imperfectly competitive nature (Davis 2010). A second set of studies abstracts from the determinants of international trade and focuses more narrowly on the exporters' optimal extraction path under imperfect competition. As this is essentially a policy choice, we return to it in Section 3.2.

A large body of economic literature has dealt with the problems associated with the high concentration of resource exports and the lack of diversification. An expansion of the natural resource sector can adversely affect exports in other sectors by raising the real exchange rate (so-called Dutch disease). A number of studies have shown that this tendency can have negative effects when the sectors that are crowded out by resource exports have positive spillovers, such as learning by doing or economies of scale, on the rest of the economy (van Wijnbergen 1984, Krugman 1987, Sachs & Warner 1995). Although later studies have shown that the real exchange rate may not necessarily increase in response to an expansion of the natural resource sector (e.g., Corden & Neary 1982, Torvik 2001), the empirical literature is generally supportive of the predictions of the Dutch disease

hypothesis. Sachs & Warner (1995) find that resource-rich economies have slower growth in manufacturing exports; Stijns (2003) shows that the price-led energy booms tend to systematically hurt energy exporters' real manufacturing trade.[7]

Trade in resources is often not just spot trade in the commodity but also involves longer-term international contracts. Historically, these included long-term contracts between producer and consumer countries in energy commodities, such as oil and natural gas, and in metals, such as copper, aluminum, and iron ore. Over time, these bilateral supply contracts have been complemented and sometimes replaced by trading on organized markets, as exemplified by the evolution of the market for crude oil (Stroupe 2006). The preponderant form of longer-term contracts is now exploration and production contracts between resource extraction companies and host governments. These are a form of FDI but are distinctive insofar as the government is the ultimate owner of the resource that is extracted and long-term arrangements—royalties, taxes, and possibly production-sharing arrangements—are put in place before contracts are signed. These long-term contracts are the subject of Section 4, and in this and the next section we concentrate on the flow trades in the resources themselves.

2.2. Prices and Volatility

Natural resource trade has taken place at prices that have undergone long periods of secular decline, followed by abrupt spikes and periods of high volatility. Reasons for the long-run decline, discussed in the Prebisch-Singer debates of the 1950s and 1960s, focused on low income elasticities for some commodities, food in particular. The picture is now very different, with growing demand from emerging markets reversing earlier price falls.

Volatility has reached new highs across fuels, minerals, and agricultural commodities. For instance, fuel prices jumped 234% during 2003–2008, whereas prices of mining products and prices of food rose 178% and 120%, respectively. Although the causes of volatility are not necessarily international, its consequences are particularly severe because of the asymmetric impact of price fluctuations on different countries. Oil price shocks were one of the major drivers of recessions in the United States (Hamilton 2009). However, there is evidence that their impact is diminishing: A 10% increase in the price of oil was estimated to reduce US GDP by 0.7% over a 2–3-year period prior to 1984, but by just 0.25% after 1984 (Blanchard & Galí 2007), a number consistent with recent cross-country work by Rasmussen & Roitman (2011). For resource exporters, particularly developing countries, price instability has been one of the major factors leading to the so-called resource curse. van der Ploeg & Poelhekke (2009) test the direct impact of natural resource abundance on economic growth and its indirect effects through volatility of unanticipated output growth. They find that, although the direct effect can be positive, it can be swamped by the negative impact resulting from volatility.

Much research has gone into investigating the causes of price volatility, particularly for oil. One fundamental reason for large price swings is low price elasticities. Estimates of the elasticity of demand for oil are extremely low, with short-run price elasticities estimated in the range of 0.05–0.3 and long-run elasticities estimated in the range of 0.2–0.9 (Hamilton

[7]An appreciation of the real exchange rate is not the only channel through which a resource curse can materialize. The literature has identified other mechanisms not directly related to natural resource trade, including the impact of resource abundance on rent seeking/institutions and on civil conflict. For a recent survey, see van der Ploeg (2011).

2008, 2009). Supply into the spot market has also been estimated to have low price elasticity. For example, the US Energy Information Agency (EIA) uses a short-run elasticity of 0.02 and a long-run elasticity of 0.1 (see Smith 2009). With such low elasticities, relatively small supply or demand shocks translate into large price changes.[8]

However, the supply side of the market is complicated by many factors, including suppliers' monopoly power and the fact that oil and other natural resources are nonrenewable assets. Price contains a large element of rent and is not anchored by unit production costs. Supply decisions depend partly on the technology of installed capacity—how much can be mined or pumped given the capital stock of the sector—and also on asset-holding decisions. Long-run decisions on depletion rates lead to the Hotelling rule: In competitive equilibrium the rent element of price will rise at the rate of interest; the level of the price is such that cumulative demand leads to its eventual complete depletion. Short-run decisions depend on the extent to which the asset can be stored underground or in aboveground inventories and on the relationship between current prices and future prices. This relationship in turn depends on the relationship between trade on the spot market (trade in the physical good) and trade in futures markets (trade in financial assets).

A frequently heard claim is that speculation in futures markets has been a factor in destabilizing the spot market. The trade is dominated by two exchanges, the New York Mercantile Exchange (NYMEX) and Inter-Continental Exchange (particularly ICE Futures Europe), on which oil trading volumes have gone from 1.51 times annual oil consumption to 8.45 times annual oil consumption between 1994 and 2009.[9] There are three broad classes of traders. Producers of resources sell short, typically with rather short contracts (six months to one year), as a way of purchasing insurance on the price of future output. This is particularly true for agricultural products but is also true for minerals and fuels. Index traders are on the other side of the market. These are investors who seek to hold commodities as part of a diversified portfolio and who do so (without holding physical commodities) by buying futures contracts; the volume of this trade is large, but most of it is accounted for by rolling over the relatively short contracts on offer. The third class of investors consists of active traders or speculators who are engaged in "price discovery."

The role of futures trades, those involving speculators in particular, in generating volatility has been hotly debated; one side has claimed that speculation has been a factor in destabilizing the spot price. However, a price increase in the futures market will raise prices in the spot market only if the quantity supplied to the spot market is reduced; this quantity reduction occurs through an increase in inventories, as the commodity is held back for future delivery rather than sold currently. There is no evidence that inventories increased during the price spikes of recent years, thus suggesting that pure speculation was not a force. However, given a very low elasticity of demand, the required scale of inventory change is correspondingly small.

A more complete understanding of the interaction between markets comes from thinking about the expectations of traders. Dvir & Rogoff (2009) look at the impact of different demand shocks and show how the asset-holding (and inventory-holding) side of the market may increase volatility. If there is a positive, transient shock to the level of demand (largest in the current period and decaying over time), then inventories will act to reduce the

[8]See Smith (2009) for some examples.

[9]See Turner et al. (2011). Of course, oil is consumed only once, but trades can take place multiple times in a year.

variance of prices; they are run down in the first period as physical supply is moved to the period with the largest demand shock. However, if a positive shock to demand is interpreted as being indicative of a shock to the rate of growth of demand (so its effect is persistent and possibly increasing), then inventory adjustment will amplify the first period impact of the shock; despite an increase in current demand, supply will be moved from the present to the future. Dvir & Rogoff make the empirical claim that this sort of behavior characterized oil markets in the period 1861–1878 and again in the period since 1972. These were periods of relatively high prices and high volatility and periods in which there were supply restrictions (due to the railroad distribution monopoly in the United States prior to 1878 and due to OPEC post-1972) and changing expectations about long-run growth (due to the transformation of the US economy in the nineteenth century and of the Asian economy in the late twentieth and twenty-first centuries). This line of argument is consistent with others. Kilian & Murphy (2011) suggest that increasing demand explains the 2003–2008 oil price shock. Allsopp & Fattouh (2011) point to increased uncertainty about future non-OECD demand, as well as about supply factors, meaning that the long-run price anchor has disappeared.

In summary, then, although understanding of resource price behavior remains incomplete, the emerging consensus is that fundamentals drive changes. Low demand and supply elasticities (the latter not increased by asset-holding behavior) combined with shocks to the fundamentals are sufficient to explain the levels of volatility observed in recent years.

3. TRADE POLICY: MOTIVES AND OUTCOMES

Given these background facts, we now turn to policy. We look at policy instruments, motives for their use, and the ensuing policy equilibrium.

3.1. Instruments and Rules

The WTO now consists of 153 countries and provides an institutional framework to reduce obstacles to international trade and to prevent the prisoners' dilemma of trade protection. The main instruments are the prohibition of quantitative trade restrictions and the downward negotiation of import tariffs, coupled with the dispute settlement mechanism and with agreements regulating trade in services and intellectual property. Since the WTO's inception (and that of its predecessor, GATT), tariff rates have fallen dramatically, and trade volumes have risen much faster than income. Progress has been fastest for trade in manufactures, with agriculture lagging behind and trade in natural resources almost entirely outside the effective reach and disciplines of the organization. There are a number of reasons for this situation.

First, the focus of the WTO is on trade policy toward imports, not trade policy toward exports. This derives from the facts that trade in manufactures has generally not faced restrictive export policy and the bulk of trade restrictions in place were targeted at imports.[10]

[10]Export promotion measures, namely export subsidies, are an obvious exception, as historically they have been widely used (WTO 2006). Over time, this policy has come under more stringent regulation in the GATT/WTO system. However, an asymmetry in the treatment of export subsidies on agricultural and manufacturing products persists to the present day. Although export subsidies on manufacturing products are prohibited by the Subsidy and Countervailing Measures Agreement, the Agreement on Agriculture envisages reduction (but not the elimination) of export subsidies to agricultural products.

Thus, whereas import tariffs cannot be set at a rate higher than the bound rate agreed in countries' schedules of commitments, exports face no such binding. Article XI of the GATT specifies that exports should not be subject to quantitative restriction (with some exceptions[11]) but places no restriction on the levels of export taxes that can be used, except for some new members that accepted them as part of their accession protocol (e.g., China, Mongolia, Saudi Arabia, Ukraine, Vietnam). However, trade policy in natural resources has largely been policy by exporters, not policy by importers.

Second, the uneven geographical distribution of resource deposits means that many countries export a very high proportion of their output or, on the other side, import a very high proportion of their consumption. In this case trade policy and domestic policy are essentially equivalent. For example, although quantitative restrictions on exports are prohibited, government can set production quotas. And on the import side, governments may have bound import tariffs (e.g., on fuel) but face no WTO discipline on the level of (nondiscriminatory) domestic tax that they can impose. Paradoxically, then, the very fact that such a high proportion of natural resource output is traded serves to put it outside the disciplines of the WTO. Furthermore, although the WTO membership now covers 153 countries, several of the largest resource exporters, including Iraq and Iran, remain outside.[12]

3.2. Trade Policy for Resource Exporters

Resource-exporting countries can potentially control both the quantity of the resource exported and the overall quantity produced. In some circumstances the two instruments may be very similar, but we separate them in our discussion, looking first at export policy. The most direct instrument is an export tax (the use of which, as noted above, is not restricted by the WTO), although there are other instruments of dual pricing, including discriminatory sales by state-owned enterprises and domestic price ceilings. The effect of an export tax is to reduce the domestic price of the resource, because producers adjust supply until they are indifferent between exporting and selling in the domestic market. Given the world price, this transfers revenue from the resource producer to the government (in the form of export tax revenue) and to domestic users (through the lower domestic price). It also creates the usual distortionary wedges, as the marginal value of exports comes to exceed the price (and marginal valuations) in the domestic economy.

The frequency of use of export taxes is illustrated in **Figure 3** (see color insert). More than one-third of all notified export restrictions are in resource sectors, according to the WTO's trade policy reviews. Specifically, export taxes on natural resources appear twice as likely as export taxes in other sectors, with 11% of world trade in natural resources covered by export taxes compared with 5% of world trade as a whole. If we focus on specific resource sectors, shares of 5% to 10% of world trade in fuels and mining are covered by export taxes, whereas for fish and forestry these shares are higher. That the frequency of these measures is generally lower than the share of trade covered suggests that

[11]Exceptions include measures "relating to the conservation of exhaustible natural resources" and "to ensure essential quantities of such materials to a domestic processing industry during periods when the domestic price of such materials is held below the world price as part of a governmental stabilization plan," but provided that such restrictions shall not operate to increase the exports of or the protection afforded to such domestic industry" [Artic. XX:(i)].

[12] Russia's WTO accession was approved in December 2010. Russia will have to ratify the deal before official entry into the WTO.

large exporters of natural resources use these measures to a greater extent.[13] What motivates governments to use such a policy?

3.2.1. Government revenue. Although resource export taxes appear to raise revenue for government, their impact has to be evaluated taking into account other taxes and sources of public revenue. Most obviously, if the government is the producer of the resource and all output is exported, then an export tax raises no (net) revenue; it is simply one part of government taxing another part of government. More generally, the export tax will raise government revenue only if the domestic private sector as a whole is a net seller of the resource (its share of resource rents is greater than its purchases of the resource, so a fall in the domestic price is a transfer from the private sector to the government). In situations in which government take from resource rents is high, the government may lose revenue from an export tax, as any apparent revenue raised by an export tax is more than offset in losses on government sales of the resource in the domestic economy.

This proposition has implications for policy toward imports, as well as for policy toward exports. Import tariffs are equivalent to export taxes by Lerner symmetry because, in equilibrium, a reduction in imports will always be matched by a reduction in exports. It therefore follows that in the above-described situation in which export taxes raise no revenue, neither would import tariffs. A general equilibrium formulation of conditions under which this holds is given in Collier & Venables (2011). We can intuitively see the argument by considering a special case in which all foreign exchange earnings come from a perfectly inelastic supply of resource exports and accrue to government; demand for foreign exchange depends on the domestic price of imports relative to the price of domestic output. An import tariff that raises the domestic price of imports must therefore cause an equiproportionate increase in the price of domestic output in order to hold demand for foreign exchange equal to the fixed supply. In this special case an import tariff does not change relative prices and therefore has no real effect on the economy. The tariff raises revenue for government but leads to an increase in the price of domestic output that erodes the real value of resource revenues by an equal amount.

Governments of resource-dependent economies are often urged to diversify their revenue base by developing alternative tax bases, including trade taxes. However, the argument above suggests that this may be a misdirected policy and that, in resource-exporting economies, the revenue argument for trade taxes may be weak. Trade tax revenues are illusory, as they merely shift real revenues between government accounts. Furthermore, trade taxes may have the usual adverse effects of causing distortions and deadweight loss. The most extreme example of this has arisen in agriculture, in which export taxes have been widely employed, in part to provide funds for governments. The distortionary effect has been massive, as exemplified by the experience of the African marketing boards (Jones 1987).

3.2.2. Transfers to households. A second motive for using export taxes is that they reduce the domestic price of the resource to domestic consumers. The clearest example is export taxes on fuel, equivalent to fuel subsidies, reducing the domestic price relative to the

[13] In addition to export taxes, a number of quantitative export restrictions are often applied to resource sectors; such restrictions include prohibitions, quotas, and automatic and nonautomatic licensing. As are export taxes, these measures are more frequently used in natural resource sectors. Specifically, approximately 35% of total notified export restrictions are applied to natural resources.

world price. The political economy case for oil exporters to use such policies can be strong, particularly in societies in which citizens see no other benefit from their resource wealth. The scale of such subsidies on petroleum has been estimated to be some $250 billion per annum (pa) (Coady et al. 2010). Coady et al. suggest that tax-inclusive subsidies, calculated as the subsidy relative to a situation in which a 30-cent-per-liter gasoline tax is imposed, amount to $720 billion pa or 1.0% of global GDP.[14]

Export restrictions—including export taxes, prohibitions, and quotas—have also been widely used in the food sector in recent times (see Bouet & Laborde 2010, Anderson & Martin 2011, and Headey 2011, among others). In the period from 2008 to 2010, approximately 85 new restrictions were implemented in this sector, covering a significant share of world trade. For food staples such as wheat and rice, shares of world trade covered by export restrictions reached 14% and 35%, respectively (Giordani et al. 2012). Although the intent of governments may well be to offset consumers' losses in the face of high and increasing world food prices, export restrictions are often ineffective in insulating domestic markets (Ivanic et al. 2011) and exacerbate volatility of world food prices, an issue that we discuss further below.

3.2.3. Downstream production. The benefits of lower prices accrue not only to households, but also to downstream users or processors of the resource. An export tax, similarly to other forms of export restrictions or dual-pricing schemes, effectively subsidizes downstream industries because it allows them to source inputs at a price lower than the otherwise prevailing price in the international market. Therefore, an export tax on raw materials can increase the competitiveness of domestic producers in international markets. Although resource production is not mobile, resource-using sectors may be, so there is an incentive to use export taxes to attract such sectors. This creates a production relocation effect of export policy similar to the one identified by literature on the effects of import tariffs. Even though second-best arguments such as infant industry protection or the need for export diversification of a resource-rich economy can justify the use of export restrictions to promote domestic downstream production, this strategy has a number of drawbacks (Piermartini 2004). First, export taxes, as other forms of subsidization, may encourage the development of inefficient industries that will depend on government subsidies to survive in the market. Second, although often justified as a tool to improve resource sustainability, export restrictions may have negative environmental effects because they replace foreign demand with higher demand by the domestic processing sector.

These trade-offs are exemplified by the experience of the tropical lumber industry. A number of WTO trade policy reviews and World Bank studies have documented how export restrictions on logs played an important role in Indonesia's industrial policy in the 1980s and 1990s, when the country expanded its plywood manufacturing and furniture industries. For instance, in 1992 Indonesia replaced a ban on exports of logs with a 200% export duty, which was decreased to 30% only in 1998 (World Bank 2000). These measures, which collectively resulted in domestic prices well below the international price, contributed to overlogging and a wastage ratio above the international average and had a negative impact on forestry conservation in Indonesia. These considerations are reflected

[14]Coady et al. select 30 cents per liter as a representative estimate of optimal gasoline taxes on the basis of revenue considerations and externalities related to congestion, accidents, and pollution.

in a recent decision by a WTO panel in the case involving export measures imposed by China on several raw materials:

> The Panel is also concerned with the possibility that export restrictions may have long-term negative effects on conservation due to the increased demand from the downstream sector. An export restriction on an exhaustible natural resource, by reducing the domestic price of the materials, works in effect as a subsidy to the downstream sector, with the likely result that the downstream sector will demand over time more of these resources than it would have absent the export restriction. This could offset the reduction in extraction determined by the export restriction. (WTO 2011, paragraph 7.430, p. 124)

3.2.4. Rent and the terms of trade. The arguments developed above work through the impact of trade policy on domestic prices. But for a large enough producer—or producer cartel—export taxes or equivalent quantity restrictions may increase the world price of the good and thereby redistribute rent toward the producer country. Many primary-commodity cartels have attempted this terms-of-trade manipulation; most such attempts have been unsuccessful (see Teece et al. 1993, Radetzki 2008).

The most important remaining cartel is OPEC, which regulates the overall quantity of oil produced by member countries. For exhaustible resources such as oil, changes in the international terms of trade are likely to be accompanied by changes in the intertemporal terms of trade. Because the resource is exhaustible, extracting less today means extracting more at some later date.[15] The benchmark model for thinking about this situation is that of Hotelling (1931), in which the equilibrium of price-taking producers has unit rent (price minus unit extraction cost) rising at the rate of interest. Although the rate of interest sets the change in the price, the initial level of the price path is such that cumulative demand for the resource leads to its eventual complete depletion. Replacing competition by a cartel with market power in resource supply means that, in this argument, price is replaced by marginal revenue. If demand is isoelastic and the power of the cartel is constant, then marginal revenue is a constant proportion of price, so the cartel extraction path is identical to the perfectly competitive one. The optimal use of cartel power is therefore to do nothing. If the ratio of marginal revenue to price changes, then it is profit maximizing for the cartel to restrict supply in periods in which the demand elasticity is relatively low, such as when the cartel is taking a large share of the market or when there are few substitutes available. This leads to a presumption that a newly formed cartel will raise the price, shifting production to the future.[16]

These arguments become less clear-cut when other factors—for example, the discovery of new sources of supply, the development of substitutes, and the divergent interests of cartel members—are factored into the analysis. But there remains the fundamental point that a limited total supply of a resource sets the level of the price path, so attempts to manipulate the price can have short-run effects but are likely to have a relatively small impact on long-run average prices.

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[15] It may be profitable, but not time consistent, to choose to leave some of the resource in the ground indefinitely.

[16] See, for example, Dasgupta & Heal (1979). Marginal revenue is a fixed proportion of price if the demand curve for the resource is isoelastic. For a nice survey of the issues, see Gaudet (2007).

3.3. Trade Policy for Resource Importers

Import tariffs on natural resources are generally extremely low. Developed country tariffs range from 2.2% on fisheries to 0.5% on fuels. Tariff rates are higher for developing countries, ranging from 15.1% to 6.0%, but they are still well below tariff protection for merchandise trade as a whole. However, it does not follow from this that importers are policy inactive. Two sorts of policies, tariff escalation and domestic taxation, are in place.

3.3.1. Tariff escalation. Just as resource exporters may seek to attract downstream activities by using resource export taxes, so resource importers may seek to attract these activities by offering tariff protection. The phenomenon of offering higher protection for processed resources than for raw ones is known as tariff escalation, and its extent is indicated in **Figure 4** (see color insert), which documents the structure of developed countries' tariff protection by stage of processing in the forestry, fuels, and mining sectors. All three sectors show tariff escalation. The figure shows that, although nominal tariff rates are low, rates on processed products are more than twice as high as rates on raw materials. For example, raw forestry products face an average rate of 0.57% when entering developed countries, whereas their processed counterparts are taxed at a rate of 1.91%. Furthermore, sectors in which tariff escalation is sizable typically involve activities that have a high share of resource inputs (and low share of value added) in gross output so that effective protection rates are high even if nominal rates are low. There are several reasons why tariff escalation in developed countries matters. First, as Corden (1966, p. 229) puts it, "an escalated structure biases trade in favor of raw materials against processed products." Second, advanced economies represent the biggest market for developing resource-rich countries. Hence, tariff escalation lowers the ability of the latter to diversify their export base. Furthermore, one reason often advanced by resource-rich countries to motivate the use of export taxes is to redress the tariff escalation that they face in export markets, an issue that we discuss in more detail in the next section.

3.3.2. Domestic tax instruments. For an importing country that does not (and cannot) have any domestic production of a resource, an import tariff is identical to a domestic consumption tax.[17] This means that trade policy objectives can be met without recourse to import tariffs and consequently without falling under WTO disciplines.

Once again, fuels and hydrocarbons are the key sector, and domestic taxation is often very high, vastly in excess of domestic tax plus import tariffs in other tradable sectors. In many European countries more than 50% of the retail price of gasoline is taxation (2009 data in Allsopp & Fattouh 2011). Of course, there are many reasons for this high rate of taxation, including congestion and environmental externalities and fuel's importance as a source of revenue, which derives from ease of tax collection and the low price elasticity of demand. However, the terms-of-trade argument may be one factor underlying these high rates. Given the low elasticity of supply of hydrocarbons, a concerted tax increase by oil importers would be borne almost entirely by oil producers. The distribution

[17]More generally, an import tariff is identical to a combination of a domestic consumption tax and a resource-specific tax such as a royalty on production. This is true in any sector; however, resource sectors are distinctive because many countries have zero production and because (for countries with some production) sector-specific tax instruments (royalties, production-sharing agreements, or sector-specific corporate income tax rates) are widespread.

of rents is determined by importers' control of demand, as well as by exporters' control of supply.

3.4. Policy Equilibrium

We suggest above that both importers and exporters have instruments that are outside WTO disciplines and that can be used to manipulate trade flows and prices to meet domestic objectives. Furthermore, importers and exporters have motives to use such instruments (although we question the extent to which the revenue argument is applicable for resource exporters and point to the trade-off between current terms of trade and future terms of trade for exhaustible resource exporters). The use of these instruments results in an inefficient policy equilibrium (Latina et al. 2011). Trade measures (a tariff on the downstream sector or an export tax on the resource) and domestic measures (a tax on resource consumption in the importing country or a production quota in the exporting economy) have a negative impact on the welfare of trading partners. This may trigger a response in kind and lead to an equilibrium at which trade in both the resource and the processed good is inefficiently low (e.g., an export tax can be a countermeasure to an escalating tariff structure; higher domestic taxes can be a response to a production quota). In this situation, no country will unilaterally find it convenient to alter its measure unless the trading partner simultaneously adjusts its policy.

Is there any evidence that use of such policies has had a quantitatively important impact on the equilibrium and leads to this adverse outcome? We address this first by reviewing literature on the effectiveness of OPEC, then by investigating the impact of policy on volatility, and finally by looking at the microeconomic efficiency losses that noncooperative policy implies.

The most-studied resource cartel is OPEC, but little consensus has emerged on its impact. There are numerous econometric studies, but these are hampered by the difficulties in understanding oil prices that we discuss above, by the fact that OPEC's influence is likely to have varied through time, and by the lack of data on key variables such as cost. Econometric studies fall into two types, one estimating the impact of OPEC on price and the other looking for other aspects of cartel behavior. Early price studies found evidence of collusive behavior, particularly for the period up to 1983 (see Griffin 1985), although little effect for later periods. A recent study (Almoguera et al. 2011) identifies periods in which OPEC behavior is and is not collusive (using both a measure based on comparison of quota and actual output and a measure using estimated break points). Collusion holds for approximately one-third of the period, and during collusive periods prices are significantly higher (with a predicted increase of 69% over noncollusion) and OPEC production lower (by 11%). Behavior is estimated to be consistent with Cournot competition with a competitive fringe and so is much less collusive than a full cartel. The alternative econometric approach looks at other aspects of behavior such as whether output changes by different countries are correlated, an indicator of collusion. Smith (2005) concludes that "OPEC is much more than a noncooperative oligopoly, but less than a frictionless cartel (i.e., multiplant monopoly)."

Econometric studies need to be assessed in conjunction with commentary by industry experts. In the view of Smith (2009), OPEC has failed to cut production from existing oil wells, except in the period from 1973 to 1975 (and, unintentionally, following the Iranian revolution in 1979). But it has succeeded in restricting the growth of capacity and

development of new fields, thus contributing to current high prices and a situation in which high-extraction-cost non-OPEC oil is beginning to replace low-extraction-cost oil from undeveloped OPEC reserves.

The effect of noncooperative trade policy on price volatility is perhaps most visible (and dramatic for its implications) in food markets. When shocks increase the global price of food, exporters face incentives to set export restrictions to insulate domestic consumers. But precisely because exporting countries impose restrictions, the world price of food increases, which makes the initial policy response inadequate and induces further restrictions as governments strive to maintain a stable domestic price. Different from the initial policy response, subsequent increases in restrictions are only a reaction to the restrictions imposed by the other exporters. Giordani et al. (2012) provide a formal analysis of this mechanism and find that each 1% increase in the share of food trade covered by export restrictions increased the world price of food by 1.1% on average in the period from 2008 to 2010. In addition, importing countries are likely to respond to changes in international prices. The interaction between exporting countries on the one hand and importers on the other may amplify situations of stress in world food markets. Specifically, if world food prices are high, both exporters and importers set trade policy to shield the domestic market from developments in the international market. However, the joint imposition of higher export taxes and lower import tariffs (or higher import subsidies) contracts world supply and expands world demand, thus resulting in even higher international food prices. Anderson & Martin (2011) and Bouet & Laborde (2010) provide evidence of this effect.

(IEA,2011)

Finally, what is the scale of the microeconomic inefficiency induced by tariff and tax policies? Cross-country variation in consumers' marginal valuations of gasoline is more than 2:1 within the OECD [more than $2 per liter in much of Europe and 95 cents in the United States IEA (2011)], extending to 4:1 once some oil producers are included (Malaysia, 61 cents; Indonesia, 51 cents). These price variations dwarf those for other traded goods, although their implication for deadweight loss depends on elasticities of demand and on an estimate of the true marginal cost of fuel. Although elasticities are very low in the short run, the longer-run estimates we note above suggest a range of −0.2 to 0.9. Simple calculations then suggest that the dispersion in fuel prices generates a deadweight loss that could amount to more than 20% of the value of consumption. Welfare calculations should also include environmental damage, both local and global. Because CO_2 emissions have a global effect on climate change, the shadow price of emissions should be the same in all countries. Sterner (2007) demonstrates the quantitative impact of moving to an equal price, and IEA (2009) estimates that simply reducing tax-inclusive subsidies by 50% would reduce total greenhouse gas emissions by 14–17% by 2050.

We also argue that policy has been used to relocate downstream production, through use of export taxes and importers' tariff escalation. We know of no studies that attempt to quantify this in aggregate, although there are numerous examples of inefficiencies, particularly in downstream processing (e.g., petrochemicals) in some resource-producing countries.

3.5. Policy Reform

The previous subsection describes a series of inefficiencies that characterize the current policy equilibrium. Here we highlight policy reforms—some of which are discussed in the literature—that can improve upon the status quo. A key economic rationale of WTO rules is to promote cooperation among trading partners in areas in which they can harm each

other by acting unilaterally. Policies that aim at international rent shifting or the location of downstream production have a beggar-thy-neighbor effect and induce reactions by trading partners. As outlined above, beggar-thy-neighbor measures include traditional trade policy actions (e.g., tariff escalation, export restrictions) and domestic instruments (e.g., resource taxes, production quotas, and dual-pricing schemes).

Consider, for illustrative purposes, the case of trade in petroleum. Heavy permanent taxes in most importing countries reduce world demand for oil and hence lower the world price, thereby shifting the rents from producers to consumers. In producer countries, consumer subsidies or export taxes and restrictions have an analogous opposing effect, raising domestic demand, reducing export supply, and tending to increase the world price. Analogous to tariff wars, the attempt to shift rents is not a zero-sum game. As substantial price wedges open up between the price of gasoline in different national markets, the efficiency losses from low-value marginal consumption in producing countries and forgone high-value marginal consumption in consuming countries are likely to be substantial.[18] However, because the efficiency losses arise from differences in domestic prices, whereas the shifting of rents arises from the effect on the world price of taxation in some countries and subsidy in others, it is potentially possible to reach a mutually beneficial deal in which the distribution of rents is unaffected whereas the efficiency losses are eliminated. Reaching such a deal, in which world prices were gradually harmonized, would be entirely analogous to the mutual de-escalation of tariff wars that has been the core function of the WTO since its foundation. However, achieving this deal would require action by both importers and exporters (Collier & Venables 2010).[19]

The asymmetries that characterize WTO rules, between export and import policy and between domestic and trade measures, limit the ability of countries to escape these inefficiencies. As shown by Bagwell & Staiger (1999) in the case of a terms-of-trade externality and by Ossa (2011) for a production relocation externality, the fundamental GATT/WTO principles of reciprocity and nondiscrimination help governments internalize the negative cross-border effects that they impose on each other. Essentially, these principles ensure that joint reductions in restrictions to trade neutralize the beggar-thy-neighbor effect of the policy while allowing trade to grow. However, a prerequisite for such mutual exchanges is that countries are able to secure negotiated policy concessions by eliminating incentives to reverse them in the future. The very fact that significant measures that affect resource trade are outside the scope of the WTO, therefore, makes it difficult to eliminate these inefficiencies within the current system (Latina et al. 2011).

These considerations have important implications in the contexts of the Doha negotiations and of the broader discussion on the future agenda of the WTO. In the current trade talks, countries have moved toward the possible application of the so-called Swiss formula to cut import tariffs, which implies a reduction of tariff escalation.[20] On the export side, however, taxes are not under negotiation. To the extent that a trade agreement is motivated

[18] Some price differential is (second-best) efficient if it is in response to local externalities such as road congestion.

[19] Clearly, the adverse effects of carbon dioxide emissions would need to inform the eventual common tax rate on petroleum. However, the path to a common global price for carbon emissions from petroleum may be more feasible if conceptualized as a standard trade negotiation and if conducted through the mechanisms of the WTO, rather than as part of wide-ranging and ad hoc negotiations on countering climate change.

[20] Algebraically the Swiss formula can be written as $t_1 = at_0/(a + t_0)$, where t_0 is the original tariff rate, t_1 is the new reduced tariff rate, and a is a coefficient. The formula implies that high tariffs are reduced more than low tariffs.

by the need to eliminate beggar-thy-neighbor effects of trade policies, this asymmetry between import and export policy is incoherent from the perspective of economic analysis and may limit the ability of countries to achieve meaningful gains in trade in natural resources and resource-based products. In terms of the broader, long-run agenda of the WTO, an increasingly debated issue is the proper regulation of domestic measures. As argued above, in natural resource sectors, a number of trade and domestic instruments can be close substitutes: A production quota is equivalent to an export quota for countries that export the quasi-totality of their resource production, and a tax at the border has the same effect as a domestic tax where countries importing the resource do not produce it. In these cases, regulating only one of the equivalent measures is insufficient to achieve undistorted trade in natural resources.

In the discussion on policy reform so far, we emphasize the symmetric incentives of exporting and importing countries to use beggar-thy-neighbor policies that affect resource trade. As discussed in Section 2.1, however, exporters of natural resources are different in one important respect: Their economy is often dominated by these sectors, with attendant problems of exposure to price volatility and of the Dutch disease. This creates a legitimate policy objective of diversifying the economy and raises the question of the best mix of policies to achieve such diversification. Existing international trade rules may induce exporters to use inefficient, but less-regulated, policy instruments rather than first-best tools. Restrictive export measures such as export taxes or dual-pricing regimes may be highly inefficient ways of encouraging local production. An issue that warrants further consideration is, therefore, the extent to which the Subsidies and Countervailing Measures Agreement leaves sufficient scope to resource-rich governments to pursue, through less distortive policy instruments, export diversification objectives that are recognized by part IV of the GATT.

4. LONG-RUN CONTRACTS

We so far concentrate on trade in the resource itself, but there is a further important international dimension. Extraction of natural resources frequently takes place under long-term contracts between government and the private sector, often foreign firms. These contracts vary widely, ranging from service contracts (the investor is paid a fee per unit for resource extracted) to production-sharing arrangements (output is shared between government and the investor) to royalty and income tax regimes, in which taxes are paid on output (a royalty per unit, or per-unit value) and on corporate profits, perhaps at a sector-specific rate. These are international contracts and can be thought of as a form of FDI. However, the particular context of natural resource exploration, development, and production creates very significant differences from other sorts of FDI and, we suggest, inefficiencies in outcomes. One inefficiency concerns the incentives to investors to undertake exploration and development, and another surrounds the allocation of licenses to explore and to produce.

4.1. Inefficiencies

A country with tracts of land (or sea) that are expected to contain subsoil assets (in particular hydrocarbons) typically goes through a process of allocating blocks for exploration and development. On one side is government and on the other investors with the expertise to undertake exploration and development. Both sides are likely to face (*a*) a great deal of

uncertainty about the geological prospects and technical difficulties that will be encountered and about future prices of the resource and (*b*) current and future political risk.

To bid for a license, investors have to formulate a view about the long-run return to the project, particularly true because their capital expenditure will be sunk; unlike other forms of FDI, a mine or oil well cannot be dismantled and moved to another location in the event of the project failing. A key determinant of the long-run return is the contractual and fiscal regime under which the project operates. The combination of sunk costs and high and potentially variable tax rates creates a severe holdup problem. Once investments are sunk, government has an incentive (and perhaps faces domestic political pressure) to increase tax rates, and knowing this, investors are unwilling to participate. All parties could be better off if government had a commitment technology that restricted its freedom to alter fiscal or contractual terms. It has been suggested that the efficiency loss associated with this market failure is significant. Collier (2010) suggests that the value of subsoil assets per square kilometer discovered in sub-Saharan Africa is just one-fifth the value of subsoil assets remaining in OECD countries. This is unlikely to be geological bad luck and is much more likely to indicate the scale to which exploration and development in African have been deterred by these concerns.

If investors are willing to participate, there remains the issue of how contracts and licenses are allocated. Such allocation can take alternative forms, ranging from open and transparent auction in which investors bid for rights to closed-door deals with risk of corruption. Auctions have the great advantage that bidders reveal their willingness to pay, government can in principle extract the full value of the resource, and auctions can be open and transparent. However, auctions work only if there are sufficiently many bidders and no one bidder has a dominant position. In the latter case, because the winning bidder generally pays only the value of the second bidder, negotiation may be preferred to auction.[21] Furthermore, high degrees of uncertainty may mean that risk-averse investors' willingness to pay is low, thus lowering the price received by government. Geological uncertainty can be reduced by survey work, but knowledge generated is a public good. The public sector can undertake prior survey work, but private-sector provision will not be efficient; if results are made public, there is no return to doing the survey, and if they are kept secret, then there will be inefficient duplication. In practice, allocations have often been done through nontransparent discretionary processes, failing to secure that the most efficient investor is awarded the contract, failing to secure maximum benefit for the state, and frequently being vulnerable to corruption.

4.2. Policy Reform

Above we point to features that make resource contracts different from other forms of FDI and prone to market failure and inefficiency. Such contracts are typically international, and the international system could offer solutions to some of the problems identified.

The holdup problem is mitigated if countries have access to a commitment technology. This is, of course, exactly what the WTO offers with respect to tariff policy, through tariff bindings and associated dispute procedures. Reflecting the need for commitment technologies for resource extraction, the internationalization of contract enforcement is occurring

[21] Vickrey's revenue equivalence theorem establishes conditions under which the value for the seller is equal to the second-highest valuation independently of the auction type.

through a number of approaches, including bilateral investment treaties (BITs) and the use of foreign courts and arbitration arrangements. Although these arrangements have certain advantages (e.g., foreign investors can obtain monetary reparation for damages suffered), they face two shortcomings. First, differences in bargaining power can be large in bilateral arrangements. Such differences skew the distribution of rent in favor of the stronger party. This is often seen as lowering the gains that resource-rich governments can achieve by signing a BIT (Guzman 1998). Second, the extent to which the holdup problem is effectively solved depends on the credibility of the arbitration system offered by the specific arrangement. One way to address these problems is to extend the role of the WTO in the enforcement of resource extraction agreements, thereby giving governments a way of committing themselves to fiscal and contractual terms (Collier & Venables 2010).

Efficient allocation of contracts requires a process analogous to the most-favored-nation (MFN) principle of the WTO. This principle is concerned to avoid discriminatory tariff wedges that disadvantage some suppliers relative to others. Because there is no market, secret and bilateral resource deals do not constitute a breach of the letter of the MFN clause, although they certainly breach its spirit. Through such deals a government can advertently or inadvertently offer privileged terms to a particular extraction company. The analog of the MFN clause would be a rule requiring or encouraging an open process for allocating resource extraction rights, as provided in auctions. This is not dissimilar from what a number of WTO members have committed to with the Agreement on Government Procurement. This plurilateral agreement is based on the principles of openness, transparency, and nondiscrimination, which apply to parties' procurement, and includes specific rules implementing those principles. The proposal would extend these practices beyond purchases to government sales.

Countering corruption in international contracts faces an acute weakest-link problem. As long as some companies are in jurisdictions where bribery is permitted, these companies will tend to win the contracts. Knowing this, individual governments will be reluctant to act in isolation. This corruption problem is widely recognized and has been addressed by a variety of ad hoc international initiatives. One such is the Extractive Industries Transparency Initiative, started in 2003 and now with more than 30 signatories among the governments of resource-rich countries, indicating recognition of concern for the problem. It aims to counter corruption in contracts by requiring companies engaged in resource extraction to report all their payments, country by country, forcing illicit payments into the open. A number of OECD countries have taken or are taking measures to increase transparency. Pan-OECD antibribery legislation has made it a criminal offense for an OECD-based company to bribe government officials anywhere in the world to win a contract. In the United States, the Frank-Dodd Act increases disclosure requirements for companies operating in resource sectors, and the EU is proposing similar measures. Given the impediments to ad hoc international cooperative initiatives, this plethora of international responses is evidence of the need for a more systematic international approach. These initiatives could potentially be subsumed and made more effective by bringing corruption in resource extraction contracts under the clear remit of the WTO.[22] For example, the antibribery legislation that the

[22]In some sense, this has been already the case for the Kimberley Process Certification Scheme (KPCS), which seeks to stem the flow of conflict diamonds. In 2003, the WTO General Council approved a request by 11 members of the KPCS to waive the application of certain GATT rules with respect to measures taken to prevent the export of conflict diamonds in accordance with the KPCS. In December 2006, the so-called Kimberley waiver was extended until 2012 (WTO 2010).

OECD now requires of its membership could be a requirement of WTO membership. The emergence of major resource extraction companies based outside the OECD has made the WTO the more appropriate institution for international cooperation on this matter.

5. CONCLUDING COMMENTS

The geography of natural resource endowments means that resources are, more than almost any other products, internationally traded. The technology of extraction means that FDI is crucial to their production. Yet resource sectors raise issues that are distinct from those covered in most of the literature on international trade and FDI. These include exhaustibility, the presence of large rents, price volatility, cartel behavior, and the political economy of contracting with government. Here we review literature on these issues and argue that there appear to be major inefficiencies in the equilibrium we observe, with many of the key policy variables being outside the disciplines that apply to other sorts of trade. Although national interests conflict on some of the issues, the inefficiencies are such that properly coordinated policy measures (on export taxes, fuel prices, contract stability, and revenue transparency) offer the potential of gains for all.

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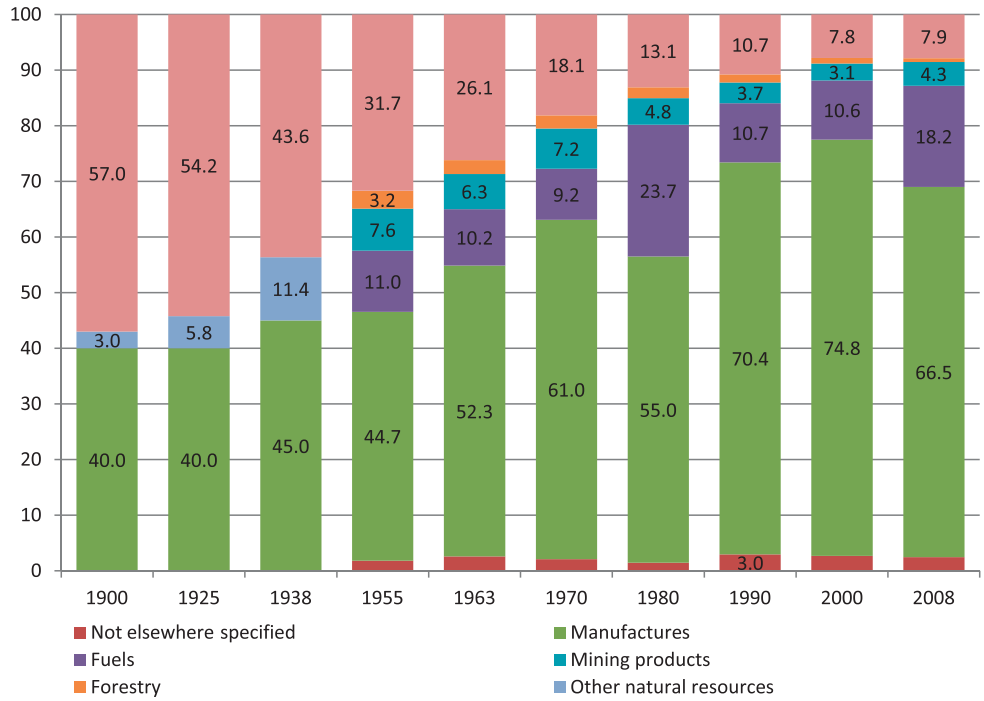

Figure 1

Product shares in world merchandise trade from 1900 to 2008. From WTO (2010).

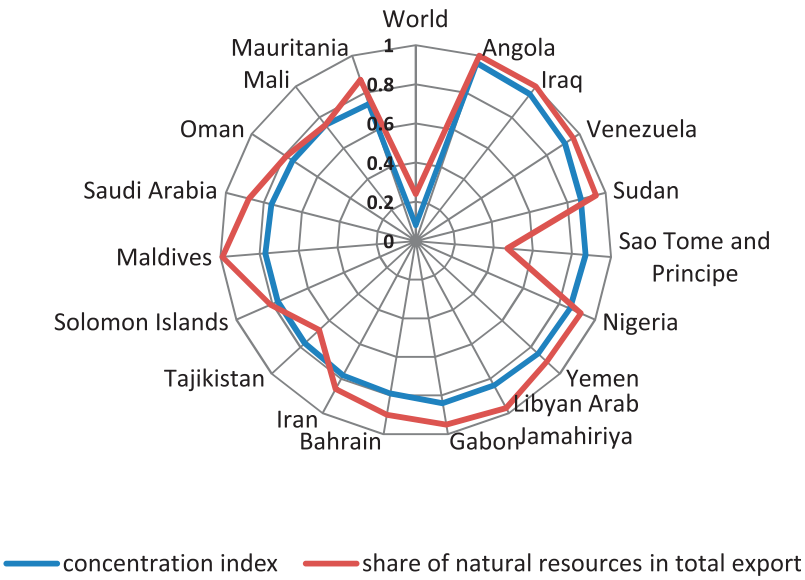

Figure 2

Dominance of natural resource exports. From WTO (2010).

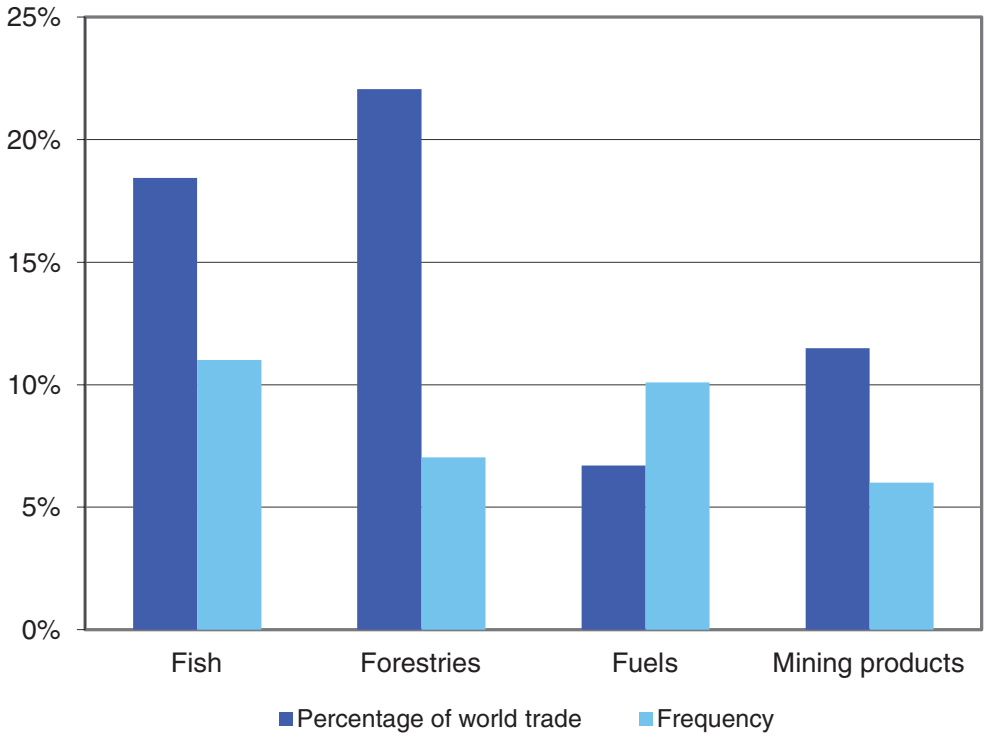

Figure 3

Export taxes by the natural resource sector. From WTO (2010).

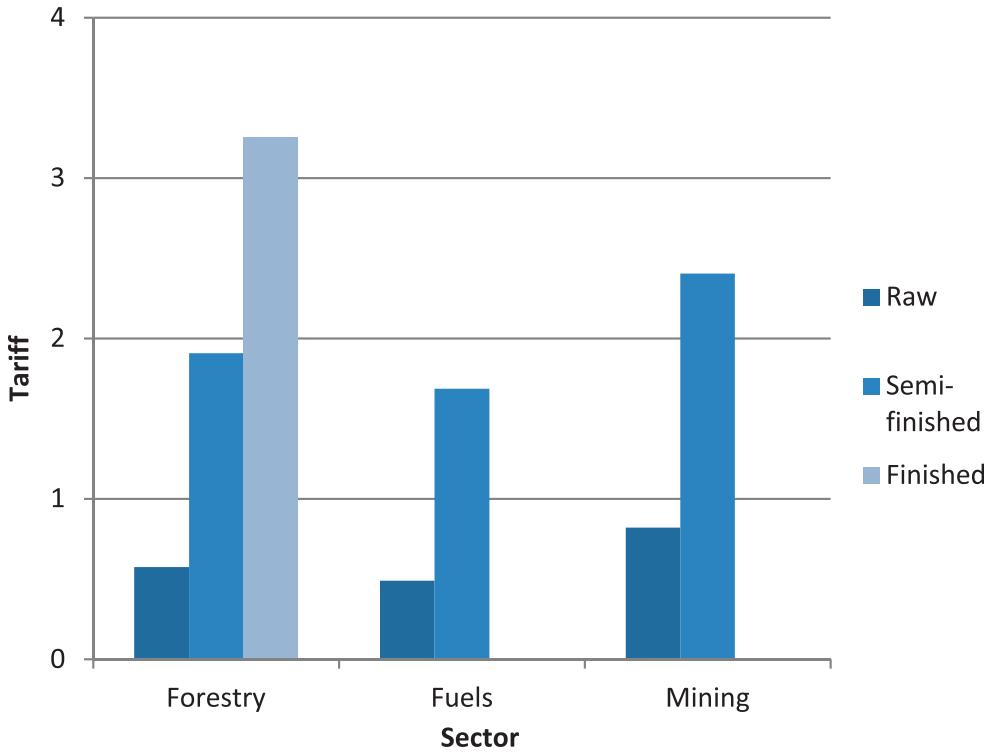

Figure 4

Tariff protection by stage of processing. From WTO (2010).