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ORIGINAL PAPER

Explaining energy disputes at the World Trade Organization

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Abstract The international trade regime has seen an explosion of challenges to government support for renewable energy in recent years, yet fossil fuel subsidies, which dwarf renewable energy subsidies, have remained unchallenged. Existing explanations for this puzzling discrepancy have focused on four rationales: major fossil fuel exporters have not historically been members of the General Agreement on Tariffs and Trade/World Trade Organization (WTO); WTO subsidies rules are inadequate to deal with the specifics of the fossil fuel trade; nations have developed separate institutions to govern energy; and all states have fossil fuel subsidies, so a challenge to one country's subsidies will prompt a reciprocal challenge. This article makes two contributions. First, it uses a survey of existing renewable energy trade disputes to critique the existing explanations. Most importantly, the article shows that the threat of reciprocal litigation exists in the renewable energy sector, and that WTO subsidies rules are rarely used to challenge renewable energy subsidies. Hence, neither the threat of reciprocal litigation nor the relative ease of applying WTO subsidies rules explains the discrepancy in the number of disputes. Second, the article hypothesizes that the economic diversification of energy-producing countries is correlated with and may drive whether energy-producing countries face WTO challenges to their energy support policies. Most major fossil fuel producers lack significant non-fossil fuel exports that could be restricted in order to induce them to reform their fossil fuel policies, the usual mechanism for enforcing a WTO judgment. States may also be more likely to challenge new, rather than long-standing, trade restrictions. This suggests that trade challenges will arise more frequently where innovation leads to competition and a demand for new trade restrictions (as in renewable energy), as opposed to in mature sectors of the economy (i.e., the fossil fuel industry). Economic diversification, in turn, is a good predictor of innovation.

Keywords Climate change · Fossil fuels · Renewable energy · Subsidies · WTO

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Abbreviations

AD/CVD	Antidumping and countervailing duty
DSB	Dispute Settlement Body
EU	European Union
FIT	Feed-in tariff
G20	Group of 20
GATT	General Agreement on Tariffs and Trade
IEA	International Energy Agency
NT	National treatment
OPEC	Organization of Petroleum Exporting Countries
PV	Photovoltaic
SCM	Agreement on Subsidies and Countervailing Measures
US	United States
WTO	World Trade Organization

1 Introduction

Perhaps no international institution is better positioned to take on energy subsidies reform than the World Trade Organization (WTO). Governmental measures that provide financial support for the energy sector can distort trade patterns and markets more generally, making it a prime target for the application of WTO rules aimed at liberalizing global trade. WTO parties deemed subsidies issues so important that they negotiated a separate Agreement on Subsidies and Countervailing Measures (ASCM) when creating the WTO. Moreover, the WTO Dispute Settlement Body (DSB) is the most successful international adjudicative mechanism ever established, resolving hundreds of cases since its creation in 1995 and enjoying relatively high levels of compliance with its rulings. This gives the WTO institutional capacity to enforce rules on government support lacking in other forums, such as the Group of 20 (G20).

Yet the pattern of WTO involvement with government support for the energy sector is puzzling. Fossil fuel subsidies are by far the largest category of energy subsidies. The International Energy Agency (IEA) estimates that consumption subsidies alone for fossil fuels totaled US$490 billion globally in 2014 (IEA 2015). Moreover, Faith Birol, then chief economist at the IEA (now its executive director), estimated that eliminating subsidies for coal, gas, and oil could produce half the greenhouse gas emission reductions necessary to keep global warming under 2 °C (Clark 2012). By contrast, global renewable energy subsidies—for either consumption or production—are relatively modest, totaling only US$135 billion in 2014 (IEA 2015). Renewable energy subsidies offer the hope of reducing fossil fuel emissions while satisfying the growing need for energy in the developing world. This might suggest that WTO rules would be applied actively to fossil fuels and but not renewable energy subsidies. The reverse is true. In the words of former WTO Director-General Pascal Lamy, 'discussion on the reform of fossil-fuel subsidies has largely bypassed the WTO. This is a missed opportunity' (Lamy 2013). Instead, the WTO dispute settlement process has seen a surge in challenges to renewable energy support programs.

Existing explanations for the absence of WTO challenges to fossil fuels have focused primarily on the lack of a mandate within the WTO. Major fossil fuel exporters have not historically been General Agreement on Tariffs and Trade (GATT)/WTO members

(Selivanova 2010); WTO rules allegedly do not apply to energy or are inadequate to deal with the specifics of energy trade (Selivanova 2007); or nations have developed separate institutions, such as the IEA or the Energy Charter Treaty, to govern energy (Selivanova 2010; Meyer 2012). Although these explanations have some explanatory power, this article argues that they cannot fully account for the pattern of WTO energy disputes.

To fill this gap, I hypothesize that the economic diversification of energy-producing countries plays a major role in driving challenges to government support for renewable energy, but not government support for fossil fuels. I use the term 'government support' rather than 'subsidies' for two reasons. First, under WTO rules (specifically the ASCM) the term 'subsidy' has a technical meaning that is limited in certain respects.[1] Governmental measures that provide financial support to energy companies may not qualify as subsidies under the ASCM, even if they have the same kind of distorting effects as measures that do qualify. Because I am interested in how trade rules generally (not just rules on subsidies) are used to challenge governmental measures that provide financial support to the energy sector, I cannot limit my inquiry to those measures that would qualify for a subsidies challenge. Second, in an ASCM case, whether a measure qualifies as a 'subsidy' may itself be in dispute. Since I am interested in the causes of disputes, and not dispute outcomes, I cannot limit my study to measures meeting a definition that is itself subject to dispute resolution. Indeed, as I show in Sect. 2, the WTO DSB has never found any governmental measure providing support to either fossil fuels or renewable energy to violate the ASCM. Yet governmental support measures have been found inconsistent with other WTO rules or have been resolved without a conclusive DSB determination that a WTO-inconsistent support policy exists.

Governments do not generally bring trade cases to vindicate abstract public policy considerations. Instead, they do so at the behest of domestic interest groups. Acting rationally, such interest groups should only pursue a trade case if they expect that a victory by the government will get them something they value. Economic diversification influences this calculus in the energy sector in two related ways.

First, states challenging energy subsidies expect to have greater success in changing the respondent's behavior when the respondent has diversified exports. Renewable energy technologies tend to be produced in countries with diversified (and in cases such as China rapidly developing) economies. The WTO essentially functions through the reciprocal exchange of concessions across multiple products, services, or intellectual property. When a country has many major exports that can be restricted in retaliation for unlawful subsidies, states have the basis for a negotiation over resolving subsidies disputes. This expected outcome, in turn, spurs disputes. By contrast, non-diversified economies are unlikely to change their behavior in response to a finding that a policy regarding their major export is WTO inconsistent. Complaining states have few meaningful concessions they can suspend within the WTO that, when weighed against the value of its preferred

[1] In particular, to qualify as a subsidy, a measure must provide a financial contribution by the government that confers a benefit on the recipient (Article 1 ASCM Agreement). Additionally, the subsidy must be specific, meaning that it is only available to an industry or enterprise or it is prohibited because it is conditioned on either exports or the use of domestic products over imported products (Article 2 ASCM Agreement). Subsidies come in a wide variety of forms, from production subsidies to consumption subsidies, and from direct financial contributions to foregone tax revenue. Government regulations, such as local content requirements, might also be thought of as indirect subsidies. Local content requirements typically require a business to purchase locally produced products as a condition of receiving a government benefit (Hestermeyer and Nielsen 2014; Meyer 2015).

policy regarding its primary export, will prompt fossil fuel exporters to change their behavior.

Second, a recent study suggests countries may be more likely to challenge new trade-distorting measures (Bown and Reynolds 2014), rather than long-standing ones. I refer to this argument as the 'loss aversion' hypothesis. New restrictions disturb investment-backed expectations. Long-standing trade restrictions, such as fossil fuel policies, are baked into investment expectations. They thus do not disturb expectations in a way that leads to domestic pressure for a WTO challenge. The loss aversion hypothesis suggests that trade challenges will arise more in sectors of the economy in which innovation leads to competition, as opposed to in mature sectors. Economic diversification, in turn, is a good predictor of innovation. As applied to energy, economic diversification contributes to innovation and competition in the renewable sector—and hence new trade restrictions—but not the fossil fuel sector, where trade restrictions have a long history.

This article proceeds as follows. Section 2 describes trade disputes involving government support for the energy sector, showing that disputes have focused entirely on government support for renewable energy, and that the WTO's subsidy rules have played a relatively minor role in these disputes. Section 3 discusses existing explanations for the absence of disputes challenging fossil fuel support programs. Section 4 develops the hypothesis that economic diversification influences the pattern of energy trade disputes. Section 5 concludes.

2 The disputes (or lack thereof)

Until 2000, no nation had filed a request for consultations (i.e., a complaint) with the WTO challenging government support measures for the energy sector. In 2009–2010, the dam broke, releasing a flood of challenges to energy support programs. These challenges, however, have focused exclusively on renewable energy programs.

Table 1 presents a survey of energy disputes challenging government support measures. In the 'type of dispute' column, I report the complainant's primary legal claims. Cases are primarily coded as either 'WTO' cases or 'Domestic.' For cases brought directly to the WTO, the two principal legal claims are discrimination against imports under national treatment (NT) rules and subsidies claims under the ASCM.[2] The coding does not indicate that the claimant necessarily prevailed on these claims.

In addition to WTO cases, Table 1 includes domestic antidumping (AD) and countervailing duty (CVD) investigations. Countervailing duties are a response to subsidization. Antidumping duties are a response to a producer selling its goods in a foreign market at less than 'normal' value. Government financial support is one reason goods might be available in a foreign market at less than 'normal' value. These investigations can result in the imposition of duties designed to offset the subsidy. Oftentimes governments include both antidumping and countervailing duties in the same investigation. Significantly, a countervailing duty investigation requires a government to make a determination that a subsidy exists under WTO rules. However, that determination is made domestically by a

[2] Each of these claims can be broken down further, and some cases raise claims beyond those indicated above. Non-discrimination cases, for instance, typically raise national treatment claims under both the GATT and the Agreement on Trade-Related Investment Measures. Countries also usually raise multiple claims under the ASCM, including that a measure is a 'prohibited subsidy' because it is contingent on the use of domestic products over imported products—a form of discrimination. For simplicity, however, I focus on the general nature of the claim and only on these four kinds of claims.

Table 1 Renewable energy trade disputes (based on Lewis 2014; WTO 2016a)

Date	Type of dispute (legal claim)	Complainant	Respondent	Industry or program targeted
March 2009	Domestic (AD/CVD)	EU	USA	Biodiesel
September 2010	WTO (NT, SCM)	EU, Japan	Canada	Ontario Province's feed-in tariff policy
December 2010	WTO (SCM)	USA	China	Chinese wind subsidy
November 2011	Domestic (AD/CVD)	USA	China	Solar Panels
November 2011	Domestic Investigation (NT)	China	USA	State-level renewable energy support programs
January 2012	Domestic (AD/CVD)	USA	China; Vietnam	Wind components
July 2012	Domestic (AD/CVD)	China	EU; South Korea; USA	Polysilicon
July 2012	Domestic (AD/CVD)	EU	China	Solar panels
September 2012	WTO (AD/CVD)	China	USA	Wind components (among other products)
November 2012	Domestic (AD/CVD)	India	China; Malaysia; Taiwan; USA	Solar panels
November 2012	WTO (NT, SCM)	China	EU; Greece; Italy	Certain EU Member States' FITs
May 2013	WTO (NT, SCM)	Argentina	EU	Biodiesel
February 2013	WTO (NT)	USA	India	India's National Solar Mission
December 2013	WTO (AD)	Argentina	EU	Biodiesel
June 2014	WTO (AD)	Indonesia	EU	Biodiesel
January 2016	Domestic (AD/CVD)	China	USA	Biofuels
September 2016	WTO (NT, SCM)	India	USA	Subnational renewable energy measures
October 2016	Domestic (AD/CVD)	Peru	Argentina	Biodiesel

Antidumping and countervailing duties are authorized for a limited period of time, but the affected industries frequently petition to extend and expand their application. I have included only the first instance of trade remedy investigations in this chart, rather than listing each separate application for extension/expansion/renewal as a separate dispute

single government, not by the WTO. Because they do not first require a determination by the WTO that an illegal subsidy exists, domestic trade investigations are widely abused (Neufeld 2001; Bown 2005a). For this reason, I do not treat domestic countervailing duty investigations as equivalent to an ASCM case brought directly before the WTO.

If the nation targeted by the domestic investigation believes that antidumping or countervailing duties are being imposed wrongfully, it can bring a WTO challenge. Hence, domestic trade investigations are subject to WTO rules and can be preluded to WTO disputes. Where a WTO dispute challenged a domestic AD or CVD investigation, I have indicated as much parenthetically in the 'type of dispute' column. To avoid double counting, AD and CVD cases that made their way to the WTO are only listed once as WTO (AD/CVD) cases.[3]

Table 1 shows, first, that these 18 disputes all deal with renewable energy technology. Second, it shows that WTO disputes raising ASCM claims have been relatively unimportant even for renewable energy. Among the 18 renewable energy cases, only five have been brought directly under the ASCM. *In none of these cases has the DSB found an ASCM violation*. Indeed, under the WTO's dispute settlement system, filing a request for consultations does not automatically trigger adjudication. Instead, a complainant must make a second request, to establish a panel to hear the dispute, if consultations fail to resolve the issue. To date, complainants have only requested that a panel be established to actually adjudicate its ASCM claims in one case: *Canada—Renewable Energy* (WTO 2013a). In other words, ASCM claims do not appear to be an important driver of challenges to government support *for either renewables or fossil fuels*. Dynamics unique to ASCM cases (whether they are more difficult or expensive to bring, for instance) thus do not appear to have significantly influenced the different rate at which renewable and fossil fuel programs have been challenged thus far.

Far more important have been domestic investigations. Ten cases involve domestic investigations of various kinds (although some of these are domestic subsidies investigations). Where the domestic investigations have been challenged before the WTO, the challenging party has prevailed every time. In other words, between direct ASCM claims and its review of domestic investigations, the WTO DSB has never found, or sustained in its entirety a domestic finding of, an illegal subsidy. Instead, where complainants have prevailed before the DSB they have generally done so on national treatment (i.e., discrimination) grounds. These claims feature in six disputes.

The development of the disputes between 2009 and the present illustrates the relative unimportance of direct ASCM claims to energy support cases. In 2010, two ASCM cases were filed: the USA challenged Chinese wind subsidies, and Japan and the EU challenged a Canadian province's feed-in tariff (FIT) for electricity generated with renewable energy equipment. The Chinese case never progressed beyond the initial request for consultations, however, because the Chinese agreed to remove the challenged measures (WTO 2010). In the latter case, the WTO Appellate Body held that the program violated the NT rule—which requires that foreign products and investments be treated no less favorably than domestic products—because producers had to use locally manufactured renewable equipment to qualify for the payments. However, the Appellate Body declined to find an ASCM violation (WTO 2013a).[4]

[3] The exception is the US imposition of antidumping and countervailing duties on Chinese and Vietnamese wind components. Although China made these duties a part of a challenge against the USA, Vietnam did not. I therefore list both the domestic investigation against China and Vietnam and the WTO dispute between the USA and China.

[4] The DSB declined to hold that the program constituted a subsidy under the ASCM.

Following these two cases, governments initiated a wide variety of trade disputes challenging government support for renewables. They have, mostly but not entirely, avoided direct ASCM claims before the WTO, however. For example, both the USA and the EU initiated domestic trade investigations into Chinese support for the solar industry (Lewis 2014). China responded with similar domestic trade investigations into US support for renewable energy, as well as into EU and South Korean trade practices (Lewis 2014). It also has challenged FIT programs maintained by several EU Member States on the basis that these programs contain local content requirements, like that in *Canada—Renewable Energy*, although that dispute has not advanced beyond the WTO (WTO 2012b). Indonesia and Argentina have challenged EU trade sanctions on biodiesel that have severely curtailed those nations' access to the European market (WTO 2013b, 2014b). Significantly, the EU investigations at the root of these cases originally included countervailing duty investigations, which were later abandoned in favor of antidumping duties (i.e., non-subsidies claims) (WTO 2016c, para. 7.179). Finally, in September 2016, the Appellate Body held in *India—Solar Cells*—that India's Jawaharlal Nehru National Solar Mission program contained unlawful local content requirements, a decision very similar to that in *Canada—Renewable Energy* (WTO 2016d). The USA had not even bothered to include an ASCM claim in that case. Only days after the Appellate Body's decision, India filed a request for consultations challenging a series of state and local renewable energy support programs on both national treatment and ASCM grounds (WTO 2016e). That case remains in its early stages.

This level of activity far outstrips concern in the WTO over fossil fuel support measures. To be sure, nations have complained about energy support measures in the WTO. Many of these complaints target 'dual pricing,' in which fossil fuel-producing countries mandate lower prices for energy domestically than on international markets (Pogoretskyy 2011). Dual pricing is a consumption subsidy that encourages fossil fuel use by making fuels cheaper. It can be used either as a social subsidy for consumers or to support energy-intensive industries (or a combination of both, as when dual pricing is used to keep food prices low) (Pogoretskyy 2011, 183).

Despite developed countries' dislike for dual pricing, however, formal WTO disputes involving energy dual pricing, or any other disputes challenging financial support measures, do not exist. Instead, nations have attempted to use the accession of fossil fuel-exporting nations to the WTO as an opportunity to impose disciplines on those countries. When a nation joins the WTO, it signs an accession protocol, which creates obligations applicable to the new member only that go beyond generally applicable WTO rules. Saudi Arabia agreed to disciplines on dual pricing in its accession protocol, for example (Marceau 2012, 387).

3 Existing explanations and their shortcomings

The absence of action in the WTO against fossil fuel support measures, or more generally against the production policies of major fossil fuel states, has been the subject of speculation for many years. Hypotheses about the causes of lack of action on fossil fuel exporters in particular vary. The primary set of explanations argues that the WTO does not have a mandate to address energy trade or fossil fuels specifically. Scholars have advanced three specific reasons for the lack of a WTO mandate. First, many major fossil fuel exporters have joined the WTO only recently, such as Saudi Arabia in 2005 and Russia in 2012[5]

[5] Other OPEC members, such as Nigeria and Kuwait, joined a bit earlier, in the mid-1990s.

(Selivanova 2010). Consequently, no claims could be brought against those nations until very recently. Path dependence is a second explanation. Because oil-producing countries were by and large not in the GATT/WTO during the energy crises of the 1970s, nations developed alternative institutions to deal with global energy trade, such as the IEA and the Organization of Petroleum Exporting Countries (OPEC). They continue to rely principally on these institutions, rather than the WTO, even after oil-producing nations joined the WTO (Meyer 2012). A third possibility is that energy is not governed by the substantive rules of the GATT/WTO at all, or that WTO rules do not easily apply to fossil fuel support programs. The fact that energy receives little individualized attention within the GATT/WTO texts, despite its outsized importance as a sector of the economy, 'originally [led to] a common perception that GATT rules did not apply to trade in energy' (Selivanova 2007, 4). Fossil fuel support programs might also be categorically different from renewable energy programs in ways that affect how WTO rules apply.

The membership and path dependence arguments certainly have some explanatory power, especially historically. GATT/WTO claims could not, of course, be brought against non-members. However, these explanations suffer from several major weaknesses. First, a number of fossil fuel producers—including the USA, Venezuela, Mexico, and Canada—have been in the GATT/WTO for decades. The USA was the world's largest producer of fossil fuels in 1947 when it was an original GATT party. Membership alone is thus an inadequate explanation.[6]

Second, neither of these hypotheses explains the lack of forum shopping. Nations regularly move among international institutions when they expect to achieve better results in alternative institutions. Indeed, the existence of the Agreement on Trade-Related Aspects of Intellectual Property Rights within the WTO can be explained largely as a forum-shopping maneuver to return power over international intellectual property matters to developed countries (Helfer 2004). Scholars have also argued that the rise of bilateral investment treaties is a type of forum shopping (Guzman 1998).

Today, most fossil fuel producers are within the WTO. We would therefore expect to see countries challenging fossil fuel policies in the WTO if they expected they could gain an advantage by doing so, notwithstanding the fact that other institutions were viewed as having primacy over energy issues in the past. The recent emergence of renewable energy disputes underscores this prediction.

The argument that energy is not governed by WTO rules at all can be dismissed fairly quickly. The general view among commentators is that WTO rules apply to all products not specifically excluded and thus apply to energy (Selivanova 2012).[7] Indeed, governments themselves have regularly raised energy issues during discussions, suggesting that they believe WTO rules apply to energy. For example, during the 1970s the USA

[6] A somewhat more nuanced hypothesis on membership would be that institutions form to resolve conflicts in global energy markets at times in which market power shifts. Because Middle Eastern countries were not in the GATT when production capacity shifted from the USA to the Middle East in the 1960 s, new institutions—OPEC and the IEA—were formed to mediate the resulting conflicts (and have continued to do so). As explained in Sect. 4, production capacity in renewable energy has developed during a time in which all of the major players are WTO members. Conflicts are thus resolved through existing institutions, without the need to establish new ones. This hypothesis, however, still does not explain the lack of forum shopping in the fossil fuel context.

[7] Some energy trade qualifies as trade in services, where the picture is a bit more complicated. Certain obligations in the General Agreement on Trade in Services apply only to affirmatively listed sectors of the economy.

unsuccessfully sought to address export restrictions and dual pricing of fossil fuels within the GATT's Tokyo Round (Leal-Arcas et al. 2014).

A more refined version of this argument is that fossil fuel support policies are systematically different from renewable energy support policies, and WTO rules apply more easily to the latter rather than the former. For example, fossil fuel policies might take the form of export restrictions or might primarily be consumption subsidies. Renewable energy policies, on the other hand, might be more likely to be production subsidies, include import restrictions, and contain discriminatory measures such as local content requirements. Production subsidies and consumption subsidies may differ in the extent to which they are trade distorting. The distinction between import and export restrictions is important because most WTO case law focuses on the imports, rather than exports. Moreover, local content requirements are a clear violation of the NT obligation, making them easy cases to bring (Hestermeyer and Nielsen 2014, 572). A challenge to an import measure, especially a discriminatory one, thus more easily finds support in WTO jurisprudence.

Although a comprehensive review of renewable and fossil fuel policies is beyond the scope of this article, in general such policies are sufficiently similar that the differences between them cannot explain the pattern of cases. Both renewable and fossil fuel support policies are, as categories, heterogeneous. Within each category, policies exist that are relatively more susceptible to challenge, and policies exist that would be difficult to challenge. Renewables and fossil fuels both, for instance, benefit from discriminatory policies. Both also benefit from production and consumption support, and hence, the distinction between production and consumption support cannot explain why only renewable policies are challenged. The IEA reports that fossil fuel consumption subsidies totaled US$490 billion worldwide in 2014 (IEA 2015). Bast et al. (2015) estimate that in 2014 the G20 provided US$444 billion in fossil fuel production subsidies. By contrast, the IEA found that in 2014 nations provided only $135 billion in renewable energy subsidies, consisting of both production and consumption subsidies (IEA 2015). Similarly, as detailed in Sect. 2, ASCM rules—where any differences in the trade-distorting impact of consumption versus production subsidies would be most relevant, because certain ASCM claims require a showing of 'adverse effects'—play only a minor role in renewable energy challenges. Put differently, ASCM claims, the legal claims most sensitive to differences in trade-distorting effects, are not habitually used in any kind of energy support challenge. Distinctions in trade-distorting effects between the two categories therefore cannot explain the difference in the frequency of renewable energy and fossil fuel disputes.

Likewise, fossil fuel and renewable energy support measures do not differ categorically in terms of local content requirements. Of course, a number of renewable energy programs contain local content requirements (Meyer 2015). And because local content requirements discriminate on a *de jure* basis, they are among the easiest kinds of trade cases to win (Hestermeyer and Nielsen 2014, 572). But fossil fuel support programs often contain local content rules too. A 2013 World Bank study of local content rules in the oil and gas sectors identified such policies in 48 nations and noted their long history in the sector: 'Local content policies were first introduced in the North Sea in the early 1970s and ranged from restrictions on imports to direct state intervention in the oil sector' (Tordo et al. 2013, 11). Similarly, in a study of the use of local content policies in the oil and gas sector in East Africa, Nwapi (2016) notes that local content policies are '[o]ne of the instruments currently being adopted by most oil and gas resource-rich countries both in and outside Africa to deal with the skills problem and to enhance linkages between the oil and gas sector and the other sectors of the economy.' In short, local content policies exist in the fossil fuel sector, just as they do in the renewable sector, but go unchallenged.

The difference between import and export restrictions may explain a bit more of the variation. As Sect. 2 demonstrates, roughly half of energy disputes involve domestic AD or CVD investigations. These investigations (along with safeguards measures) and the resulting remedies do not require prior approval by the WTO DSB. In this respect, domestic trade investigations differ from other WTO obligations—such as Article XI of the GATT, which bans quantitative restrictions on both imports and exports—where members require the approval of the WTO prior to taking retaliatory action in response to a breach. Because they do not require prior WTO approval, domestic trade remedies are easier for members to impose than retaliatory measures in response to breaches of general WTO obligations (Bown 2005a). But domestic trade remedies are ineffective at responding to other nations' export restrictions, since the result of a successful trade investigation is an import restriction on the product in question.[8]

Having said that, the distinction between import and export restrictions still cannot explain the complete lack of challenges to fossil fuel measures. Article XI of the GATT bans quantitative restrictions on both imports and exports, making clear that export restrictions are as unlawful as import restrictions. Moreover, nations have brought other export restriction cases, including two recent challenges to Chinese restrictions on the exports of raw materials and rare earths (WTO 2012a, 2014a). Similarly, a GATT case from the 1980s challenged Japanese export restrictions on semiconductors (GATT 1988). The WTO's Appellate Body has also been expansive in interpreting what counts as a restriction. In *India—Autos*, for example, the Appellate Body found a measure requiring companies to balance their imports and exports to be an unlawful restriction, even though it does not directly restrict imports and exports (WTO 2002).[9] Taken together, these cases provide a basis for challenging export as well as import restrictions before the WTO.

Beyond issues with the WTO's rules, at least one other hypothesis is worth considering. Most economically significant nations have, or may benefit from, fossil fuel subsidies and support programs. Nations may be reluctant to initiate trade disputes challenging such measures for fear that their own similar measures (or other's measures from which they benefit) may be attacked in return. The USA, for example, might refrain from challenging OPEC nations' production restrictions and dual-pricing policies for fear of triggering a challenge to its own subsidies for fossil fuel producers. The principle defect with this argument is that all major renewable energy producers appear to have renewable energy subsidies, yet reciprocity has not deterred challenges in this area. The USA, for example, brought a discrimination claim against India's Solar Mission and pursued domestic trade remedies against Chinese renewable energy products, even though India and China both indicated that they believed US state and local renewable energy measures regularly violated WTO rules (Meyer 2015). Indeed, three days after the USA' victory in *India—Solar Cells* case, India filed a retaliatory complaint challenging discriminatory US state renewable energy measures (WTO 2016e). Likewise, the EU has aggressively pursued trade investigations against China even though its members have renewable support programs that are likely themselves WTO incompatible, prompting retaliatory claims by China (Meyer 2015, 1954–1955). The question thus remains: why have challenges to

[8] Export restrictions often will create an 'upstream' subsidy. For example, by restricting the export of oil, a nation may depress the domestic price of oil, which is a subsidy to energy-intensive domestic producers of other products. Domestic trade investigations aimed at this kind of subsidy do not, however, directly target support for the fossil fuel sector. Rather, they target the energy-intensive product that benefits from cheaper fossil fuels.

[9] *India-Autos* dealt with import restrictions, but the principle is the same.

renewable energy support programs sprung up in recent years, while challenges to fossil fuel support programs have remained dormant?

4 Energy subsidies and WTO dispute settlement

To answer this puzzle, I advance an alternative hypothesis: the diversification of exports of energy-producing countries explains the puzzling pattern of challenges to renewable energy but not fossil fuels. Economic diversification works through two distinct mechanisms. First, in the energy context, economic diversification is critical for the proper functioning of the WTO dispute settlement system. Countries with diversified economies are more likely to feel the effects of the linkages the WTO establishes between policies for different products. Countries with non-diversified economies and high costs to compliance with WTO rulings on their key products—fossil fuels—are unlikely to be responsive to these tactics (Sect. 4.1). Second, domestic interest groups are more likely to lobby for trade cases in response to new trade restrictive measures, rather than preexisting ones. These new measures are more likely in areas in which countries wish to invest in innovative new technologies and products. Economic diversification, in turn, leads to greater innovation (Sect. 4.2). Owing to the complete lack of fossil fuel challenges, testing this hypothesis using data about WTO disputes is difficult. However, I present qualitative evidence that supports this hypothesis (Sect. 4.3).

4.1 Economic diversification and the effectiveness of WTO dispute settlement

In general, and with exceptions, the countries that are major players in renewable energy production have more diversified economies and exports than do the majority of major fossil fuel exporters, many of whom are located in the Middle East (Esanov 2012).[10] The first hypothesis is that countries with diversified economies are more amenable to the WTO dispute settlement process than countries with non-diversified economies that have significant power in the market for their primary export.

The logic of the WTO is essentially one in which concessions for market access on a product Country A produces are exchanged for concessions on market access on a product Country B produces. In the event that the WTO's DSB finds that Country A is violating its commitments, Country B can retaliate by suspending concessions on different products (or even on services or intellectual property). For example, when the USA imposed unlawful duties on imported steel in 2002, the EU threatened to raise tariffs on oranges (Tran 2003). In effect, the WTO establishes a legalized system in which states hold market access to each other's products hostage. The WTO thus links government policies on market access on specific products, services, and intellectual property in ways that the market itself does not.

A general prediction about whether economic diversification will help this system function well is difficult to make. Some scholars, such as Bown (2005b, 301), have hypothesized that countries are more likely to bring claims when they have the capacity to withdraw trade concessions that are likely to hurt the respondent nation. Non-diversified economies may be more vulnerable to retaliation because withdrawn trade concessions on their primary export hurts their overall economy more than it would a diversified economy

[10] Esanov (2012) shows that from 1980 to 2006 resource-rich countries had export diversification scores that were three to eight times worse than both high-income countries and emerging markets.

(Bown 2005b, 306; Horn et al. 2005). Empirical evidence offers support for this hypothesis (Bown 2005b, 306). In the context of energy subsidy disputes, this would suggest that we should observe the USA and the EU bringing claims challenging all manner of energy support policies, because their market size gives them the retaliatory power to get their way should they prevail in a formal dispute.

By contrast, I hypothesize that in the energy context specifically the respondent's lack of economic diversification reduces the likelihood of a challenge to fossil fuel support measures. I assume that complainants initiate disputes primarily in situations in which they expect a successful outcome to result in the respondent changing the offending policy. My focus is on the respondent's costs of complying with an adverse WTO ruling or trade remedy investigation, relative to the costs of ignoring the ruling. This balance of costs determines how likely a successful challenger is to get the policy changes it seeks. If the expected costs of compliance with the ruling are high relative to the costs of ignoring the ruling, the complainant will expect the respondent to ignore an adverse ruling. Hence, the complainant will decline to bring a claim. When the costs of ignoring the ruling are high relative to the costs of complying, the complainant can expect to get the policy change it seeks and thus is more likely to initiate a dispute.

In the fossil fuel context, non-diversified oil exporters—the most important class of potential respondents (see Sect. 4.3)—face unusually high costs to compliance. Fossil fuel policies in these countries are often critical to the success of other governmental policies, such as foreign policy and domestic social policies (UNEP 2016). Rents from fossil fuel economies tend to be narrowly concentrated in the upper echelon of society, and the fossil fuel extraction sector tends not to promote growth in other sectors, such as manufacturing or technology (Ross 1999). Restricting fossil fuel exports and subsidizing fossil fuel consumption domestically provides a blunt instrument that can be used to address a variety of issues that result from this lack of broad-based economic development: social unrest, high food costs, and efforts to attract or support energy-intensive industries.

In short, non-diversified fossil fuel-exporting nations have an incentive to use fossil fuels to achieve the same purposes other nations achieve with government spending programs ranging from foreign aid to infrastructure investments and social safety nets. Non-diversified oil exporters thus cannot easily change those policies, because doing so may prompt social unrest. The Iranian government, for example, has implemented subsidy reforms but has proceeded slowly out of fear of a political backlash (Nikou and Glenn 2015).

Normally, the WTO's dispute settlement process (or the imposition of trade remedies) would step into provide the respondent with a competing incentive to change its WTO-inconsistent policies. If a losing respondent did not bring itself into compliance, a successful complainant could retaliate by suspending concessions—i.e., imposing import restrictions—on either the product in question, fossil fuels, or some other product. Because of the centrality of fossil fuel policies to non-diversified oil-exporting nations, this incentive would have to be unusually significant in order to induce compliance.

However, import restrictions on fossil fuels and import restrictions on other products are likely to be unusually weak tools to motivate non-diversified oil exporters to change their fossil fuel policies. With respect to the former, complainants are unlikely to raise barriers to the import of fossil fuels. As discussed above and in Sect. 3, many fossil fuel support measures in non-diversified economies—such as production restrictions, dual pricing, and other forms of domestic consumption subsidies—have the effect of restricting fossil fuel exports. The objective of a challenge would be to remove these export restrictions so that the challenging nation could import more fossil fuels. Yet imposing trade remedies or

retaliating directly on fossil fuels would require the challenging nation to raise import restrictions on fossil fuels, defeating the purpose of initiating the dispute. The fear that initiating disputes would be self-defeating has deterred WTO challenges to OPEC's fossil fuel policies. For example, in both 2005 and 2008 members of the US Congress introduced bills requiring the USA to initiate a WTO complaint against OPEC countries that were also WTO members. The Bush administration threatened to veto the bills, however. It argued that the practical effect would be to trigger retaliation against the USA and ultimately harm the US' ability to import oil (Stefanini 2008).

Thus, while claims challenging export restrictions have been brought in other contexts, they only generate compliance in situations in which the complainant can threaten to suspend concessions on some other product. For example, export restriction claims have been successful against China and Japan, both countries that are susceptible to the pressure created by restrictions on the importation of other products (GATT 1988; WTO 2012a, 2014a). For oil-exporting states with non-diversified economies, though, the loss of concessions on another product are relatively minor, precisely because they tend not to have other significant exports. The gains from protecting those smaller exports from retaliation pale in significance when compared to the gains from having its preferred policy in place on fossil fuels, its dominant product.

On the other hand, diversified respondents are more likely to have products on which a successful complainant can retaliate. Such retaliation creates a constituency in the respondent's country to eliminate the unlawful measure. Compliance may injure the industry in the respondent's country that benefitted from protectionism in the respondent's country, but it creates countervailing benefits within the respondent's own economy and at the WTO. As applied to energy, this suggests that the logic of WTO dispute settlement will function more effectively in the renewable energy area, in which exporting nations tend to be diversified, and not the fossil fuel sector, where exporters tend to be less well diversified *and* dependent on their fossil fuel policies to achieve important government objectives outside of the sector (see Sect. 4.3).

More generally, this hypothesis suggests that diversification as a proxy for retaliatory capacity needs to be qualified by an understanding of the overall importance of the challenged policies to the respondent. Non-diversification could leave a respondent especially vulnerable to withdrawn concessions. On the other hand, it could also leave the complainant with few, if any, effective levers to pull to generate compliance, especially in cases challenging measures that restrict exports. The hypothesis here is that if non-diversification *raises* the respondent's costs of complying with a WTO ruling, as in the case of fossil fuels, then non-diversification may deter WTO challenges. On the other hand, non-diversification should promote the efficacy of WTO dispute settlement (and therefore the odds of a challenge) when it increases the costs of *failing to comply* with a WTO ruling because of bilateral dependence.

4.2 The loss aversion hypothesis

Economic diversification may be correlated with the probability of a WTO claim in another way: states may be more likely to challenge new WTO-inconsistent policies rather than WTO-inconsistent policies that simply were never brought into compliance. Under this 'loss aversion hypothesis,' WTO challenges are more likely when market access has been restricted, as opposed to when it never existed. Bown and Reynolds (2014, 9) find that only about 23% of WTO claims challenged policies that were never brought into compliance, as opposed to 77% that challenged new policies that altered a WTO-consistent status quo.

This finding suggests that states may be more likely to challenge policies that cost them market access they enjoyed or—in emerging product markets—expected, rather than market access to which they were entitled but never actually had or expected.

Industries that produce innovative new products, in turn, are more likely to lobby their governments for challenges to restrictions on market access they expected under trade rules prevailing at the time the product was developed. Innovation thus breeds disputes by prompting efforts to restrict and enlarge market access for new products. Industries and businesses in economically diverse countries are, in turn, more likely to innovate. Economically diversified countries are thus more likely to develop new products and more likely to seek to protect global markets for those products. Hence, innovation influences the kinds of products that are the subject of disputes, while economic diversification influences which countries are likely to be involved in those disputes.

A range of studies on the diversification and complexity of products links greater economic diversification with greater innovation. Quintana-Garcia and Benavides-Velasco (2008), for example, find in their study of biotechnology firms 'strong support for the premise that a diversified technology base positively affects innovative competence.' Where countries are concerned, Hidalgo et al. (2007) demonstrate that countries tend to diversify by developing products that are closely associated with products they already manufacture. Well-diversified countries that make technologically complex products are thus more likely to develop other technologically complex products. By the same token, non-diversified countries are less likely to develop innovative or technologically complex products. The loss aversion hypothesis therefore suggests they are less likely to challenge or be challenged, even if they have significant WTO-inconsistent policies relating to their incumbent exports.

In the energy context, this hypothesis suggests that we should see challenges to renewable energy policies but not fossil fuel policies. Renewable energy technologies are new technologies, the production of which can move from country to country, like ordinary manufactured goods. Competitiveness in the renewable sector also depends on innovation, which is occurring rapidly and often with government support (Johnstone et al. 2009). This twin dynamic of competition and innovation breeds demand for new government support measures for renewable energy industries in those countries positioned to compete in the growing global market for renewable energy.

Under this hypothesis, the features of WTO dispute resolution do not drive WTO challenges to renewable policies. Instead, restrictions on new product markets that reduce the value of investments made in expectation of market access push domestic interest groups to lobby for WTO challenges. Because diversification supports innovation, renewable energy technology developments are more likely in diversified countries, which in turn are more likely to bring challenges to trade-distorting measures. Non-diversified economies are not well positioned to go beyond their core competencies and are thus less likely to try to enter new product markets. They will therefore neither be victimized by technology support measures in other countries nor be tempted to impose such measures themselves. Although I make this argument in the context of energy specifically, it could apply more generally in any product market in which an incumbent product competes with new or innovative products. Similar trade restrictions might exist for both products, but investment-backed expectations will drive challenges primarily toward the newer product.

Fossil fuel exporters (diversified or otherwise), for their part, usually have long-standing fossil fuel policies. Moreover, as mentioned above, many of the non-diversified fossil fuel exporters only recently joined the WTO, meaning their arguably non-compliant policies were well known and established at the time of their WTO accession. Indeed, existing

WTO/GATT members pressed applicants such as Saudi Arabia, Ukraine, Venezuela, and Russia on their fossil fuel policies (Marceau 2012). Having reached agreement about what steps these fossil fuel exporters would take as part of their accession, states may feel bound not to challenge those policies now. Moreover, the long-standing nature of these policies means that investments in fossil fuels are made with these policies in mind. Investments in fossil fuels in effect bake in the WTO-inconsistent policies, dampening down the pressure on governments to challenge trade-distorting fossil fuel policies.[11]

4.3 The distribution of fossil fuels versus renewable energy patents

Directly testing these hypotheses using quantitative data is difficult. A major problem with quantitative studies of participation in WTO dispute settlement is that there is no reliable way to estimate the underlying number of WTO-inconsistent policies (Bown 2005b; Guzman and Simmons 2005). Scholars have generally tried to solve this problem by examining the attributes of states that participate in WTO disputes (Bown 2005b; Guzman and Simmons 2005). This approach is not viable in the energy context, however. The complete lack of challenges to fossil fuel policies means that no matter what independent variables one chooses, the odds of a challenge to fossil fuel policies are zero. This difficulty is compounded by the fact that most developing country members—including fossil fuels producers such as Saudi Arabia, Venezuela, and Kuwait—do not actively participate in the dispute settlement system, either as complainants or respondents, on any issues (although fossil fuels are, for most of these countries, their most important export) (WTO 2016b).[12]

Having said that, a look at the global distribution of production capacity for fossil fuels versus renewable energy can shed some light on whether economic diversification is correlated with challenges to different kinds of energy policies. While these data cannot support strong causal claims, the evidence suggests that the hypotheses offered above are plausible.

Table 2 provides data on the top five countries in each of seven categories of energy production: crude oil, natural gas, coal, solar thermal, solar photovoltaic (PV), wind, and biomass. For the three fossil fuels, the data provided are the percent of global proven reserves that each country possesses (Knoema 2016). For the four renewable energy sources, the data indicate the percentage of global patents in each technology registered in each country between 2006 and 2011 (Helm et al. 2014, 19, 23, 27, 31). I chose these two datasets because they compare comparable levels of trade. Patents and reserves are an indication of production potential in the short to medium term. As such, they provide a reasonable estimate of the kinds of trends to which states might respond in bringing WTO suits. Parenthetically next to each, I also provide the International Monetary Fund's measure (a Theil Index score, in which higher numbers mean lower levels of diversification) and rank (out of 186 countries) of each country's export diversification (IMF 2014).

[11] One might object that fossil fuels cannot be relocated among different countries, and therefore, competition among fossil fuel-producing countries is less intense than among renewable energy-producing countries. While this argument certainly has merit, today's fossil fuel markets have more players than such markets 30 years ago. The expansion of natural gas exports, and in particular the shale gas revolution, has prompted new entrants into the fossil fuel-exporting business (Cohen et al. 2013). These new entrants have boosted competition among fossil fuel exporters much in the way that new players can enter the renewable energy market by developing the ability to manufacture renewable energy equipment. OPEC's collusive practices, for example, are no longer as effective as they were in the 1970 s (Colgan 2014, 604–605).

[12] Saudi Arabia and Kuwait have never been either a complainant or a respondent; Venezuela has been a complainant once and a respondent twice.

Table 2 Global distribution of fossil fuel reserves and renewable energy patents

Crude oil	Natural gas	Coal	Solar thermal	Solar PV	Wind	Biofuels
Venezuela 18% (5.68, 175)	Iran 18% (4.64, 153)	USA 27% (1.48, 3)	China 57% (1.97, 26)	Japan 28% (2.09, 32)	China 41% (1.97, 26)	China 41% (1.97, 26)
Saudi Arabia 16% (5.41, 171)	Russia 18% (3.54, 101)	Russia 18% (3.54, 101)	Japan 15% (2.09, 32)	China 23% (1.97, 26)	South Korea 10% (2.38, 44)	South Korea 10% (2.38, 44)
Canada 10% (2.07, 31)	Qatar 13% (4.67, 155)	China 13% (1.97, 26)	Germany 9% (1.62, 7)	Republic of Korea 19% (2.38, 44)	Germany 9% (1.62, 7)	Germany 9% (1.62, 7)
Iran 9% (4.64, 153)	Turkmenistan 9% (4.19, 136)	Australia 9% (2.99, 74)	South Korea 6% (2.38, 44)	USA 9% (1.48, 3)	USA 9% (1.48, 3) (1.62, 7)	USA 9% (1.48, 3)
Iraq 9% (6.41, 186)	USA 5% (1.48, 3)	India 7% (1.92, 23)	USA 4% (1.48, 3)	Germany 8% (1.62, 7)	Japan 7% (2.09, 32)	Japan 7% (2.09, 32)

The data are most striking with respect to oil. Four of the top five countries in terms of oil reserves rank in the bottom quintile in terms of export diversification (Canada is the exception). In other words, those countries that are likely to export the most oil in the future are also the countries with the fewest ties to the international trade system outside of oil. Moreover, those four countries alone account for over half of the world's proven reserves. Natural gas shows a similar picture. Indeed, only the USA—with a mere 5% of global reserves—ranks in the top 100 nations in terms of diversification. Interestingly, the distribution of coal reserves differs from oil and gas. Four of the top five countries rank in the top 100 nations in terms of export diversification, and 47% of reserves reside in countries in the top 30.

In sharp contrast, the same five nations top each type of solar technology—the USA, China, Japan, South Korea, and Germany. All of these nations are in the top quarter of nations in terms of export diversification. Together, they account for the great majority of renewable energy patents in each category.

These data suggest that economic diversification is indeed correlated with WTO challenges to energy policies. Again, non-diversification may explain a lack of participation in the WTO dispute settlement system as a whole. With fewer products, states are less likely to file claims or be named as respondents. It is worth noting, however, that fuel exports alone constitute 17% of global exports, the largest single category of merchandise to move in world trade (WTO 2015, 71). Moreover, during the 20 years of the WTO's existence, fuel exports have grown at an average rate of 12% per year, the fastest growing category of exports (WTO 2015, 29). Fossil fuel exports are thus central to the global economy, to say nothing of their environmental effects. Non-diversified fossil fuel exporters are thus not like other kinds of non-diversified countries that we would expected to see on the sidelines of trade disputes. Even undiversified fossil fuel exporters are tightly linked to the global economy through their export of one of the world's most important and highly traded products. We therefore might expect fossil fuel policies to be challenged, even in non-diversified states. The fact that we do not suggest that non-diversification presents a challenge to fossil fuel claims specifically, rather than to WTO participation generally.

5 Conclusion

Critics of renewable energy support programs have generally invoked a free-trade mantra. Like the USA following its recent victory in *India—Solar Cells*, they urge nations to remove subsidies and other forms of support in order to create a level playing field. Unfortunately, however, a level playing field within renewables may not be the kind of level playing field we need. Renewable energy competes not only with other forms of renewable energy, but also with fossil fuels. The application of trade rules to renewable energy support programs, but not fossil fuel support programs, risks disadvantaging renewable energy. This risk arises right as a transition to renewable energy is environmentally critical and evidence suggests that government support is necessary.

To be sure, the bout of renewable energy challenges is recent. In the future, we may see more challenges aimed at fossil fuel producers. Russia's recent challenge to the EU's third energy package may make consumer nations more comfortable filing such challenges. Moreover, the rise of state-owned enterprises in many oil-producing countries may lead to greater challenges as well. State-owned enterprises are a difficult trade problem, one that extends well beyond the energy sector. Nations may choose to take it on for that reason, or

because the increased role of state-owned enterprises minimizes the chance for companies from consuming nations to profit from production. Estimates are that state-owned enterprises have about five times the fossil fuel reserves of private companies (Carrington 2015).

More generally, this article suggests the need to consider competition in the market in evaluating the competitive effects of WTO challenges. If WTO challenges do indeed skew toward disputes between economically diversified countries over policy changes (including market access limitations for new industries), the WTO may place a restraining hand on technological innovation. We would expect to observe this effect in situations in which new technologies developed in economically diversified countries compete with incumbent products (often natural resources) in non-diversified economies. While this effect might have equitable distributional consequences, insulating developing countries from the effects of free trade, it may also—as it does in the energy context—support the unsustainable consumption of natural resources.

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References

Bast, E., Doukas, A., Pickard, S., van der Burg, L., & Whitley, S. (2015). *Empty promises: G20 subsidies to oil, gas, and coal production*. Washington, DC: Oil Change International and Overseas Development Institute.

Bown, C. P. (2005a). Trade remedies and World Trade Organization dispute settlement: Why are so few challenged? *Journal of Legal Studies, 34*(2), 515–555.

Bown, C. P. (2005b). Participation in WTO dispute settlement: Complainants, interested parties, and free riders. *The World Bank Economic Review, 19*(2), 287–310.

Bown C. P., & Reynolds, K. M. (2014). *Trade flows and trade disputes*. World Bank Research Group, Policy Research working paper 6979. Washington, DC: World Bank.

Carrington, D. (2015). Carbon reserves held by top fossil fuel companies soar. *The Guardian*.

Clark, D. (2012). Phasing out fossil fuel subsidies could provide half of global carbon target. *The Guardian*.

Cohen, G., Joutz, F., & Loungani, P. (2013). Measuring energy security: Trends in the diversification of oil and natural gas supplies. *Energy Policy, 39,* 4860–4869.

Colgan, J. (2014). The emperor has no clothes: The limits of OPEC in the global oil market. *International Organization, 68*(3), 599–632.

Esanov, A. (2012). Economic diversification: Dynamics, determinants and policy implications. *Revenue Watch Institute*, 1–26.

GATT. (1988). Japan—Trade in semi-conductors. Report of the Panel, L/6309–35S/116 (4 May 1988).

Guzman, A. T. (1998). Why LDCs sign treaties that hurt them: Explaining the popularity of bilateral investment treaties. *Virginia Journal of International Law, 38*(4), 639–688.

Guzman, A. T., & Simmons, B. (2005). Power plays and capacity constraints: The selection of defendants in World Trade Organization disputes. *Journal of Legal Studies, 34*(2), 557–597.

Helfer, L. R. (2004). Regime shifting: The TRIPs agreement and the new dynamics of international intellectual property lawmaking. *Yale Journal of International Law, 29*(1), 1–83.

Helm, S., Tannock, Q., & Iliev, I. (2014). *Renewable energy technology: Evolution and policy implications—Evidence from patent literature*. Geneva: World Intellectual Property Organization.

Hestermeyer, H. P., & Nielsen, L. (2014). The legality of local content measures under WTO law. *Journal of World Trade, 48*(3), 553–591.

Hidalgo, C. A., Klinger, B., Barabási, A.-L., & Hausmann, R. (2007). The product space and its consequences for economic growth. *Science, 317*(5837), 482–487.

Horn, H., Mavroidis, P. C., & Nordström, H. (2005). Is the use of the WTO dispute settlement system biased? In P. C. Mavroidis & A. Sykes (Eds.), *The WTO and international trade law/dispute settlement* (pp. 454–483). Cheltenham: Edward Elgar.

IEA. (2015). *World energy outlook 2015*. Paris: IEA.
IMF. (2014). *The diversification toolkit: Export diversification and quality databases*. https://www.imf.org/external/np/res/dfidimf/diversification.htm.
Johnstone, N., Hascic, I., & Popp, D. (2009). Renewable energy policies and technological innovation: Evidence based on patent counts. *Environmental and Resource Econonomics, 45*(1), 133–155.
Knoema. (2016). *BP: World reserves of fossil fuels*. http://knoema.com/smsfgud/bp-world-reserves-of-fossil-fuels.
Lamy, P. (29, April 2013). Remarks to the workshop on the role of intergovernmental agreements in energy policy. *World Trade Organization*. http://www.wto.org/english/tratop_e/envir_e/wksp_envir_apr13_e/wksp_envir_apr13_e.htm.
Leal-Arcas, R., Filis, A., & Gosh, E. S. A. (2014). *International energy governance: Selected issues*. Cheltenham: Edward Elgar.
Lewis, J. I. (2014). The rise of renewable protectionism: Emerging trade conflicts and implications for low carbon development. *Global Environmental Politics, 14*(4), 10–35.
Marceau, G. (2012). The WTO in the emerging energy governance debate. *Proceedings of the Annual Meeting of the American Society of International Law, 106,* 385–389.
Meyer, T. (2012). The architecture of international energy governance. *Proceedings of the Annual Meeting of the American Society of International Law, 106,* 389–394.
Meyer, T. (2015). How local discrimination promotes global public goods. *Boston University Law Review, 96*(6), 1939–2027.
Neufeld, I. N. (2001). *Anti-dumping and countervailing procedures—Use or abuse? Implications for developing countries*. New York and Geneva: United Nations Commission on Trade and Development.
Nikou, S. N., & Glenn, C. (2015). *The subsidies conundrum*. United States Institute of Peace. http://iranprimer.usip.org/resource/subsidies-conundrum.
Nwapi, C. (2016). *A survey of the literature on local content policies in the oil and gas industry in East Africa*. University of Calgary School of Public Policy technical paper 9.
Pogoretskyy, V. (2011). Energy dual pricing in international trade: Subsidies and anti-dumping perspectives. In Y. Selivanova (Ed.), *Regulation of energy in international trade law: WTO, NAFTA and Energy Charter* (pp. 181–228). Alphen aan den Rijn: Kluwer Law International.
Quintana-Garcia, C., & Benavides-Velasco, C. A. (2008). Innovative competence, exploration and exploitation: The influence of technological diversification. *Research Policy, 37*(3), 492–507.
Ross, M. L. (1999). The political economy of the resource curse. *World Politics, 51*(2), 297–322.
Selivanova, Y. (2007). *The WTO and energy: WTO rules and agreements of relevance to the energy sector*. Geneva: International Centre for Trade and Sustainable Development.
Selivanova, Y. (2010). Managing the patchwork of agreements in trade and investment. In A. Goldthau & J. M. Witte (Eds.), *Global energy governance: The new rules of the game* (pp. 49–72). Washington, DC: Brookings Institution Press.
Selivanova, Y. (2012). International energy governance: The role of the Energy Charter. *Proceedings of the Annual Meeting of the American Society of International Law, 106,* 394–398.
Stefanini, S. (2008). Bill says OPEC's WTO members breach trade laws. *LAW360*. http://www.law360.com/articles/55011/bill-says-opec-s-wto-members-breach-trade-laws.
Tordo, S., Warner, M., Manzano, O. E., & Anouti, Y. (2013). *Local content policies in the oil and gas sector*. Washington, DC: World Bank.
Tran, M. (2003). Bush lifts steel tariffs to avert trade war. *The Guardian*.
UNEP. (2016). *Fossil fuel subsidies policy brief*. Geneva: UNEP.
WTO. (1996). United States—Standards for reformulated and conventional gasoline. Appellate Body Report, WT/DS2/AB/R (20 May 1996).
WTO. (2002). India—Measures affecting the automotive sector. Report of the Panel, WTO/DS146 (5 April 2002).
WTO. (2010). China—Measures concerning wind power equipment—Request for consultations by the United States. WT/DS419/1 (22 December 2010).
WTO. (2012a). China—Measures related to the exportation of various raw materials. Reports of the Appellate Body, WT/DS394/AB/R, WT/DS395/AB/R, WT/DS398/AB/R (22 February 2012).
WTO. (2012b). European Union and certain member States—Certain measures affecting the renewable energy generation sector—Request for consultations, WT/DS451/1 (5 November 2012).
WTO. (2013a). Canada—Certain measures affecting the renewable energy generation section-Canada—Measures relating to the feed-in tariff program. Reports of the Appellate Body, WT/DS412/AB/R, WT/DS426/AB/R (6 May 2013).
WTO. (2013b). European Union—Anti-dumping measures on biodiesel from Argentina—Request for Consultations, WT/DS473/1 (19 November 2013).

WTO. (2014a). China—Measures related to the exportation of rare earths, tungsten, and molybdenum. Reports of the Appellate Body, WT/DS431/AB/R, WT/DS432/AB/R, WT/DS433/AB/R (29 August 2014).
WTO. (2014b). European Union—Anti-dumping measures on biodiesel from Indonesia—Request for consultations, WT/DS480/1 (10 June 2014).
WTO. (2015). International Trade Statistics 2015. https://www.wto.org/english/res_e/statis_e/its2015_e/its2015_e.pdf.
WTO. (2016a). *Chronological list of disputes cases*. https://www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm.
WTO. (2016b). *Dispute settlement: Disputes by country/territory*. https://www.wto.org/english/tratop_e/dispu_e/dispu_by_country_e.htm.
WTO. (2016c). European Union—Anti-dumping measures on biodiesel from Argentina. Panel report, WT/DS473/R (29 March 2016).
WTO. (2016d). India—Certain measures related to solar cells and solar modules. Report of the panel, WT/DS456/R (14 February 2016).
WTO. (2016e). United States—Certain measures relating to the renewable energy sector—Request for consultations. WT/DS510/1 (2016).