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The pacifying effect of energy dependence on interstate conflict: A Large-N analysis

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ABSTRACT

Energy remains essential to all forms of economic and military activity and constitutes one of the most valuable and strategic commodities in international trade. Using the newly released Global Energy Relations Dataset, we assess whether trade in energy resources systematically affect bilateral relations between an importer and its exporter. More specifically, we contrast the liberal expectation that dependence on trade in energy pacifies with the realist expectation that the vulnerabilities created via dependence on energy trade will lead to conflictual relations. Our random coefficient regression models indicate that the more dependent an importer is to an exporter for energy, the more pacific the importer will be towards that exporter. Different types of energy resources pacify importers to varying degrees; importers are less reluctant to initiate conflict against their exporters of more fungible energy resources. Accordingly, our findings show that this pacifying effect is minimal for coal and oil. Trade in electricity emerges as a stronger pacifier. We find natural gas to be the most potent pacifying energy resource. Our study also contributes to the debate on the geopolitical implications of global energy flows by pointing out to regional variations in how countries manage their relations vis-à-vis their energy suppliers.

1. Introduction

Energy is essential to all forms of economic and military activity, hence to the functioning of a state. States vary significantly in their energy resources leading to various forms of trading relations between states. A country's energy endowment can have a big impact on its destiny. Its abundance was critical to the rise of some global powers (e.g., UK) while its scarcity has led others to start wars and disappear (e.g., Imperial Japan).

The variance with respect to global energy resource endowments also make energy the most valuable and strategic commodity in international trade. Securing dependable and affordable supply of energy has been a major policy goal for many importing states. Securing dependable flow of oil to markets at stable prices also constitute a central policy aim for oil exporting countries [1]. Achieving such "security of demand" at stable prices is critical towards financing public spending and investments [2], hence constitutes an important foreign policy goal for these countries. Accordingly, states have often used various tools of foreign policy to shape interstate flows of energy resources according to their preferences. Understanding whether and how these energy flows affect foreign policy choices states make remains a salient question for international relations and energy policy scholars alike.

This paper aims to examine energy relations, more specifically energy flows from one country to the other, as a factor in shaping interstate conflict and contribute to the empirical literature by focusing on such dyadic factors. While a wealth of studies has examined how the quest to secure energy shaped the foreign policies of states, most of these have been confined to specific case studies. More recent studies have started looking at how endowments in energy resources shape foreign policy choices that states make. Surprisingly, however, few studies have looked at how energy flows shape "relations" between two countries in a large-N setting. One of the main reasons for such paucity of studies have been the lack of a dyadic dataset of energy flows between countries that allows such energy data to be articulated on to existing canonical models of international conflict.

This study aims to contribute to international conflict and energy literature by asking whether dependence on an energy resource pacifies this importer against its exporter? By using the newly released Global Energy Relations Dataset [3], which covers dyadic energy flows from 1978 to 2014, we assess whether trade in various energy resources, such

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as coal, oil, gas and electricity, systematically affect bilateral relations between an importer and its exporter. More specifically, we contrast the liberal expectation that dependence on trade in energy pacifies with the realist expectation that the vulnerabilities created via dependence on energy trade will lead to conflictual relations. Our random coefficient regressions provide evidence for the liberal argument and indicate that the more dependent an importer is to an exporter of energy, the more pacific the importer will be in its foreign policy to that exporter. Different types of energy resources pacify importers to varying degrees; importers are less reluctant to initiate conflict against their exporters if a global and integrated market for that imported resource exists. Accordingly, our findings show that this pacifying effect is minimal for coal and oil. Despite their low volumes in global trade, trade in electricity emerges as a stronger pacifier. We find natural gas to be the most pacifying energy resource. These findings also contribute a novel perspective to the debate on the geopolitical implications of global energy flows.

2. Energy, economic ties and interstate conflict

International relations (IR) scholars have long debated whether higher levels of trade leads to cooperation or conflict within a dyad [see, inter alia, 4–8]. Those adopting the realist perspective have argued that increasing economic ties render states vulnerable to each other, especially when the relationship becomes asymmetric [9–13]. The realist position builds on the presence of a 'security dilemma,' an essential feature of geopolitics for many IR scholars. The security dilemma posits that states are concerned with relative, rather than absolute, gains from any interaction, including trade. International trade often tends to favor one party more than the other, thereby making one party relatively stronger even though both may be better off in absolute terms. In an anarchical environment, where no higher authority exists to police and sanction a belligerent state, every state must fend for itself and will strive to maximize its power relative to others. Otherwise, states that "depend on others for critical economic supplies will fear cutoff or blackmail in time of crisis or war" [14], incentivizing these states "to extend political control to the source of supply" [15]. In global energy markets, such a drive to secure resources may often result in mercantilist behavior among consumer states, whereby their behavior towards securing sufficient energy supply at the expense of others, is often determined beyond what the market dictates [16,17]. Such drive to secure energy, critical to industry and military, constrained by geographical endowments in turn, could entice these countries to employ (all) foreign policy tools at their disposal, which includes the use of militarized force. Conflict becomes especially likely if expected "spoils" from such an attempt to secure resources remain sufficiently attractive for the attacker [5].

In contrast, liberal democratic peace theorists assert that 'peace dividends' enlarge and strengthen the dovish camp in trading countries, leading to more cordial relations between states. This pacifying effect becomes especially potent when beneficiaries of international trade have more influence over the foreign policymaking apparatus of their respective states. Indeed, those in the liberal camp have provided ample empirical evidence showing the pacifying effects of strong trade and economic ties between states [18,19].

Since then, the debate moved from whether economic relations pacify states or not to what specific types of economic relations lead to more peaceful or conflictual relations. In an early study, Morrow [20] demonstrated the fear of "relative gains" from trade correlated with how quickly this relative gain from trade by one party could be turned into a military advantage. Dorussen [21] showed that the exchange of goods and resources that can otherwise be easily appropriable by force builds tensions between trading states. On the other hand, trading goods that rely on high levels of technology, as well as human and organizational capital, brings countries closer into partnership. Dissecting trade data into specific sectors, Goenner [22] similarly demonstrated that higher levels of trade in resources that can be "plundered" (including energy and non-ferrous commodities) increase the chances of conflict initiation. In contrast with Goenner [22], Li & Reuveny [8] demonstrated that importing higher amounts of energy, in addition to agriculture, fishery products, chemical and minerals pacifies that importer against its exporter. Peterson & Thies [23] differentiated between intra- and inter-industry flows and demonstrated that increases in intra-industry flows led to more peaceful relations between trading partners. More recent work has also looked at how other forms of financial flows, such as FDI, pacify relations between states [24].

3. Energy Security, energy flows, and interstate relations

The notion of interdependence, however, relates to aspects beyond trade and financial flows. In fact, interdependence is a defining feature of the contemporary global energy system, with considerable security, economic, and financial implications [25]. With regard to security, energy is an integral part of almost all human activity. It is not only of paramount importance for military activity (e.g., warfare or logistical support), but also an indispensable input for economic prosperity. The global market for fuels account for more than half of the commodity export value in the world [26], which makes energy the most valuable traded commodity. As a result, securing sustained and predictable flow of energy often becomes a foreign policy priority both for 'have's and 'have-not's.

How does this desire for accessing energy resources shape a state's foreign policy, especially towards its suppliers? Our theoretical framework rests on the assumption that energy importer countries are more vulnerable and in a more dependent position vis-à-vis their exporter partners in the short term [27–30]. This vulnerability can reflect on an importer's foreign policy in two main ways. Realists often claim that the vulnerability of an importer creates a security dilemma between the trading parties, tempting the importer state to take preemptive action [9]. Indeed, command over energy resources has been found to influence inter- and intra-state conflict dynamics [31–33] by directly affecting states' ability and willingness to wage and maintain war [34,35]. Moreover, the fact that energy resources are also relatively easy to appropriate, process, and sell may also tend to provoke conflict and lead to resource wars [36]. Invasion of Kuwait by Iraq in 1990 and Japanese invasion of Southeast Asia in 1941 exemplify that situation.

The neo-mercantilist frame in energy studies closely echoes these realist premises in international relations [37]. Focusing more on the availability and accessibility aspects of energy security, neo-mercantilists depict global energy relations as "a geopolitical power game between net energy exporters and importers," in which states might use energy as a weapon serving to their foreign policy goals and the race over scarce resources may risk peaceful relations between these states [38].

> **Hypothesis 1a:** As energy dependence of a country to its supplier increases, the likelihood that this country initiates militarized conflicts against that supplier also increases.

The liberal camp argues the contrary. Owing to its significance compared to other tradable commodities and inelastic nature in demand, energy increases the opportunity cost of exiting ongoing relationship for both partners, but especially for the importer state. In such a setting, the costs of disrupting energy relations by engaging in any militarized action outweighs gains an importer state may obtain by bluffing or otherwise coercing the other party towards policy change [39]. Rather, the importing state is more likely to prefer peaceful solutions to potential disagreements within the dyad [40,27]. Similarly, the

market liberalist frame, the reflection of the liberal strand in energy literature, highlights the economic affordability aspect in energy security [37].[1] Considering both sides prioritize their economic interests, market liberals expect interdependence to secure an affordable energy mix for an importer, hence raising the costs of using military force against its exporters to prohibitively high levels.

Hypothesis 1b: As energy dependence of a country to its supplier increases, the likelihood that this country initiates militarized conflicts against the supplier decreases.

While the uneven dispersion of energy resources inevitably creates dependency to others for many states [41] the extent of this dependency varies. A state can easily change its supplier if the energy resource or its substitutes are readily available on a well-developed, deep, global spot-market [42,43]. For instance, the market for oil has become increasingly global, integrated, transparent, and fluid than that for natural gas [44,45], for which a single global price exists [46]. A wide network of seaborne network forms the backbone of global oil trade where thousands of private and public players buy and sell oil around the clock. This network is further enhanced by various pipelines that either move oil from its production to ports, or from ports to end-users. In addition, recent advances in fracking technology have considerably increased the proven reserves in the world, effectively putting a "price-cap" on oil. Recent technological improvements have rendered refineries more versatile and quicker to adopt to different mixes of oil for processing.[2] Such developments have raised the question of whether oil can still be considered as a foreign policy lever for its producers [47].

In contrast, notwithstanding recent developments in global LNG capacity, international trade in natural gas is quite politicized where market forces play a relatively smaller role compared to trade in other hydrocarbons [48]. A significant part of gas trade occurs through pipelines, which bestow further control to the exporting country over the supply of gas. The highly capital-intensive nature of natural gas transport, combined with the politicized nature of gas trade that limit access to capital of such projects, prevent the construction of alternative means of accessing global gas supplies, effectively leaving many importing countries (or some regions within) subject to a single supplier. As a result, gas contracts tend to be longer term with more opaque pricing structures. The "inflexibility and rigidity of gas transportation framework and the need to establish and preserve a physical link between two countries or regions," therefore, make gas an important issue of foreign policy among trading parties [36,49,50]. Whether or not the issues dependence on gas raises will lead to conflictual or cordial relations remain an empirical question.

Trade in electricity also creates deep ties between the parties. Carrying such trade at high quantities requires significant infrastructure that will transmit electricity across borders, often traversing the ocean floor. Such electricity exports often originate from nuclear, hydro or other renewable powers, hence necessitating the commitment of capital-intensive resources by the exporter. Unexpected disruptions in supply of electricity can cause a multitude of problems. The importing state's infrastructure may not allow backup plants within the country to come online quickly. Such disruptions in supply of electricity can cascade beyond the areas that "use" that energy in the importer state; fluctuations in grid frequency and resultant overloads in the grid instability may lead to blackouts in the rest of the country as well. We expect importers to be quite sensitive in maintaining this flow of energy, hence prefer more peaceful relations with its suppliers of electricity.[3]

Finally, coal is the most widely available hydrocarbon energy resource in the world. Responsible for 40% of the world's electricity generation, global coal production in 2019 was slightly shy of 8000 million tons, of which 279 million tons were globally traded [52]. The wide range of available producers and exporters make coal the least "strategic" energy resource. Accordingly, we expect coal to have a small, if any, effect in modifying an importer state's behavior against its supplier state.

Hypothesis 2: Dependence on natural gas and electricity will pacify an importer country against its exporter more compared to dependence on oil and coal.

4. Methodology

Since this study is practically one of the very first ones looking at the relationship between energy trade and conflict initiation in a large-N setting, it inevitably carries an exploratory nature. Accordingly, in this study, we choose to adopt an inductive, agnostic view and let the data speak as much as possible. In line with this choice, we employ random coefficients model as our main framework for analysis. In a standard estimation of the effect of energy dependence on the likelihood of MID initiation, the coefficient of the energy dependence indicates the nature and magnitude of the impact such dependence has on the likelihood of a conflict.[4] However, this effect can be country-specific as such for some countries. In other words, energy dependence might pacify certain importers more than others. Systematic, large-N dyadic analyses on the relationship between energy trade and conflict are scarce. Therefore, we do not have a sufficient body of empirical literature that could guide us in theoretically correlating these country-specific unobserved factors with other variables ex-ante.[5]

Random coefficient models allow us to adopt such an inductive approach while maintaining tractability in our analysis. Accordingly, we allowed the coefficients to vary across each importer country (regardless of its importer). On other words, we treated each importer country as a level within our multilevel model, hence creating 196 levels in our data. We chose "importer country/potential initiator" as our level for several reasons. Most importantly, our theoretical framework focuses on the decision to initiate conflict, not whether a relationship is peaceful or not. We do not, however, wish to impose further theoretical assumptions. Choosing each initiator as a "level" in our random coefficient model, therefore, allows us to capture sufficient idiosyncrasies within foreign policy calculations of various countries while keeping the number of

[1] Wilson [25] holds a very similar discussion, contrasting "geopolitical approach" with "global energy governance approach."

[2] One deduction that can be made from this line of argument is that oil's pacifying effect may have subsided over time due to improvements in refining, transport and pipeline technology. The effect of technological development on the geopolitical effect of oil trade constitutes a promising avenue of research.

[3] Lee and Mitchell [51] demonstrated that when producing notable hydroelectric power from a river themselves, downstream states prefer more cordial relations with upstream states. This pacifist orientation is mostly due to the fact that upstream countries control the "energy resource" for these hydroelectric plants, i.e., water.

[4] Since coefficients are asymptotically identical in very large-N samples, like the ones used in this study, we chose to run linear instead of logistic regressions for computational convenience.

[5] Still, a wealth of individual case studies provides us cues as to how energy trade and foreign policy may empirically relate. For instance, case studies focusing on importer-exporter pairs, such as on Ukraine-Russia [53,54], EU-Russia [55,56], Russia-China [57], and Chile-Bolivia [58], demonstrate how energy trade can escalate bilateral tensions to militarized conflict or create opportunities for further cooperation. Case studies focusing on energy importing countries also clearly illustrate how the quest to secure energy shapes foreign policy choices of these states, such as Pakistan [59], China [60,61] and India [62].

levels at a manageable level for later interpretation.

We are interested in the relationship between the dependent variable of militarized interstate disputes ($MID_{ij,m,t}$) with the energy dependency $ED_{ij,m,t}$ of the country i to country j for energy resource m at year t. In a simple linear regression framework, the coefficient β_m in the Eq. (1) captures the associated mean effect.

$$MID_{ij,m,t} = \alpha_{i,m} + \beta_m ED_{ij,m,t} + \theta_{ij,m} + \rho_{ij,m} + \mu_{m,t} + \beta_{i,m} X_{ij,m,t} + \varepsilon_{ij,m,t} \quad (1)$$

where $X_{ij,m,t}$ captures all the other relevant variables that affect the conflict initiation risk. The random coefficients model extends this framework by incorporating the country level random effects for coefficients β.

$$MID_{ij,m,t} = \alpha_{i,m} + (\beta_m + \delta_{i,m}) ED_{ij,m,t} + \theta_{i,m} + \rho_{ij,m} + \mu_{m,t} + \beta_{i,m} X_{ij,m,t} + \varepsilon_{ij,m,t} \quad (2)$$

where $\delta_{i,m} \sim N(\beta_m, \sigma_m)$. Within this framework, each country's effect of energy dependence on the conflict risk is captured through country specific random component $\delta_{i,m}$ as an adjustment to the mean effect of the energy dependence, which is still captured by β_m as:

$$E[MID_{ij,m,t}] = \alpha_m + \beta_m E[ED_{ij,m,t}] + \beta_{i,m} E[X_{ij,m,t}] \quad (3)$$

The expected mean effect in Eqs. (1) and (3) is the same. The main distinction is that Eq. (3) allows country-specific unobserved factors to vary the mean level effect β_m by each importer country. For some importers, conditional $\beta_{i,m}$, that is country-specific effect of energy dependence on the importer's conflict initiation behavior, may be higher than the expected mean level effect of β_m for our overall sample. For some others, this conditional effect may be lower. For certain importers, the signs can flip for the relationship between energy dependence and the risk of MID initiation. A cursory analysis of how the conditional effect of energy dependence changes across various importers can, in turn, inform us what types of regional, political and/or economic structures may be shaping an importer's foreign policy choices against its energy suppliers.[6]

5. Variables and data

5.1. Militarized interstate dispute initiation

Militarized interstate disputes (MIDs) refer to conflicts between two states in which either one of both parties resorts to the threat, display or use of militarized force. The data for militarized interstate disputes is obtained from MID 4 data, for years between 1978 and 2010 [63]. An initiation indicates whether one state initiates a militarized interstate dispute against the other in a dyad at a given year.[7] Our unit of analysis is "directed-dyad year," i.e., our dataset distinguishes between who initiates and who receives the first militarized action. For example, Nepal–India–1990 and India–Nepal–1990 constitute two separate observations in our dataset, treating a hypothetical initiation of conflict by Nepal against India in 1990 as a separate event then a hypothetical initiation of conflict by India against Nepal.

Energy Dependence: Our main independent variable calculates the level of energy dependence country A has to country B. The variable is calculated with data retrieved from the Global Energy Relations Dataset [3]. This directed dyadic dataset features data on how much energy, in terms of megaJoules, flows from one exporter country to an importer country annually, from 1978 to 2014.[8] The dataset also breaks down these flows by four major types of resource, namely, oil, coal, gas and electricity. The energy dependence variable is calculated as follows:

$$ED_{ij,m,t} = \frac{Exports_{ji,m,t}}{TotalConsumption_{i,m,t}} \times \frac{TotalConsumption_{i,m,t}}{GrossEnergyConsumption_{i,t}} = \frac{Exports_{ji,m,t}}{GrossEnergyConsumption_{i,t}}$$

where $ED_{ij,m,t}$ is energy dependence of country i to country j for energy resource m at year t. $Exports_{ji,m,t}$ denotes the exports of country j to country i for energy resource m at year t. $Total\ Consumption_{i,m,t}$ indicates the total consumption of energy resource m for country i at year t.

Note that the term $Total\ Consumption_{i,m,t}$ cancels out, simplifying our energy dependence measure to $\frac{Exports_{ji,m,t}}{GrossEnergyConsumption_{i,t}}$. In other words, our measure indicates what percent of overall energy consumed in country i is provisioned by resource m imported from country j in year t. Summing these figures over the four types of energy resources calculates the overall energy dependence country i has to country j for year t.[9] Missing values are treated as zeros if at least one of these four energy dependence figures is available.[10] Otherwise, we left the overall energy dependence variable as missing. We obtain total inland consumption by each of four different primary energy resources and total inland energy consumption data from the monadic version of the GERD dataset to calculate the index.

6. Control variables

To prevent omitted variable bias, we include a set of canonical control variables that may alternatively explain a state's propensity to initiate conflict against another in our subsequent analyses. More specifically, our models control for contiguity, joint democracy, relative power of a potential initiator, dyadic foreign policy similarities, alliance ties, and temporal dependence. Table 1 presents basic statistical figures for our dependent, independent and control variables.

6.1. Joint democracy

That democracies are significantly less likely to fight with each other is one of the very few assertations that approximate a law in

[6] Our analyses were run with the xtmixed command in Stata 13 with robust standard errors. The random intercepts were calculated at the dyad level.

[7] We do not drop the years during which the dyad experiences an ongoing MID with the assumption that various energy resources may lead to separate disputes. The results remain substantively the same when the ongoing MID years are dropped from the sample.

[8] The GERD dataset does not distinguish forwarded or reimported energy from origin-end user energy flows. For example, a hypothetical barrel of crude that moves from United Arab Emirates, arrives in Singapore, gets blended with crude from other suppliers and ships off to China is recorded as two separate moves: one from UAE to Singapore and the other from Singapore to China. Similarly, each reexport/reimport move registers to its respective supplier's aggregate export figures. For instance, Mexican oil that moves to US towards a refinery, and the reentry of refined oil back to Mexico are registered as two separate moves.

[9] Note that *Gross Energy Consumption* refers to the total inland energy consumption of country i comprising of all resources.

[10] We conducted additional robustness checks to address the issue of missing data: (i) coding the energy dependence variable as "missing" if any of the constituent parts (coal oil, gas or electricity) is missing, and (ii) coding the overall variable as "missing" if only gas or oil figures are missing (with the assumption that these two resources are strategically more important. Results remain substantively the same. For more information about missing data in GERD, see Gökçe and Hatipoglu [3].

Table 1
Descriptive Statistics.

	Mean	Std Dev	N
MID Initiation	0.00094	0.03069	1,191,496
Coal Dependence	0.00019	0.00589	1,172,545
Oil Dependence	0.00305	0.03645	1,172,545
Natural Gas Dependence	0.00026	0.00820	1,172,545
Electricity Dependence	0.00007	0.00521	1,172,545
Overall Energy Dependence	0.00346	0.03857	1,191,496
Joint Democracy	0.18669	0.38966	1,027,280
FP Similarity	0.67513	0.30130	1,080,872
Contiguity	0.02334	0.15097	1,191,496
Allied	0.05712	0.23207	1,191,496
Relative Power	0.5	0.37588	1,070,488
Peace Years	31.989	23.44575	1,020,772
Dyad-Year	–	–	1,191,496
Country	–	–	196

international relations [64]. Such similarity in regime types also affects trading relations in a positive direction [65,66]. To identify jointly democratic dyads, we use Polity IV data [67], where a country is coded as a democracy if the country has a Polity score (democracy score–autocracy score) of six or greater. When both countries are democracies, the variable takes on a value of 1.

6.2. Foreign policy similarity

Since a conflict of interest between states is one of the main reasons for them to engage in a dispute, the extent to which their international interests are in compliance with one another may also affect conflict propensities within a dyad. Conflict is presumed to be less likely between countries having agreed on major issues in their foreign policies [68,69]. We use similarity of United Nations General Assembly voting patterns obtained from FPSIM Dataset [70]. Each similarity score ranges from −1 to 1; larger numbers indicate greater similarity in international interests.

6.3. Contiguity

Being contiguous increases not only the volume of mutual trade between countries [71], but also the likelihood of intense conflicts [72,73]. Underlying arguments explain the relationship between a geographical proximity and conflict by referring to the contact theory—conflicts of interest are observed more likely between countries having frequent levels of contact [9]—or the issue salience—geographical proximity may lead to conflicts related to severer issues more frequently between countries, such as territorial issues [74]. Similar arguments might also remain valid for trade–conflict nexus: higher levels of interaction led by trade might trigger conflicts over a trading relationship or other issues. We refer to a dyad as contiguous if dyad the two countries are contiguous on land or separated by<150 miles of water [75].

6.4. Relative power

Whether preponderance or balance of power between two countries leads to peaceful relationship has led to a large debate [76,77], where empirics have increasingly shown that power preponderance is conducive to peaceful relations [72,78]. We use Composite Index of National Capabilities (CINC) dataset to operationalize relative power of two countries in a given dyad, where the index ranges from zero to one [79]. The relative power variable measures the share of dyadic capabilities possessed by the potential initiator, i.e., $CINC_{initiator}/(CINC_{initiator} + CINC_{target})$ [80].

6.5. Alliances

Alliance ties may affect both the likelihood of observing conflict within a dyad and the level of trade between states. Scholarly studies

Table 2
Dependence on Energy and MID Initiation.

	Random Effects, unrestricted sample	Random Effects, restricted sample	Random Coefficients, unrestricted sample	Random Coefficients, restricted sample
Overall Energy Dependence	−0.00764***	−0.0137**	−0.0185*	−0.0112**
	(0.00126)	(0.00542)	(0.00972)	(0.00498)
Joint Democracy	−0.000218*	−0.00368***	8.88E-05	−0.000738
	(0.000123)	(0.000986)	(0.000281)	(0.000961)
FP Similarity	−0.00252***	−0.0112***	−0.00225***	−0.0110***
	(0.000188)	(0.00135)	(0.000621)	(0.00227)
Contiguous	0.0272***	0.0243***	0.0272***	0.0254***
	(0.000404)	(0.00153)	(0.00315)	(0.00438)
Allied	8.59E-05	0.000148	−0.000111	−0.000349
	(0.000258)	(0.00151)	(0.000574)	(0.00192)
Rel Power of Importer	0.000561***	0.00306**	−0.00252***	−0.0118**
	(0.000176)	(0.00135)	(0.000456)	(0.00599)
Peace Years	−0.000223***	−0.00176***	−0.000382***	−0.00236***
	(9.54e-06)	(7.65e-05)	(5.38e-05)	(0.000245)
Peace Years^2	3.09e-06***	2.39e-05***	4.87e-06***	3.08e-05***
	(1.84e-07)	(1.40e-06)	(7.30e-07)	(3.48e-06)
Peace Years^3	−1.18e-08***	−8.88e-08***	−1.79e-08***	−1.12e-07***
	(8.66e-10)	(6.40e-09)	(2.87e-09)	(1.39e-08)
Constant	0.00539***	0.0357***	0.00953***	0.0481***
	(0.000211)	(0.00155)	(0.00148)	(0.00486)
ln(sigma1)	−4.712***	−3.688***	−2.216***	−19.55**
	(0.00610)	(0.0199)	(0.336)	(9.366)
ln(sigma2)	−3.425***	−2.368***	−5.893***	−4.159***
	(0.000788)	(0.00247)	(0.0956)	(0.101)
ln(sigmae)			−3.391***	−2.343***
			(0.0705)	(0.0633)
Observations	834,371	84,901	834,371	84,901
Number of groups	30,280	2,993	186	179

Dependent variable: Initiation from importer to exporter.
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 3
Coal Dependence and MID Initiation.

	Random Effects, unrestricted sample	Random Effects, restricted sample	Random Coefficients, unrestricted sample	Random Coefficients, restricted sample
Coal Dependence	−0.00758	−0.0062	−0.110*	−0.0136
	(0.00685)	(0.0237)	(0.0639)	(0.0194)
Joint Democracy	−0.000217*	−0.00371***	7.92E-05	−0.000653
	(0.000124)	(0.000988)	(0.000279)	(0.000960)
FP Similarity	−0.00249***	−0.0111***	−0.00223***	−0.0109***
	(0.000189)	(0.00135)	(0.000626)	(0.00226)
Contiguous	0.0270***	0.0240***	0.0265***	0.0250***
	(0.000403)	(0.00152)	(0.00309)	(0.00434)
Allied	1.20E-05	−8.70E-05	−0.000306	−0.000586
	(0.000258)	(0.00151)	(0.000583)	(0.00193)
Rel Power of Importer	0.000605***	0.00339**	−0.00241***	−0.0113*
	(0.000176)	(0.00135)	(0.000452)	(0.00595)
Peace Years	−0.000226***	−0.00177***	−0.000391***	−0.00237***
	(9.59e-06)	(7.67e-05)	(5.44e-05)	(0.000246)
Peace Years^2	3.14e-06***	2.41e-05***	5.01e-06***	3.10e-05***
	(1.85e-07)	(1.41e-06)	(7.39e-07)	(3.49e-06)
Peace Years^3	−1.20e-08***	−8.95e-08***	−1.85e-08***	−1.13e-07***
	(8.69e-10)	(6.41e-09)	(2.90e-09)	(1.39e-08)
Constant	0.00539***	0.0356***	0.00958***	0.0480***
	(0.000211)	(0.00155)	(0.00148)	(0.00485)
ln(sigma1)	−4.710***	−3.687***	−0.539	−14.59
	(0.00610)	(0.0199)	(0.363)	(15.21)
ln(sigma2)	−3.425***	−2.368***	−5.892***	−4.158***
	(0.000789)	(0.00247)	(0.0961)	(0.102)
ln(sigmae)			−3.390***	−2.342***
			(0.0704)	(0.0633)
Observations	833,155	84,829	833,155	84,829
Number of groups	30,270	2,993	186	179

Dependent variable: Initiation from importer to exporter.
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 4
Oil Dependence and MID Initiation.

	Random Effects, unrestricted sample	Random Effects, restricted sample	Random Coefficients, unrestricted sample	Random Coefficients, restricted sample
Oil Dependence	−0.00624***	−0.0122**	−0.0167*	−0.0104*
	(0.00136)	(0.00621)	(0.00938)	(0.00587)
Joint Democracy	−0.000218*	−0.00367***	8.46E-05	−0.000673
	(0.000124)	(0.000987)	(0.000283)	(0.000959)
FP Similarity	−0.00250***	−0.0112***	−0.00224***	−0.0109***
	(0.000189)	(0.00135)	(0.000621)	(0.00227)
Contiguous	0.0272***	0.0242***	0.0271***	0.0253***
	(0.000404)	(0.00153)	(0.00312)	(0.00437)
Allied	4.37E-05	−2.47E-05	−0.000156	−0.000498
	(0.000258)	(0.00151)	(0.000581)	(0.00193)
Rel Power of Importer	0.000571***	0.00315**	−0.00251***	−0.0116*
	(0.000176)	(0.00135)	(0.000455)	(0.00596)
Peace Years	−0.000226***	−0.00177***	−0.000386***	−0.00237***
	(9.59e-06)	(7.67e-05)	(5.41e-05)	(0.000246)
Peace Years^2	3.13e-06***	2.41e-05***	4.94e-06***	3.09e-05***
	(1.85e-07)	(1.41e-06)	(7.35e-07)	(3.49e-06)
Peace Years^3	−1.20e-08***	−8.95e-08***	−1.81e-08***	−1.13e-07***
	(8.69e-10)	(6.40e-09)	(2.88e-09)	(1.39e-08)
Constant	0.00542***	0.0358***	0.00958***	0.0482***
	(0.000211)	(0.00155)	(0.00148)	(0.00486)
ln(sigma1)	−4.711***	−3.688***	−2.222***	−15.92
	(0.00611)	(0.0200)	(0.313)	(17.29)
ln(sigma2)	−3.425***	−2.368***	−5.895***	−4.161***
	(0.000789)	(0.00247)	(0.0958)	(0.102)
ln(sigmae)			−3.391***	−2.342***
			(0.0705)	(0.0633)
Observations	833,155	84,829	84,829	84,829
Number of groups	30,270	2,993	186	179

Dependent variable: Initiation from importer to exporter.
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5
Natural Gas Dependence and MID Initiation.

	Random Effects, unrestricted sample	Random Effects, restricted sample	Random Coefficients, unrestricted sample	Random Coefficients, restricted sample
NG Dependence	−0.0294***	−0.0319*	−0.0988***	−0.0201
	(0.00546)	(0.0168)	(0.0330)	(0.0127)
Joint Democracy	−0.000217*	−0.00372***	6.79E-05	−0.00072
	(0.000124)	(0.000987)	(0.000282)	(0.000965)
FP Similarity	−0.00250***	−0.0111***	−0.00224***	−0.0109***
	(0.000189)	(0.00135)	(0.000622)	(0.00226)
Contiguous	0.0272***	0.0241***	0.0267***	0.0251***
	(0.000404)	(0.00152)	(0.00309)	(0.00432)
Allied	5.93E-05	6.64E-05	−0.000231	−0.00046
	(0.000258)	(0.00152)	(0.000585)	(0.00193)
Rel Power of Importer	0.000588***	0.00324**	−0.00244***	−0.0114*
	(0.000176)	(0.00135)	(0.000457)	(0.00594)
Peace Years	−0.000226***	−0.00177***	−0.000391***	−0.00237***
	(9.59e-06)	(7.67e-05)	(5.42e-05)	(0.000246)
Peace Years^2	3.13e-06***	2.41e-05***	4.99e-06***	3.10e-05***
	(1.85e-07)	(1.41e-06)	(7.37e-07)	(3.49e-06)
Peace Years^3	−1.20e-08***	−8.95e-08***	−1.84e-08***	−1.13e-07***
	(8.69e-10)	(6.41e-09)	(2.89e-09)	(1.39e-08)
Constant	0.00540***	0.0357***	0.00960***	0.0481***
	(0.000211)	(0.00155)	(0.00148)	0.0481***
ln(sigma1)	−4.710***	−3.687***	−1.493***	−11.84
	(0.00610)	(0.0199)	(0.329)	(14.04)
ln(sigma2)	−3.425***	−2.368***	−5.885***	−4.161***
	(0.000789)	(0.00247)	(0.0943)	(0.102)
ln(sigmae)			−3.390***	−2.342***
			(0.0704)	(0.0633)
Observations	833,155	84,829	833,155	84,829
Number of groups	30,270	2,993	186	179

Dependent variable: Initiation from importer to exporter.
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

hypothesize that alliance ties make conflict between states less likely. Although such a hypothesis lacks firm theoretical and empirical agreement [68,72], many empirical studies have included a variable corresponding to formal security alliances in their models of conflict initiation [81]. Besides having influence the conflict proneness within a dyad, alliance ties may also affect the level of trade between state—states are more likely to trade with their allies [82]. To operationalize interstate alliance, we use Gibler and Sarkees's [83] defense pacts data. "Allied" is a dichotomous variable equal to one if states have a defense pact with one another. Defense pacts indicate whether parties of the dyad both join in a treaty of alliance providing security guarantees of mutual assistance in the incidence either party is attacked. This type of alliance indicates the highest degree of common security interests.

6.6. Temporal Dependence

To control for temporal dependence between events, we employ linear, squared and cubic specifications of peace years, i.e., the number of years since the dyad last experienced a militarized dispute [84].

7. Findings and discussion

We present our findings in Tables 2–6. We run all our models with an unrestricted and a restricted sample. The unrestricted sample includes all potential interactions from any country towards any other in the world. The restricted sample is confined to "politically relevant" dyads, that is pairs of countries that have a feasible chance of interacting militarily should either of them wished to do so [85,86]. Politically relevant dyads are defined as pairs of countries that share a land border, are separated by a maximum of 150 miles of sea or contain at least one major power.[11]

We establish our empirical baseline with dyad-specific random effects models in each set of regressions grouped by energy resource. Although our models control for various dyad specific factors, the lack of a strong ex-ante theory suggests we take a conservative approach in controlling for unobserved factors that may moderate the relationship between energy dependence and the possibility of MID initiation. Our next step is to allow for the coefficient of the energy dependence variables to vary by each importer country. We expect that various unobserved importer specific factors, such as the country's political institutions, the political and economic organizations in its region, its historical heritage in foreign policy, among others will condition the relationship between the level of energy dependence an importer has towards and its propensity to initiate conflict against a supplier country. While we do not impose an ex-ante expectation as to what factors condition this relationship, we hope to parse out suggestive patterns by eyeballing which countries significantly deviate from the mean effect and in what direction.

In Table 2, we test whether an increase in overall energy dependence level pacifies an importer or makes it more aggressive against its exporter, hence contrasting Hypothesis 1a with 1b. All models favor the liberal proposition (Hypothesis 1b) that increased levels of energy trade pacifies relations. Our set of models also justify our concern that unobserved country and dyad-specific factors matter, hence suggesting

[11] Major powers are those assumed to possess the ability to project power to any region in the world. In our study, the United States, China, Russia, United Kingdom and France are treated as major powers for our whole time frame; Japan and Germany are treated as major powers from 1991 onwards, as defined by the Correlates of War Project [87].

Table 6
Electricity Dependence and MID Initiation.

	Random Effects, unrestricted sample	Random Effects, restricted sample	Random Coefficients, restricted sample
Electricity Dependence	−0.0316***	−0.031	−0.0450*
	(0.00745)	(0.0238)	(0.0236)
Joint Democracy	−0.000216*	−0.00369***	−0.00063
	(0.000124)	(0.000987)	(0.000882)
FP Similarity	−0.00249***	−0.0111***	−0.0109***
	(0.000189)	(0.00135)	(0.00108)
Contiguous	0.0271***	0.0241***	0.0251***
	(0.000403)	(0.00152)	(0.00118)
Allied	5.68E-06	−0.00012	−0.00063
	(0.000258)	(0.00151)	(0.00111)
Rel Power of Importer	0.000605***	0.00338**	−0.0113***
	(0.000176)	(0.00134)	(0.00188)
Peace Years	−0.000226***	−0.00177***	−0.00237***
	(9.59e-06)	(7.67e-05)	(6.49e-05)
Peace Years^2	3.13e-06***	2.41e-05***	3.10e-05***
	(1.85e-07)	(1.41e-06)	(1.15e-06)
Peace Years^3	−1.20e-08***	−8.95e-08***	−1.13e-07***
	(8.69e-10)	(6.41e-09)	(5.15e-09)
Constant	0.00538***	0.0356***	0.0480***
	(0.000211)	(0.00155)	(0.00168)
Observations	833,155	84,829	84,829
Number of groups	30,270	2,993	179

Dependent variable: Initiation from importer to exporter.
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

further theory-driven research.[12]

That said, do unobserved country specific effects exhibit discernible patterns? To answer this question, Fig. 1 summarizes which countries significantly deviate from the sample mean and by what magnitude in our random coefficients model.[13] Eyeballing this data renders interesting insights. One such insight is that regions seem to matter, reflecting a similar debate in geopolitics [88,89]. Energy dependence seems to be a less effective pacifier in the American continent compared to other continents. The figures for Europe confirm various case studies that highlight the eastern/western divide in European infrastructure in general, and energy infrastructure in particular: Central and Eastern European countries, especially those that depend on Russian exports (e.g., Latvia, Belarus), are significantly less likely to initiate conflicts against their energy suppliers compared to Western European countries. In Asia, energy dependence seems to pacify landlocked countries against their importers more (e.g., Kyrgyzstan). The attenuated effect of energy dependence on peaceful relations draws attention to the already tense relations in the blue waters of East Asia (e.g., China, Japan, S. Korea). Sub-Saharan Africa does not exhibit a discernible intra-continental pattern. Moving beyond regions, we also see that oil and gas exporting countries are less deterred by their level of dependency on energy imports in other resources to other exporter countries (with the exception of Turkmenistan, which is a landlocked country).

While most of the country-specific coefficients are significant, the marginal effect of our overall energy dependence appears relative limited from our random coefficient model. For instance, an "average" importer that imports 1% of its annual energy from an exporter country has a chance of 1.4% to initiate a conflict against that exporter, setting the rest of the variables to their medians and means with 10 years of peaceful relations in our random coefficient model run on the unrestricted sample. Increasing this level of overall energy dependence to 5% decreases the probability of MID to 1.36%, pointing to a 3% decrease in baseline probability. An increase from a 5% to 10% overall energy dependence causes a 4.2% shift in baseline probability to 1.3% in a given dyad year. The relative pacifying effect of overall energy flows is higher from our random coefficient model run on the unrestricted sample. The corresponding reduction in baseline probability of conflict for shifts from 1% to 5% and 5% to 10% are 23% (0.32% to 0.25%) and 37.4% (0.25% 60 0.16%), respectively.[14] The varying pacifying effects different energy sources have on potential initiators may be causing these inconsequential results. To recall, our theoretical expectation is that more fungible energy sources for which a global market exists (e.g., coal and oil) are less effective pacifiers for their importers, compared to less fungible energy sources that require committed energy infrastructure (e.g. gas and direct imports of electricity).

To further unpack the relationship between energy flows and interstate conflict, Tables 3–6 test the effect each specific energy resource has on the probability of an importer initiating conflict against its relative exporter. The coefficients for coal dependence turn out to be insignificant.[15] Our findings are nuanced for oil. In line with our expectations, the effect of oil dependence is slightly more significant than coal, although its marginal effect is smaller than the overall energy dependence variable presented in Table 2. The marginal effects on the initiation of MID is very similar that of overall energy dependence figures. A shift from 1% to 5% dependence shifts the baseline probability of MID initiation by 6%, from 1.1% to 1.06% in an average dyad, as depicted above, in our restricted sample. A shift from 5% to 10% dependence to oil imports in overall energy consumption in an importing country shifts the baseline probability by 7.9%, from 1.06% to 0.97%. in a given year within an average dyad.

Results presented in Table 5 indicate dependence to natural gas is a more potent pacifier for the importer, although one interesting caveat is that the coefficient for the restricted sample in our random coefficient model is not statistically significant.[16] The pacifying effect for natural gas is more pronounced seen in the unrestricted sample. When an importer's dependence on an exporter's natural gas increases from 1% to 5%, its probability of initiating a MID against that exporter decreases from 2.9% to 2.5% indicating a 15% drop in baseline probability. An

[12] The possibility of reverse causality/endogeneity remains an important issue for the inferences we make in our paper. Countries may choose to buy energy from suppliers with whom they enjoy cordial relations to start with, suggesting the line of causality may run in reverse. We take some precautions to address such potential causality. First, dyad and country-level effects control for baseline propensity for the importer to initiate conflict against the exporter. Surely, this baseline effect can vary over time (e.g., due to the end of Cold War). We also control for ex-ante foreign policy preference similarity between the two countries, and peace years. In addition, if endogeneity were a dominant force, we would expect oil and coal (where importers can choose their trading partners more easily) to be stronger pacifiers than gas and electricity (where geography can, to a certain extent, "dictate" with whom an importer can trade with). Our results suggest the opposite. Finally, a wealth of cases (e.g., Russia-Germany, UAE-Qatar) suggest acute conflicts within a dyad do not necessarily disrupt trade in energy. Surely, potential endogeneity in the relationship between energy flows and interstate relations merits further analyses, and possibly a series of papers, on its own. Being one of the first large-N analysis on this topic, this study remains agnostic on this front.

[13] We chose to represent results from the restricted sample for ease of analysis. Coefficients for individual countries can be found in Appendix A.

[14] One of the reasons of this increase is that the "average" dyad in the unrestricted sample is quite peaceful; the use of military force between Botswana and Moldova, or Micronesia and Bolivia is improbable. Any deviation from this baseline probability will, therefore, be large.

[15] The coefficient for coal dependence in our random coefficient model run on the unrestricted sample is significant at 10%, two-tailed.

[16] Although the sign is in the expected direction, we suspect self-selection may be playing a role here amongst politically relevant dyads. Alternatively, certain rivalries that have carried over from Cold War, such as those between Russia and its now gas customers in the "West" may have reduced the magnitude of the coefficient.

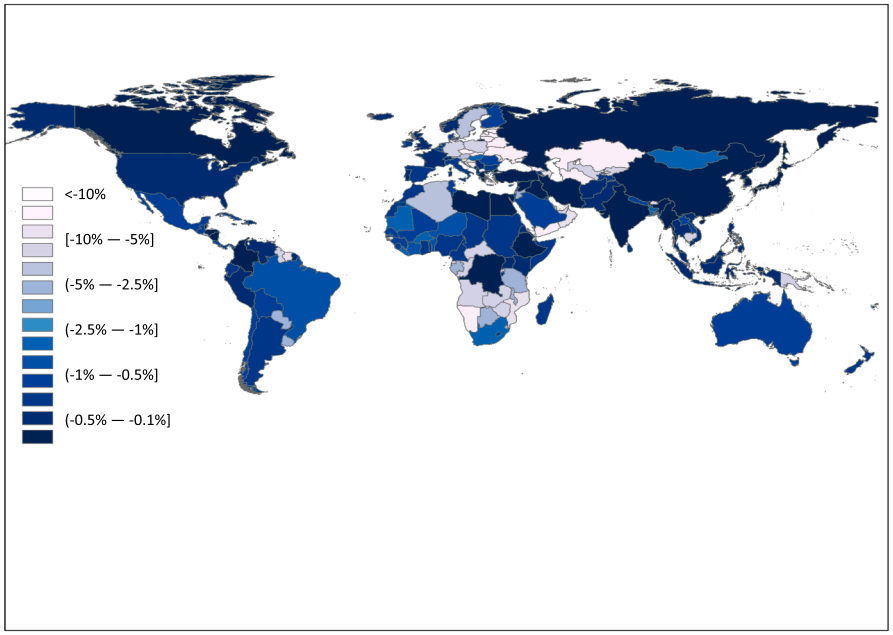

Fig. 1. Country-specific deviations from average effect of energy dependence on conflict initiation * Country-specific deviations from the average effect of energy dependence on conflict initiation expressed as percentages. Darker colors indicate a weaker pacifying effect higher levels of energy dependence has on MID initiation. Country-specific effects were calculated from the random coefficients regression with restricted sample displayed in Table 2.

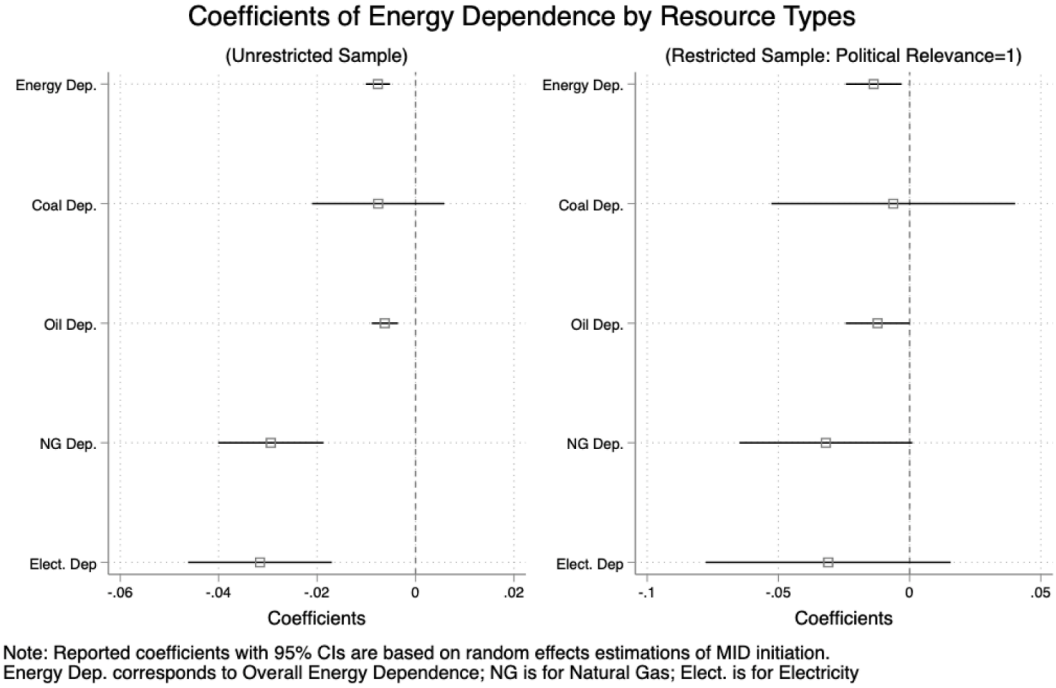

Fig. 2. Regression Coefficients of Energy Dependence by Energy Resource Type.

increase in dependency from 5% to 10% leads to a corresponding decrease from 2.5% to 2%, resulting in a 20% drop in baseline probability for that year.

Our findings for electricity dependence point out to a negative relationship. A very large portion of the dyads do not trade electricity at all creating a large group of zeros, which prevented our random coefficients model to converge using the full, unrestricted sample. The simulated of effects of dependency on imports of electricity run on the same model using the restricted sample are slightly larger than those of oil, but smaller than those of natural gas. When an importer's dependence on imported electricity from a specific exporter in an "average" dyad increase from 1% to 5%, the probability of that importer initiating a MID decrease from 3.9% to 3.7%, reflecting a 4.7% drop in baseline probability. An increase from 5% to 10% leads to a decrease of the probability of MID initiation from 3.7% to 3.5%, reflecting a 6% drop in baseline probability. Fig. 2 juxtaposes coefficients for our energy flow

variables from the random effects regressions with 95% confidence intervals around them. The center points in Fig. 2 also indicate the predicted reduction in the possibility of a MID initiation by an importer against its exporter, as a result of a one percent increase in the share of that energy import's share in the overall total primary energy supply of the importer.

Our control variables reflect general findings in the literature, hence increasing the validity of our results. Having similar foreign policy preferences, being jointly democratic pacifies dyads.[17] We find inconsistent results for relative power. Contiguity, as expected, is a significant and strong predictor of MID initiation.

8. Robustness checks

We ran a series of additional regressions to check the robustness of our results. The first two robustness tests were run only with random effects for brevity. First, we asked whether our findings hold at higher levels of hostility, and, therefore, reran our random effects regressions with two additional outcome variables: MIDs that were reciprocated by the exporter, and MIDs that led to at least one military fatality. Tables B1.1 and B1.2 in the appendix display the results. Our findings indicate that importers are reluctant to signal discontent against their energy suppliers via lower-level militarized disputes but are willing to initiate higher level hostilities. Still, trade in natural gas and electricity remain to be statistically significant pacifiers, strengthening our argument that dependence on non-fungible energy flows makes importers more reluctant to employ their military against their suppliers. Second, we regressed MID initiation on all four types of energy flows at once to rule out the possibility that the pacifying relationship is in fact driven by only one type of source (e.g., natural gas). Results displayed in Table B2.1 echo our original findings. Third, we constructed a measure of non-energy trade flows from an exporter to the importer.[18] When we add this variable to our random effects and random coefficient models as an additional independent variable, the results remain substantively the same, as shown in Table B3.1. The only exception appears to be the coefficients for oil dependence, whose level of significance slightly decreases in random effects regressions.

9. Conclusion

Energy remains to be the most important traded commodity in the world. Economic progress, social development and national security of a state necessitate dependable and affordable energy. As a result, securing affordable and sustained flow of energy resources has been a major foreign policy objective of modern societies. Despite the salience of energy for an item in a state's foreign policy, few studies have systematically analyzed how energy flows affect interstate relations in a large-N setting. Using the recently released Global Energy Relations Dataset that covers the globe between 1978 and 2014, we conduct one of the first such systematic analysis and look at whether an importer's level of energy dependency to an exporter affects its behavior towards this supplier. In doing so, we also dissect interstate energy flows into various components namely coal, oil, gas and electricity, and assess the individual effect each resource has on dyadic relations of peace and conflict.

The findings confirm our main expectation; energy dependency pacifies importers against their importers. Further analyses suggest that the level of trade in coal and oil, the more fungible of the two energy sources, seem to have no effect on the propensity of MID initiation while higher levels of natural gas and electricity trade seem to pacify importers against their exporters. These findings reflect Bell and Long's [91] argument that the more global the market becomes for a trade commodity, i.e., the easier importer countries can shift to other suppliers, the less reason these importers will feel the need to coerce their exporters by employing militarized force. Our random coefficient models also indicate that the pacifying effect of energy trade varies by region; for instance, Eastern European importers seem to cultivate more peaceful relations with their energy suppliers than Western European importers.

Being one of the first to cover the globe over an extensive period—from 1978 to 2010—, this study inevitably overlooks certain region- and technology-specific details. Noting the exploratory nature of this study, we adopted an inductive approach and chose to strike a balance between being theoretically agnostic while maintaining analytical tractability. In doing so, we also hope our findings will motivate future research on identifying systematic factors that condition the relationship between energy dependence of an importer and the foreign policy it formulates towards its suppliers.

Despite this inductive approach, our findings are robust to various empirical specifications. Means of incorporating such details into our framework suggest several promising avenues of future research. The first of these avenues relates to how technological change reshapes energy dependence. Advancements in oil refining technology over the last two decades, for instance, might have allowed refineries to process a wider-range of crude mixes, hence making them less-dependent on a specific type of oil. Advances in LNGfication may similarly be making natural gas more fungible.[19] Global investments in degasification and regasification capacity have been moving natural gas towards being a truly global commodity, potentially decreasing the political lock-in effect pipelines were arguably creating otherwise. Logistic bottlenecks constitute another detail that our analyses overlook. Energy suppliers or transit countries who also command over logistical means to deliver may be more valuable to importers when such means (such as oil or LNG tankers) are scarce.

This study operationalizes energy dependence via realized flows but does not account for an importer country's ability to substitute among potential suppliers for an energy source. While we establish a strong link between the level of fungibility of an energy source and its pacifying effect, future studies could control for the level of diversification an importer has within a specific type of energy source. The construction of an LNG terminal, for instance, could reduce the dependency an importer has on a supplier that supplies gas via pipelines, even if the LNG terminal does not operate at full capacity. Further disaggregation of an importer's region- or industry-specific dependency could also unearth interesting patterns of how energy trade shapes foreign policy. To illustrate, such industry-specific dependency may become especially salient if certain sectors of the importer's industry become dependent on low-carbon energy sources such as green hydrogen in the future.[20]

The rise of renewable energy is worth special attention. Increasing levels of international trade in electricity are very likely to challenge the

[17] The occasional non-significance of the joint democracy variables can be attributed to its high level of correlation with the foreign policy similarity variable.

[18] In constructing this variable, we followed three main steps. First, we identified reported energy resource flows using UN COMTRADE and the ATLAS of Economics Complexity databases in current U.S. dollar amounts. Using 2-digit (SITC – revision 2) detail levels for commodity type (32–35), we calculated the U.S. dollar value of reported energy flows from one country to another. To calculate levels of non-energy trade flows within a dyad at a given year, we subtracted these yearly figures for energy trade from each dyad's total trade in that given year. Total trade figures were obtained from Barbieri and Keshk's [90] dyadic trade dataset for years between 1978 and 2014. Finally, we calculated non-energy trade dependence for an energy importer country by using the conventional formula of exports+imports/GDP.

[19] Adding two dummies that indicate whether (1) a gas pipeline exists between an importer and an exporter or (2) gas was traded via this pipeline between these two countries did not change our findings regarding the pacifying effect natural gas trade has on MID initation. These additional results are presented in our online appendix.

[20] We thank one of the reviewers for bringing this point to our attention.

validity of our discussion in this study. The increase in cross-border electricity trade, especially due to the advance of renewables, is shaping the way countries are relating to each other via energy. Bhutan derives about a third of its GDP from exports of hydroelectricity [92]. Should Ethiopia succeed to complete its Grand Ethiopian Renaissance Dam project, its energy exports may be a re-defining factor in Ethiopia's relations with its neighbors [93]. Various other countries are investing in solar and wind power with the view of exporting some of this energy to their neighbors.

As a result, trade in renewable electricity may be creating new forms of interdependencies that may not necessarily be captured by our energy flow data. Indeed, recent debates on global politics of energy have also started focusing on the governance of trade in renewable energy and electricity in the world [94,95]. Although renewable energy requires high levels of investment at the beginning, marginal cost is effectively zero for the producer thereafter. Demand is instantaneous, i.e., a sophisticated and secure infrastructure should be present to deliver electricity across borders. Meanwhile, electricity from renewables that is not traded is instantaneously spoiled, i.e., cannot be stored (unlike oil in tankers) for future use.[21] In addition, flow of electricity requires transmission lines across borders, adding a further layer of complication, especially with respect to any transit states involved. To illustrate, after United Kingdom finalized its Brexit decision, France and Ireland concluded the Celtic Interconnector project which provisions for the establishment of a direct underwater connection between the two countries. China has been floating the idea of forming ultrahigh voltage transmission networks to wheel renewable energy across hemispheres, making use of day-time and seasonal differences [96]. Should such large-scale projects come to fruition, the debate on geopolitical implications of interstate renewable energy flows will certainly escalate from a dyadic/regional to a global perspective.

Our study provides an initial comparative insight into how trade in electricity may influence interstate relations differently than trade in conventional energy sources such as oil and gas. Extending our time frame to 2021, hence capturing the boom in the solar and wind power capacity, may allow for nuanced analysis on renewables and interstate relations. This study's focus on exclusive focus on flows of *energy* is another shortcoming for assessing the effect energy transition may have on geopolitics. Recent developments suggest that trade in rare earth minerals, critical to the construction of renewable energy generation and storage equipment, can cause conflict between states as much as the flow of energy itself [97,98,99]. Switching to a wider lens, future studies can incorporate such non-traded commodity "bottlenecks" in energy flows (e.g., critical raw materials, oil refinery capacity, pumping capacity of natural gas pipelines) into their analysis of energy flows and interstate relations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.erss.2021.102133.

[21] Developments in battery storage and hydrogen technology may make renewable electricity "storable" in the medium term.

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