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From Mines to Markets

Gravity Model Insights on Critical Raw Material Trade

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Abstract

Access to critical raw materials (CRMs) is increasingly being shaped by geopolitical dynamics, fuelling a global competition for supply security. This paper applies the gravity model of trade to examine how OECD countries leverage Aid for Trade (AfT), Bilateral Investment Treaties (BITs), and Preferential Trade Agreements (PTAs) to influence CRM imports from developing countries. Using extensive bilateral panel data from 1995 to 2023, we find that PTAs are particularly effective, affecting both the intensive and extensive margins of trade. These findings highlight the strategic role of formal trade agreements and suggest that a coordinated policy mix of trade diplomacy, investment, and aid is essential for resilient and diversified CRM supplies.

Keywords: Aid for Trade; Bilateral Investment Treaties; critical raw materials; extensive margin; intensive margin; gravity model; Preferential Trade Agreements

JEL Classification: F13; F14; F15; F21; F35; F53

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Contents

Tables

Appendix Tables

Abbreviations

AfT	Aid for Trade
BACI	Base pour l'Analyse du Commerce International
BIT	Bilateral Investment Treaty
CRM	critical raw material
CTIP	Clean Trade and Investment Partnership
DAC	OECD Development Assistance Committee
EU	European Union
FDI	Foreign Direct Investment
HS	Harmonised System
LPM	linear probability model
MFN	Most Favoured Nation
MSP	Minerals Security Partnership
OECD	Organisation for Economic Co-operation and Development
PPML	Poisson pseudo-maximum likelihood
PTA	Preferential Trade Agreement
USD	US dollar

1 Introduction

Our modern world runs on critical raw materials (CRMs). Elements like lithium, cobalt and rare earth metals are key ingredients behind electric vehicles, semiconductors, and wind turbines, placing them at the heart of high-tech innovation and the green energy transition. As a result, CRMs have become a top priority on political and economic agendas worldwide (see, for instance, *The Economist*, 2023).

While high-income countries and global powers such as Australia, Canada, and – most notably – China hold substantial reserves of CRMs, significant deposits also lie in low- and middle-income countries, many of which remain commercially untapped. However, access to these resources is often constrained not only by extraction challenges but also by geopolitical dependencies, fuelling a global race to secure supplies (see, for instance, UNCTAD [United Nations Conference on Trade and Development], 2024; WEF [World Economic Forum], 2024).

This competition is reshaping international relations, prompting leading economies to respond strategically. The European Union (EU), for example, has incorporated CRM-related provisions into its trade deals, with the revised EU-Chile agreement serving as a notable example. However, the EU's approach is expanding beyond traditional trade tools, increasingly integrating a wide array of foreign policy tools to secure reliable CRM access. Recently, it launched negotiations for Clean Trade and Investment Partnerships (CTIPs), aimed at formalising bilateral ties while prioritising financial support and investment for critical supply chains – complementing its broader Global Gateway initiative. Similarly, the United Kingdom and the United States have leaned toward investment-led strategies over conventional trade deals, both being founding members of the Minerals Security Partnership (MSP), which mobilises public and private capital to support CRM mining and processing projects in developing countries.

This paper offers a macro-level, empirical perspective on this evolving landscape. To our knowledge, it is the first to apply the gravity model of trade to systematically assess how three trade-related policy instruments have shaped OECD (Organisation for Economic Co-operation and Development) countries' CRM imports from developing countries. We focus on Aid for Trade (AfT), Bilateral Investment Treaties (BITs), and Preferential Trade Agreements (PTAs) as proxies for shifting policy complexities, selected for their relevance and availability of reliable, comprehensive data.

Each of these instruments serves distinct, yet complementary, purposes: PTAs formalise trade ties and support broader policy cooperation; BITs help attract Foreign Direct Investment (FDI) and signal stable investment conditions; and AfT provides targeted financial support to strengthen infrastructure or productive capacity. Together, these instruments can form a strategic policy mix for building long-term supplier partnerships. Whether they do so, and to what extent, remains an empirical question. Our analysis explores their influence on both the intensive (deepening trade relationships) and the extensive (activating supplier links in underutilised markets) margins of trade.

We build on two strands of recent gravity model literature. First, we engage with the nascent body of research on the determinants of trade in critical resources – both in aggregated contexts (e.g., Farag & Zaki, 2025; Zhong & Su, 2023) and in specific sectors such as fuels (e.g., Barnes & Bosworth, 2015; Farag & Zaki, 2023; Zhang et al., 2018), and rare earth metals (e.g., Shigetomi et al., 2017; Yaseen et al., 2025). While this literature highlights the importance of country-specific supply-side and demand-side factors, (bilateral) foreign policy tools remain underexplored.

Second, from a methodological perspective, we draw on studies analysing AfT, BITs, and PTAs in broader or more siloed frameworks (e.g., Calì & te Velde, 2011; Heid & Vozzo, 2020; Mattoo et al. 2022; Stender & Vogel, 2025; Xiong, 2022). By bridging these perspectives, our paper

contributes novel insights to the geopolitical significance of trade-related policies in securing access to CRMs.

Our analysis shows that PTAs play a pivotal role in securing CRM access for OECD countries, affecting both the intensive and extensive margins of trade. These findings challenge a narrow focus on finance and investment alone, underscoring the strategic value of formal trade agreements. A well-calibrated policy mix – combining trade diplomacy, investment, and targeted aid – is likely essential for resilient and diversified CRM supplies.

We present our empirical strategy and data in Section 2, followed by the results in Section 3. Section 4 concludes.

2 Empirical strategy and data

Estimation models

We examine how AfT, BITs, and PTAs shape CRM trade from different empirical angles. Our main specification applies the Poisson pseudo-maximum likelihood (PPML) estimator, which accounts for residual heteroscedasticity and zero-trade flows (Santos Silva & Tenreyro, 2006). Specifically, we estimate an augmented gravity equation of the form:

$$M_{ijt} = \exp\left[\eta_{it} + \mu_{jt} + \beta_1 asinh(AfT_{ijt-1}) + \beta_2 BIT_{ijt} + \beta_3 PTA_{ijt} + \pi_{ij} + \varepsilon_{ijt}\right] \quad (1)$$

where M_{ijt} represents CRM imports of OECD country i from developing country j in period t, and ε_{ijt} denotes standard errors clustered at the country-pair level. Following best practice, we include country-pair (π_{ij}) and two-way importer-year and exporter-year fixed effects (η_{it} and μ_{jt}) to address bilateral policy endogeneity and multilateral trade resistance, respectively (Baldwin & Taglioni, 2007). These three fixed effects also control for the key determinants of critical resource trade identified in previous studies.

Annual bilateral AfT flows are represented by AfT_{ijt}. Because a substantial share (78 per cent) of AfT observations in our estimation sample are zero, we follow the AfT and broader empirical trade literature (e.g., Kristjánsdóttir, 2012; Yoon et al., 2024; Fuchs et al., 2025) and apply the inverse hyperbolic sine transformation, defined as $\ln\left(x + \sqrt{(x^2+1)}\right)$, where x is the AfT value. This approach allows us to retain all observations in the estimation, reduce skewness, and maintain interpretability in a log-like framework. To mitigate reverse causality, we lag the AfT variable by one year (see Hoekman & Shingal, 2020).

PTA_{ijt} and BIT_{ijt} are dummy variables equal to 1 if a country pair has a PTA or BIT, respectively, in period t, and 0 otherwise.[1]

To better understand the mechanics captured in the estimation of equation (1), we proceed in two steps. First, we focus on the intensive margin of trade by restricting the analysis to positive trade flows. Using the PPML estimator, we examine how AfT, BITs, and PTAs influence the value of *existing* trade relationships.

Second, we analyse the extensive margin of trade, that is, the formation of *new* trade links, to highlight two key aspects of CRM trade: First, greater geographical diversification reduces

1 Note that we do not lag the BIT and PTA dummies, as they switch from 0 to 1 upon entry into force and remain at 1 thereafter. Unlike the year-specific AfT data, this coding reflects broader time windows and thus does not require adjustment for potential reverse causality.

geopolitical dependencies. Second, aggregating all CRMs can obscure trade in especially critical materials, such as heavy rare earths, which have low trade values but high strategic importance. Normalising trade flows to a 0-1 scale helps amplify the relevance of these smaller flows in the analysis. While PPML is well-suited for modelling expected trade values, it is not appropriate for analysing the binary decision of whether trade occurs. To capture this dimension, we therefore estimate the likelihood of any trade occurring using a linear probability model (LPM):

$$P(M_{ijt} > 0) = \eta_{it} + \mu_{jt} + \beta_1 asinh(AfT_{ijt-1}) + \beta_2 BIT_{ijt} + \beta_3 PTA_{ijt} + \pi_{ij} + \varepsilon_{ijt} \quad (2)$$

where the dependent variable equals 1 if $M_{ijt} > 0$, and 0 otherwise. We choose the LPM over probit or logit models because the latter are unsuitable for high-dimensional fixed effects due to the incidental parameters problem (Greene, 2004).

Data

Our data cover the period from 1995 to 2023 and include 33 OECD importers and 172 developing country exporters (see Appendix Tables A1 and A2).[2] CRM trade is measured in current million US dollars (USD) and aggregated for each data year at the country-pair level based on Harmonised System (HS) 6-digit product lines following Georgitzikis (2023), using the latest version (January 2025) of the Base pour l'Analyse du Commerce International (BACI) trade dataset developed by Gaulier and Zignago (2010). Appendix Table A3 provides a detailed list of the base CRMs included in our analysis.

A key strength of the Georgitzikis (2023) classification over alternatives like the one proposed by Kowalski and Legendre (2023) is its fine-grained categorisation of both base CRMs and selected intermediate products derived from them into four distinct supply chain stages: Extraction and mining, processing and refining, fabrication, and recycling. This granularity enables a more nuanced policy analysis, particularly since supply bottlenecks are often concentrated in processing and refining (Le Mouel & Poitiers, 2023). Moreover, unlike broader classifications that include materials like wood, the Georgitzikis (2023) list focusses on CRMs central to high-tech industries and the green energy transition.

PTA (content) data come from the World Bank's Deep Trade Agreements database 2.0 (Mattoo et al., 2020). BIT data are from the Electronic Database of Investment Treaties (EDIT) by Alschner et al. (2021). We consider the entry-into-force dates for both PTAs and BITs. AfT data, expressed in constant million USD, are from the OECD Creditor Reporting System (2025). We use disbursements rather than commitments to capture the effects of actual financial flows.

Summary statistics are provided in Appendix Table A4.

2 We include all OECD Development Assistance Committee (DAC) donors that reported AfT commitments at the start of our sample period, with all current EU member states included given their joint trade policy.

3 Results

Table 1 presents baseline results for aggregated CRM trade. Columns (1)-(2) show PPML estimates including zero-trade flows (*overall* trade); columns (3)-(4) restrict the sample to positive trade flows (intensive margin); and columns (5)-(6) use a LPM to assess the extensive margin.

Table 1: Baseline results

	Overall		Intensive margin		Extensive margin	
Dep. variable	M_{ijt}		$M_{ijt} > 0$		$P(M_{ijt} > 0)$	
	(1)	(2)	(3)	(4)	(5)	(6)
$asinh(AfT)$	-0.005	-0.005	-0.006	-0.006	**0.001****	**0.001****
	(-0.97)	(-0.94)	(-1.16)	(-1.13)	**(2.02)**	**(2.03)**
BIT	0.105	0.127	**0.109***	**0.133***	0.013	0.010
	(1.58)	(1.59)	**(1.66)**	**(1.70)**	(1.62)	(1.08)
PTA	**0.204***	**0.186***	**0.202***	**0.177***	**0.029***	**0.049***
	(2.92)	**(1.73)**	**(2.92)**	**(1.66)**	**(3.30)**	**(3.64)**
$BIT\ complexity$		-0.090		-0.101		0.011
		(-0.46)		(-0.51)		(0.54)
$PTA\ depth$		0.073		0.106		**-0.115****
		(0.20)		(0.29)		**(-2.30)**
Observations	118,454	118,454	61,562	61,562	157,696	157,696
Country pairs	4,380	4,380	3,810	3,810	5,632	5,632
Estimator	PPML	PPML	PPML	PPML	FE OLS	FE OLS

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Constant, country-pair and country-year fixed effects always included but not reported.

Each model examines the effects of (i) the presence of PTAs and BITs (columns (1), (3), and (5)) and (ii) their depth and complexity, respectively (columns (2), (4), and (6)). $PTA\ depth$ is measured by the number of specific provisions included across 18 policy areas, with higher scores indicating deeper agreements. $BIT\ complexity$ reflects the breadth and scope of treatment provisions across nine key categories, notably including dispute resolution and inter-state cooperation. Both indices are normalised between 0 and 1 for comparability.

Across all models, PTAs consistently show a positive and statistically significant effect on CRM trade, both by increasing trade values and by facilitating entry into (new) supplier markets.[3] While our estimated PTA effect aligns with findings for total trade (see Larch & Yotov, 2024), it likely reflects more than tariff liberalisation, since Most Favoured Nation (MFN) tariffs on CRMs are already near zero in most major economies (own calculation based on data from World

3 Note that coefficient interpretation varies by model. For instance, in the case of the PTA variable, columns (1) to (4) show the percentage change in the dependent variable for country pairs participating in a common PTA, while estimates related to the extensive margin in columns (5) to (6) reflect changes in the probability of positive CRM trade.

Bank, 2025). Instead, PTAs may promote trade by locking in these low tariffs, enhancing transparency, and reducing policy uncertainty – factors that strengthen trust and supply stability. Many recent PTAs also contain clauses that limit or ban export restrictions (see Korinek & Bartos, 2012), further supporting trade growth, especially along the extensive margin.[4]

By contrast, the effects of BITs and AfT are less clear-cut. BITs may help to secure existing trade links by protecting investment, but they show no significant effect on the creation of new ones. This could be because private investors tend to be risk-averse and favour familiar relationships. Similarly, while AfT can support the emergence of new trade by improving infrastructure and capacity in developing countries, it does not have a clear impact on scaling up existing flows. One explanation could be that substantial AfT in earlier periods may have unlocked the extensive margin of trade, and additional AfT offers only diminishing marginal returns at the intensive margin.

These patterns hold even when accounting for PTA depth and BIT complexity. Notably, BIT complexity has no discernible effect on CRM trade, consistent with previous research showing limited impact on FDI (Berger et al., 2011).

Interestingly, deeper PTAs may sometimes hinder trade expansion, as shown in column (6). This could reflect the impact of stringent environmental provisions on raw material exports – aligning with Brandi et al. (2020), who find that such clauses can reduce exports of pollution-intensive goods.

Leading economies increasingly combine trade diplomacy, investment policies, and financial and technical support measures – often as part of broader trade and development strategies, whether coherently structured or not. Table 2 therefore examines the interaction effects between AfT, BITs and PTAs. A key finding is the consistently negative interaction between AfT and PTAs, suggesting that the positive effects of PTAs diminish when paired with AfT. This may reflect overlapping objectives – such as streamlining export procedures – resulting in redundancy and diminishing returns when both tools are scaled simultaneously.

By contrast, AfT and BITs appear complementary, possibly because AfT enhances infrastructure and capacity on the supply side, while BITs boost investor confidence and attract private investment to capitalise on these improvements.

The interaction between BITs and PTAs shows no significant effect, consistent with Heid and Vozzo (2020) for overall trade.

4 Our main findings are robust to various robustness checks. These include reallocating EU institutional aid to member states based on their national contributions to the EU budget; treating the EU as a single donor by aggregating EU institutional and member state AfT; using longer AfT lags; excluding OECD countries with notable CRM exports; limiting the exporter sample to major CRM exporters; excluding China entirely due to its role as a global CRM hub; varying the sample period (for example, starting in 2002 or ending in 2019); and disaggregating AfT by type.

Table 2: Policy interaction results

	Overall	Intensive	Extensive
Dep. variable	M_{ijt}	$M_{ijt} > 0$	$P(M_{ijt} > 0)$
	(1)	(2)	(3)
$asinh(AfT)$	-0.0017 (-0.22)	-0.0039 (-0.52)	**0.0024*** **(2.80)**
BIT	0.0363 (0.43)	0.0345 (0.42)	**0.0198**** **(2.27)**
PTA	**0.4201*** **(4.51)**	**0.3951*** **(4.25)**	**0.0403*** **(4.32)**
$asinh(AfT) * BIT$	**0.0165*** **(1.80)**	**0.0167*** **(1.82)**	-0.0008 (-0.73)
$asinh(AfT) * PTA$	**-0.0327*** **(-4.10)**	**-0.0298*** **(-3.79)**	**-0.0036*** **(-2.96)**
$BIT * PTA$	-0.0337 (-0.37)	-0.0220 (-0.24)	-0.0179 (-1.64)
Observations	118,454	61,562	157,696
Country pairs	4,380	3,810	5,632
Estimator	PPML	PPML	FE OLS

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Constant, country-pair and country-year fixed effects always included but not reported.

Lastly, Table 3 explores how our baseline effects vary across different stages of the CRM value chain, spanning from raw material extraction to higher value-added segments of processing and fabrication. While the regressions offer a fragmented picture, a notable pattern is that PTAs are more strongly associated with trade in downstream fabrication, whereas BITs are linked to upstream sectors such as mining but also circular economy activities like recycling.

This distinction carries important implications: PTAs appear to have limited influence on trade in raw, unprocessed CRMs directly after extraction. However, they may foster value addition within developing countries by encouraging domestic fabrication before export – be this due to gaps in OECD manufacturing capacities, or deliberate efforts to promote deeper supply chain integration. In either way, PTAs may contribute to local content generation and industrial development.

By contrast, BITs seem more effective in facilitating investment in capital-intensive sectors, particularly where high upfront costs and longer return horizons are offset by strategic value – whether in early-stage extraction or in technology-driven lifecycle processes. These findings underscore the complementary roles of PTAs and BITs in shaping different parts of the CRM value chain.

Table 3: Results by supply chain stage

	Extraction and mining			Processing and refining		
	Overall	Intensive	Extensive	Overall	Intensive	Extensive
	(1)	(2)	(3)	(4)	(5)	(6)
$asinh(AfT)$	0.014	0.013	**0.002****	**-0.016****	**-0.017****	0.001
	(1.44)	(1.28)	**(2.53)**	**(-2.24)**	**(-2.43)**	(1.56)
BIT	**0.211***	**0.224****	**0.029***	-0.137	**-0.138***	**0.018****
	(1.87)	**(2.07)**	**(3.60)**	(-1.64)	**(-1.66)**	**(2.26)**
PTA	0.043	0.037	0.014	0.000	-0.001	0.014
	(0.38)	(0.32)	(1.50)	(0.00)	(-0.01)	(1.60)
Observations	93,367	58,535	157,696	92,824	58,643	157,696
Country pairs	3,578	3,350	5,632	3,595	3,338	5,632
Estimator	PPML	PPML	FE OLS	PPML	PPML	FE OLS
	Fabrication			Recycling		
	Overall	Intensive	Extensive	Overall	Intensive	Extensive
	(7)	(8)	(9)	(10)	(11)	(12)
$asinh(AfT)$	-0.012	-0.012	**0.001***	0.010	0.010	0.000
	(-1.28)	(-1.27)	**(1.92)**	(0.96)	(0.94)	(0.46)
BIT	0.026	0.025	0.028*	**0.236****	**0.235****	**0.034***
	(0.29)	(0.28)	(3.71)	**(2.50)**	**(2.49)**	**(4.23)**
PTA	**0.186***	**0.186***	0.002	-0.119	-0.120	0.004
	(1.75)	**(1.75)**	(0.31)	(-0.92)	(-0.92)	(0.48)
Observations	93,130	57,682	157,696	88,739	57,372	157,696
Country pairs	3,655	3,334	5,632	3,385	3,179	5,632
Estimator	PPML	PPML	FE OLS	PPML	PPML	FE OLS

Notes: Robust, clustered (at the country-pair level) standard errors in parentheses. Asterisks denote the level of statistical significance with *** p<0.01, ** p<0.05, * p<0.1. Constant, country-pair and country-year fixed effects always included but not reported.

4 Conclusions

Understanding the impact of foreign policy tools on CRM trade is vital for policymakers in both high-income and developing countries. For advanced economies, stable and sustainable access to CRMs is crucial for economic security and industrial competitiveness. For developing countries, trade-related policies offer pathways to integrate into global value chains and attract investment in CRM extraction and processing.

Our empirical analysis reveals that PTAs significantly enhance the CRM imports of OECD countries from developing countries, affecting both the intensive and extensive margins of trade. In contrast, BITs primarily influence the intensive margin, while AfT supports the extensive margin.

These findings suggest that advanced economies should not focus solely on financial assistance and investment to secure CRM access but should also keep PTAs firmly in focus. A well-calibrated policy mix – combining trade diplomacy, investment, and targeted aid – is likely essential for resilient and diversified CRM supplies.

Interestingly, neither the depth of PTAs nor the complexity of BITs appears to be decisive. In some cases, the provisions contained in PTAs may even hinder the development of new supplier relationships. Sectoral regressions further indicate that PTAs are linked to trade in downstream CRM processing. This suggests that PTAs may promote local value addition by encouraging CRM refinement within developing countries before export, generating local content, and supporting pro-development outcomes.

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Appendix

Table A1: Exporting countries in the sample

Afghanistan	Ghana	Palau
Albania	Grenada	Palestine
Algeria	Guatemala	Panama
Angola	Guinea	Papua New Guinea
Anguilla	Guinea-Bissau	Paraguay
Antigua and Barbuda	Guyana	Peru
Argentina	Haiti	Philippines
Armenia	Honduras	Rwanda
Aruba	Hong Kong	Saint Helena, Asc. and Tr. da C.
Azerbaijan	India	Saint Kitts and Nevis
Bahamas	Indonesia	Saint Lucia
Bahrain	Iran	Saint Vincent and the Grenadines
Bangladesh	Iraq	Samoa
Barbados	Israel	Sao Tome and Principe
Belarus	Jamaica	Saudi Arabia
Belize	Jordan	Senegal
Benin	Kazakhstan	Serbia
Bermuda	Kenya	Seychelles
Bhutan	Kiribati	Sierra Leone
Bolivia	Korea, Democratic People's Republic of	Singapore
Bosnia and Herzegovina	Korea, Republic of	Sint Maarten
Botswana	Kyrgyzstan	Slovenia
Brazil	Lao People's Democratic Republic	Solomon Islands
Burkina Faso	Lebanon	Somalia
Burundi	Lesotho	South Africa
Cabo Verde	Liberia	South Sudan
Cambodia	Libya	Sri Lanka
Cameroon	Macao	Sudan
Cayman Islands	Madagascar	Suriname
Central African Republic	Malawi	Syrian Arab Republic
Chad	Malaysia	Tajikistan
Chile	Maldives	Tanzania
China	Mali	Thailand
Colombia	Malta	Timor-Leste
Comoros	Marshall Islands	Togo
Congo	Mauritania	Tokelau
Cook Islands	Mauritius	Tonga
Costa Rica	Mayotte	Trinidad and Tobago
Côte d'Ivoire	Mexico	Tunisia
Croatia	Micronesia	Turkey
Cuba	Moldova	Turkmenistan

Cyprus	Mongolia	Turks and Caicos Islands
Democratic Republic of Congo	Montenegro	Tuvalu
Djibouti	Montserrat	Uganda
Dominica	Morocco	Ukraine
Dominican Republic	Mozambique	United Arab Emirates
Ecuador	Myanmar	Uruguay
Egypt	Namibia	Uzbekistan
El Salvador	Nauru	Vanuatu
Equatorial Guinea	Nepal	Venezuela
Eritrea	New Caledonia	Viet Nam
Eswatini	Nicaragua	Virgin Islands
Ethiopia	Niger	Wallis and Futuna
Fiji	Nigeria	Yemen
French Polynesia	Niue	Zambia
Gabon	North Macedonia	Zimbabwe
Gambia	Oman	
Georgia	Pakistan	

Table A2: Importing countries in the sample

Australia	Denmark	Ireland	Netherlands	Spain
Austria	Estonia	Italy	Norway	Sweden
Belgium	Finland	Japan	Poland	Switzerland
Bulgaria	France	Latvia	Portugal	United Kingdom
Canada	Germany	Lithuania	Romania	United States
Croatia	Greece	Luxembourg	Slovakia	
Czech Republic	Hungary	Malta	Slovenia	

Table A3: List of base critical raw materials used for computation of dependent variable

Aluminium	Dysprosium	Iridium	Phosphate rock	Tantalum
Antimony	Erbium	Lanthanum	Phosphorus	Tellurium
Arsenic	Europium	Lithium	Platinum	Terbium
Baryte	Feldspar	Lutetium	Praseodymium	Thulium
Beryllium	Fluorspar	Magnesium	Rare earth elements	Titanium metal
Bismuth	Gadolinium	Manganese	Rhodium	Tungsten
Boron	Gallium	Natural graphite	Ruthenium	Vanadium
Cerium	Germanium	Neodymium	Samarium	Ytterbium
Cobalt	Hafnium	Nickel	Scandium	Yttrium
Coking coal	Helium	Niobium	Silicon metal	
Copper	Holmium	Palladium	Strontium	

Table A4: Summary statistics

	Obs.	Mean	Standard Deviation	Min.	Max.
M (imports [intensive margin])	157,696	25,166	264,363	0	16,344,856
M (import dummy [extensive margin]))	157,696	0.40	0.49	0	1
M (mining imports)	157,696	12,856	207,015	0	16,331,429
M (processed imports)	157,696	9,801	115,368	0	7,861,460
M (fabricated imports)	157,696	3,476	48,605	0	4,390,963
M (recycled imports)	157,696	2,089	30,215	0	3,318,267
AfT	157,696	1,985	25,582	-18,309	3,395,840
PTA	157,696	0.22	0.41	0	1
$PTA\ depth$ (non-normalised)	157,696	221.41	538.14	0	3,466
$PTA\ depth$	157,696	0.04	0.10	0	0.67
BIT	157,696	0.20	0.40	0	1
$BIT\ complexity$ (non-normalised)	157,696	12.66	24.37	0	150
$BIT\ complexity$	157,696	0.08	0.16	0	1

Notes: CRM trade is measured in current million USD, except for the extensive margin; AfT data are in constant million USD.