Impact of Environmental Regulation on Cross-Border M&A in high and low pollutant sectors

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WORK IN PROGRESS

Abstract

We test the influence of environmental regulation (ER) on the location's decision of cross-border Mergers and Acquisitions (M&As) for a large sample of countries, sectors and years using a structural gravity approach that accounts for omitted bias, border effects and simultaneity bias. Our results confirm the pollution haven's hypothesis according to which more stringent ER make countries less attractive to foreign investors planning to invest through M&As compared with domestic ones. Policies that put quantitative limits to emissions discourage especially investments in dirty sectors while taxes on emissions have a more obvious negative impact in clean sectors. The impact of ER differs depending on the type of investors and investees echoing the fact that investments realised in developed countries and in BRICS respond to different motivations. In emergent countries, lax ER could attract significantly more inward M&AS. In developed countries, ER has less discouraging effect. Quantitative limits on greenhouse emissions could discourage M&As in dirty sectors from other developed countries and technological support could attract larger investments from BRICS.

Keywords: Environmental stringency, pollution havens, M&As, structural gravity, pollutant sectors.

1. Introduction

One of the most challenging Sustainable Development Goals adopted by all UN Member States in 2015 is to achieve greenhouse gas emissions by 2030. To encourage these changes, a more stringent regulation appears indispensable (but not sufficient). In this regard, one heavily debated issue concerns whether this shift toward "green" policies would provoke a relocation of activity in countries with laxer regulation of the most polluting firms, a phenomenon known among academics as the pollution haven hypothesis (PHH).

Many researchers have intended to check if such fear was supported by evidence. Results are far from unanimous, but tend to conclude that environmental measures usually do not increase sufficiently the production costs to provoke *per se* massive relocations. The motivations of Multinationals (MNEs) to invest abroad can vary among sectors, countries and obviously on firms. While MNEs from developed countries usually seek to lower their cost of production when investing in emergent countries, they may invest in other developed countries to access larger market or maintain their firm specific advantage. In the same line, MNEs from emergent countries may invest in other developing countries to lower their costs but their motivations to invest in developed countries are completely different. Then ER may bring additional costs or even limit the production in the more pollutant sector but these inconvenient may be compensated by other advantages provided by the location. Stringent ER may also induce technological changes, management practises and consumer's behaviour that could offset the direct costs of ER. The net effect of ER on location's decision of MNEs remain an empirical question.

The present article contributes to the literature on the PHH by considering the case of cross-border M&As which represent 70% of total inward and outward FDI capital flows in developed countries (Carril-Caccia and Pavlova, 2018) but has been overlooked in the FDI-Environment literature. The exceptions are the studies of Leon-Gonzalez and Tole (2015) on M&A in the mining industry and Bialek and Weichenrieder (2015) on German M&A and greenfield investments but they do not account for multiple home and host and hence, reduce the possibility to explore the variations of regulations among countries. Carril-Caccia and Milgram (2020) overcome these limitations by relying on a bilateral dataset for M&As with a wide sample of countries but do not consider heterogeneity among industries.

This study examines if M&A across nations are influenced by environmental stringency. To this end, we estimate a structural gravity model using an original bilateral database for M&As between 40 countries, during the period 1995-2019 originating from all sectors and flying to 24 manufacturing sectors. We test whether countries with laxer environmental regulation attract more cross-border M&As and larger amounts of investments. We additionally test if the effects differ among sectors depending on their pollution level and the type of countries (developed versus emergent countries). Finally, we deep in the discussion by studying the impact of different types of ER: non- market based instruments (NMBI), market based instruments (MBI) and technological support (TS).

We tend to confirm the PHH: adopting "green" policies could be less attractive in the eye of potential foreign acquirers of local firms. In other words, laxer environmental regulations attract more cross-border M&As. This is especially the case, as expected, in the most pollutant sectors

of destination. Finally, the effect of more stringent environmental policy does not significantly affect the amount invested (intensive margin). However, ER had different impacts depending on the type of measures and of the development levels of investors and investees. When developed countries invest in other developed countries, non-market based instruments (MBI) reduce the likelihood to invest in dirty sectors and the amounts invested; in contrast, MBI and technological support have no obvious effect. When developed countries invest in BRICS, Non-MBI have a negative effect both in clean and dirty sectors. In general, the decision of BRICS+ to invest in developed countries is not influenced by ER.

The following section provides a brief literature review on the FDI-environment relationship. Section 3 explains the empirical strategy and section 4 discusses the results. Finally, the article ends with some concluding remarks.

2. Influence of ER on location's choice of foreign investors

The choice of locations would imply a trade-off between the advantages and disadvantages displayed by the distinct locations compared with the firm's home country, and ER is only one of the elements. In their location's choice, investors would take into consideration a wide range of factors such as the quality of institutions, market access, availability of capital and skilled labour, infrastructure and regulations, including environmental measures. MNE's motivations to invest abroad are usually classified in market, efficiency, resource and strategic asset seeking (Dunning, 1993). While market access and strategic asset seeking fit better with the strategies of MNEs from developed countries investing in other developed countries, efficiency seeking explain better their investments in developing or emergent countries while resource seeking is linked to the abundance in natural resources of the host. In developed countries especially, the environmental costs could be more than offset by skilled-labor, availability of capital and infrastructure, access to market. In last decades the surge of FDI from emerging countries (in particular from China) led researchers to the conclusion that MNEs from emergent countries may also seek market access and efficiency when investing in other developing countries. In contrast, their motivations to invest increasingly in developed countries could be to overcome disadvantages related with products quality, technology, high-qualified skills, recognized brands, management and tacit knowledge (Amal et al., 2013; Buckley et al., 2012; Brienen et al., 2013; Child and Rodrigues, 2005).

According to the PHH, in response to a shift toward more stringent environmental policy and, in order to maximise profits, firms would be pulled to relocate in countries with looser environmental regulation. Hence, countries with lax environmental regulations would acquire comparative advantage, in particular in polluting industries (Pearson, 1987; Baumol and Oates, 1988). Accordingly, weak environmental regulations could enhance incoming FDI. Using different settings, Tang (2015) predict that export-orientated FDI is more sensitive to stricter environmental regulations than local-market orientated FDI.

The first generation of studies that intended to test the PHH, failed to find conclusive results (see Cole et al 2017) due to several limitations. Indeed, most of these studies were conducted on country or industry basis with aggregated FDI. Focusing on a specific host country obviates the alternative locations, while separating industries according to their pollution intensity can lead to biased results due to other industry specific trends.

This lack of robust evidence gave rise to a new generation of empirical models intending to overpass the methodological challenges that make difficult to capture the effect of environmental measures on FDI, while other authors have drawn the attention to other mechanisms that could counteract the rationale underlying the PHH. In particular, some authors have challenged the idea that investors would consider stringent environmental regulation as harmful. In contrast, they argue that some MNEs may consider environmental strictness as beneficial. Tougher policies regarding environment may induce several greening transfers both of environment-friendly technology (Gallagher and Zarsky, 2007) and management practices (Poelhekke and van der Ploeg, 2015; Jin et al., 2019). Hence, MNE could upgrade local environmental standards contributing to a positive "pollution halo" effect[1]. Zugravu-Soilita (2017) advocates that the overall result may depend on the capital or skilled level abundance of countries along with the stringency of the environmental policy. Given the growing demand for environmentally friendly products and services, firms may also be interested in being the first in accessing environmentally sensitive consumers, located in markets with stricter environmental regulations in order to obtain price premiums, hence leading to a "win-win" situation (Rivera and Oh, 2013). Moreover, several theoretical models have considered an endogenous market structure where foreign firms benefit from a better technology than domestic firms (Dijkstra et al., 2011) or from a first-mover advantage (Elliott and Zhou, 2013) leading to a situation in which a more stringent policy confers advantage to foreign firms. All in all, whether the pollution haven effect or the pollution halo effect dominates remains an empirical question with discrepant answers.

Another important flaw of the PHH is the one related with other important determinants of FDI that, if omitted could lead to a spurious relationship between FDI and environmental stringency. One noticeable determinant of FDI highlighted by economic geographic model is market size for horizontal FDI and transport costs for re-exporting FDI. In this line, Sanna-Randaccio and Sestini (2012) extend Markusen et al. (1993)'s model to take into account changes in environmental policy. The authors conclude that firms would relocate only if the regulation's gap is large enough to offset re-exporting costs to the market of origin. Tang (2015) predicts that export-orientated FDI is more sensitive to stricter environmental regulations than local-market orientated FDI. For the case of European firms, Candau and Dienesch (2017) show that a better access to a large market of origin from the host country may outset the cost of tougher environmental regulation for export platform FDI.

Another concern in order to accurately assess the impact of environmental regulations on FDI is the possibility of a reverse causality that might arise if governments relax the stringency in order to attract pollutant firms, or if the increase in FDI gives foreign investors sufficient power to negotiate pollution levies with local authorities. Instead, some authors found contrary evidence. Cheng et al. (2018) emphasise that FDI inflows have increased both the number and severity of local environmental regulations. Brucal et al. (2019) conclude that FDI increases the overall energy usage due to expansion of output while it decreases the plant's energy intensity. All in all, such effects (pressures to lessen the measures or increase stringency in response to growing FDI) are exerted once the MNE is operating in the country, what would reduce the case for a two-way causality in location's choice models.

Almost all the previously mentioned studies focus on FDI, regardless the entry mode. To the best of the authors' knowledge, there are only few exceptions. Leon-Gonzalez and Tole (2015) that

[1] Cheng et al. (2018) cite several works that confirm that management and innovation compensation effects could offset compliance costs.

study M&As in the mining industry, at the world level between 1994 and 2006 and find no evidence of pollution havens in this industry. If anything, buyers from countries with high levels of environmental stringency are more likely to invest and make larger investments in countries with similar requirements' level. Bialek and Weichenrieder (2015) gain robust support for PHH for greenfields invetsments from Germany in polluting industries. In turn, M&A investments in low polluting industries seem to be attracted by stricter environmental regulation, this could be explained by competitiveness effects associated with grandfathering[2] as well as the "green image" that German firms are trying to keep. Even if the specific contexts of their analysis do not allow to generalise their results, these two studies tend to refute the PHH hypothesis for M&As. Carril-Caccia and Milgram (2020) overcome certain limitations of previous studies by relying on a bilateral dataset for M&As with a wide sample of countries but do not consider heterogeneity among industries, neither domestic M&As.

3. Empirical strategy

3.1. Empirical model

The present work relies on the structural gravity model to address the PHH for the case of cross-border M&As. Head and Ries (2008) have provided a theoretical background for using the gravity equation for analysing the drivers of M&As, and this empirical strategy has been widely followed by the previous literature (e.g. di Giovanni, 2005; Garrett, 2016; Hyun and Kim, 2010).

The basic intuition of the gravity model is that M&As are positively moderated by countries economic mass, and negatively by their bilateral costs (e.g. transport or language differences). In addition, outward M&As depend on firms (and countries) relative capacity of investing abroad, and inward M&As depend on firms (or countries) relative capacity of attracting them. If the PHH holds, stricter environmental regulation should limit countries relative capacity of attracting cross-border M&As. In other words, a country's firms should become less prone to be target of a foreign M&As. To model this, using a Poisson Pseudo-Maximum Likelihood estimator[3], we estimate the following equation with domestic investment:

$$MA_{iojdt} = \exp\left(\alpha X_{jt} x Int_{ij} + \beta X_{ijt} + \lambda_{iojd} + \lambda_{iot} + \lambda_{jdt} + Int_{ijt}\right) x\, \varepsilon_{iojdt} \quad (1)$$

where MA_{iojdt} is the number of M&As projects (or sum of values) from country i originating from sector *o* to country j in sector d in year t. The dependent variable includes both, domestic ($i = j$) and cross-border M&As ($i \neq j$).

Guided by the gravity model theory for M&As (Head and Ries, 2008) and specification recommendations (Yotov et al., 2016; Yotov, 2022), the model incorporates a wide range of fixed effects that control for different drivers of M&As. First, λ_{iojd} are fixed effects for any quadruple of country of origin, sector of origin, country of destination, sector of destination. These fixed

[2] They argue that greenfield projects usually need to obey all the latest environmental requirements whereas M&As involve local firms that usually, due to grandfathering policies, remain unaffected by the latest rules and need to adhere to the older regulations only. Moreover, in the case of an M&A project, the acquisition price may already be a function of the regulation faced by the company as the purchaser of the existing plant is only willing to pay the present discounted value of future profits.

[3] The Poisson Pseudo-Maximum Likelihood estimator overcomes the heteroskedasticity issues from OLS's estimates and include in the analysis the zeros usually present in bilateral FDI databases (Santos-Silva and Tenreyro, 2006).

effects account for the bilateral time-invariant determinants of FDI, such as geographic distance or common language that have been traditionally accounted for in the literature (e.g. di Giovanni, 2005; Head and Ries, 2008). Also, they control for the border effect (i.e. the extent to which domestic investment is larger than foreign one). Furthermore, the bilateral and sector perspective of these fixed effects control for the nature of the M&As transactions, that is to say, whether these investments are horizontal, vertical or conglomerate.[4]

Second, λ_{iot} (respectively λ_{jdt}) are fixed effects for any triple of country of origin, sector of origin and years (respectively for any triple of country of destination, sector of destination and years). They both control for the multilateral resistance term at the sectoral level, that is to say the relative capacity of investing abroad or the relative capacity of attracting M&As for firms from one sector and one country (Head and Ries, 2008). In addition, these fixed effects control for all country-sector time varying drivers of M&As, such as economic size or specific country and sector regulation.[5]

Third, Int_{ijt} is a set of indicators variables that turn one when investment are international ($i \neq j$) in a given year. The associated coefficients of these dummies quantify the change of the border effect during a given period relative to the base year (1995). Thus, this set of fixed effects control for the evolution of the border effect. Broadly speaking, these fixed effects control for the evolution of globalization (Bergstrand et al., 2015), the increasing or decreasing cost (or capacity) of investing abroad relative to investing domestically. Some works present evidence of a decreasing border effect on international trade (e.g. Anderson et al., 2018; Bergstrand et al., 2015). However, for the specific case of M&As, Carril-Caccia et al. (2022) find that border effect remains unchanged for a sample of 30 countries during the period 1995-2015.

A limitation of including country-sector-year fixed effects (λ_{iot}, λ_{jdt}) is that these fixed effects are colinear with country specific time-varying variables such as countries' environmental policy. To overcome this limitation, we interact country specific variables (X_{jt}) with a dummy (Int_{ij}) that takes one whenever the investment is international and zero if investment is domestic (i.e. when $i = j$). As demonstrated by Heid et al. (2021), this strategy enables to estimate the effect of country-specific variables, such as environmental policy, at the same time that we fully control for the multilateral resistance term[6].

This interaction also leads to interpret the estimated coefficients (α) as the effect that the X variable has on foreing M&As relative to domestic ones. A negative sign for α would support the PHH and would indicate that environmental regulation increases the border effect on M&As (Anderson et al., 2018). That is to say, that environmental regulation increases the likelihood for

[4] Correctly identifying the type of M&As is challenging in terms of data requirements. One would require more disaggregated sectoral data that the one available for the present analysis as well as data on firms' sales and purchases of goods and services (Ahn and Park, 2022). This is a potential source of omitted variable bias that we seek to minimize with fixed effects.

[5] Notice that these fixed effects control for a wide number of determinants of FDI that have been previously present in the literature (e.g. di Giovanni, 2005; Garrett, 2016; Hyun and Kim, 2010). For instance, GDP, institutional quality, taxes or exchange rate.

[6] Without this interaction the time-varying country-specific variables are collinear with the destination-sector-year fixed effects (λ_{jdt}).

an M&A to take place between firms from the same country than between firms from different countries.[7]

In addition, environmental regulation is less prone to be endogenous if we consider bilateral M&As instead of aggregate M&A. Indeed, it is little likely that M&As projects from a specific country-sector influence the environmental regulation of the host before investing[8]. Beverelli et al. (2018) points that this empirical strategy serves for limiting the potential endogeneity that might arise between M&As and countries' environmental policy. Assuming that domestic and foreign firms can influence environmental policy, interacting the potentially endogeneous variable by a strictly exogeneous variable (Int_{ij}), turns the new variable into a diff-in-diff that limits the potential endogeneity issue (Nizalova and Murtazashvili, 2016).

Besides countries' environmental policy stringency (EPS), X_{jt} is a vector that includes other destination country specific variables that are usually present for explaining cross-border M&As, namely: GDP per capita, unemployment rate, natural resources endowment, exchange rate, number of patents per million habitants and political stability.

X_{ijt} refers to different bilateral time-variant determinants of M&As. Bilateral investment treaties are expected to promote bilateral FDI between signing parties and to reduce expropriation risks (e.g. Bergstrand and Egger, 2013). Signing a bilateral trade agreement can incentivize vertical, export platform and export supporting FDI (e.g. Ekholm et al., 2007; Hanson et al., 2005; Krautheim, 2013). Nonetheless, in the context of horizontal FDI type, bilateral trade liberalization is expected to have a negative impact on FDI, since trade and FDI substitute each other as alternative strategies to serve a foreign market (e.g. Antras and Yeaple, 2014; Jang, 2011; Horstmann and Markusen, 1987). The λ_{iojd} fixed effects serve for overcoming the potential endogeneity issues present between our dependent variable and these X_{ijt} variables (Baier and Bergstrand, 2009; Bergstrand and Egger, 2013).

3.2. Data overview

M&As database

The M&As data are retrieved from Eikon Thomson Reuters. We exploit a database that covers domestic and international investments during the period 1995-2019 into the manufacturing sector. Due to data availability of the environmental regulation index, our analysis is limited to 40 countries. However, these 40 countries host 80% of cross-border M&As realised in the manufacturing sector worldwide. As reported in table 1, our sample includes both developed countries and emerging and developing countries (BRICS+).

[7] Based on the previous M&As literature, in the present work we assume that the border effect on M&As is positive. For instance, Carril-Caccia et al. (2022) show that within countries the number and value of M&As are five times larger than between countries.

[8] However, environmental policy is not fully exogeneous to FDI (e.g. Dam and Scholtens, 2008). Our empirical strategy partially address this issue and we tackle the potential endogeneity bias in the robustness analysis.

Table 1: Country sample

Developded countries			BRICS +
Australia	Greece	Norway	Brazil
Austria	Hungary	Poland	Chile
Belgium	Iceland	Portugal	China
Canada	Ireland	Slovak Republic	India
Czech Republic	Israel	Slovenia	Indonesia
Denmark	Italy	Spain	Korea, Rep.
Estonia	Japan	Sweden	Mexico
Finland	Luxembourg	Switzerland	Russian Federation
France	Netherlands	United Kingdom	South Africa
Germany	New Zealand	United States	Turkey

A positive feature of the database is that transactions are recorded at the firm level, reducing in this way the common bias in FDI statistics due to the use of tax haven countries by MNEs. In turn, a drawback of this disaggregation is the frequent missing values regarding the value of M&As (they nearly affect 60% of all transactions). Since these missing values correspond to small transactions that are not fully publicly disclosed, we assign them a small value of one million US dollars in order not to lose so much information. As in Carril-Caccia et al. (2022), we show that estimates related to the value of M&As are robust to this data imputation strategy.

Originally, Eikom Thomson Reuters provides its own sectoral classification (TRBC) that we aggregate into NACE rev. 2 classification at the two digits level in order to be able to be able to classify sectors in to dirty or clean[9]. The analysis considers M&As from 84 manufacturing and non-manufacturing sectors into 24 manufacturing activities. A list the manufacturing sectors included in the analysis together with some descriptive statistics are available in table 2.

The TRBC sector classification considers a significant level of granularity (841 economic activities). Despite this interesting feature, the inconvenient is that the TRBC classification has, to the best of our knowledge, no direct conversion to other standard sectoral classification (i.e. NACE rev. 2 or NAICS). To overcome this caveat, we construct an equivalence between the TRBC sector classification and NACE rev. 2. First, we rely on the equivalence tables constructed by the European Commission (Hoepner, 2020; Slevin et al., 2020). This allows us to link 195 TRBC sectors to the NACE classification. The remaining sectors are matched based on name similarity between the TRBC and the NACE classification. When names are not sufficiently informative, we look up for the firms involved in the M&As in ORBIS, and retrieve the sector classification from the latter source. Nevertheless, it was possible to match 97.7% of the TRBC economic activities to a NACE rev. 2 two digits classification.

We classify sectors into high and low polluting based on the average level of greenhouse emissions (GHG) per employee[10] (see table 2). Sectors with a level of pollution in the top 33%

[10] To this end, we combine the OECD's Air Emissions Accounts database and the Structural Analysis Database (STAN). We retrieve sectoral data on greenhouse gases emissions (GHG) in tonnes of C02-equivalent from the first, and the number of employees from the latter. For the year 2015 (year with

are the ones classified as highly pollutant. These sectors have also been considered as highly pollutant by previous works such as Bialek and Weichenrieder (2021) or Martinez-Zarzoso et al (2016).

Table 2 reports the ratio of cross-border M&As relative to domestic ones, and the share that BRICS+ countries represents as a source or destination of cross-border M&As into each sector. Overall, inward M&A represents 34.7% of domestic M&As in terms of number of projects. Even if cross borders M&As are less frequent than domestic ones, they represent 25% of total M&As project on average which is highly relevant. The volume of inward M&A represents 53.4 % of the volume of domestics M&AS. Then, cross-borders M&As involve, on average, larger amounts than domestic ones.

Table 2: Cross borders M&A in dirty and clean sectors, shares of region

	Nb of cross borders M&A, %			
	DEVDEV	DEVBRICS	BRICSBRICS	BRICSDEV
Total	81,4	12,6	0,9	5,1
High	76,9	16,7	1,3	5,1
Low	83,4	10,7	0,8	5,1
	Volume of cross borders M&A, %			
	DEVDEV	DEVBRICS	BRICSBRICS	BRICSDEV
Total	88,5	6,8	0,4	4,3
High	86,1	8,7	0,5	4,6
Low	90,9	4,8	0,3	3,9

Note: own's calculations based on Eikom Thomson Reuters.

Table 3: Cross borders M&A by origin and destination: shares of dirty and clean sectors

	Nb of cross borders M&A, % in total				
	DEVDEV	DEVBRICS	BRICSBRICS	BRICSDEV	All
High	29,1	26,4	23,1	18,7	28,2
Low	70,9	73,6	76,9	81,3	71,8
	Volume of cross borders M&A, %				
	DEVDEV	DEVBRICS	BRICSBRICS	BRICSDEV	All
High	24,1	16,6	24,2	16,3	23,2
Low	75,9	83,4	75,8	83,7	76,8

Note: own's calculations based on Eikom Thomson Reuters.

The relevance of cross-border M&As in domestic M&As displays a significant heterogeneity across sectors. The sectors that register higher number of cross borders M&As in comparison with domestic are two highly contaminating sectors: Chemicals and Tobacco. In Tobacco, cross borders M&As involve important amounts per project explaining why the volume of cross borders M&As represent 88.6% of domestic ones. This is also the case in the Manufacture of beverages where the volume of cross borders M&As represents 371% of domestic ones. In Tobacco and Beverages, M&As are mainly driven by investors from developed countries. Nonetheless, the representativeness of cross borders M&As is quite similar between high and

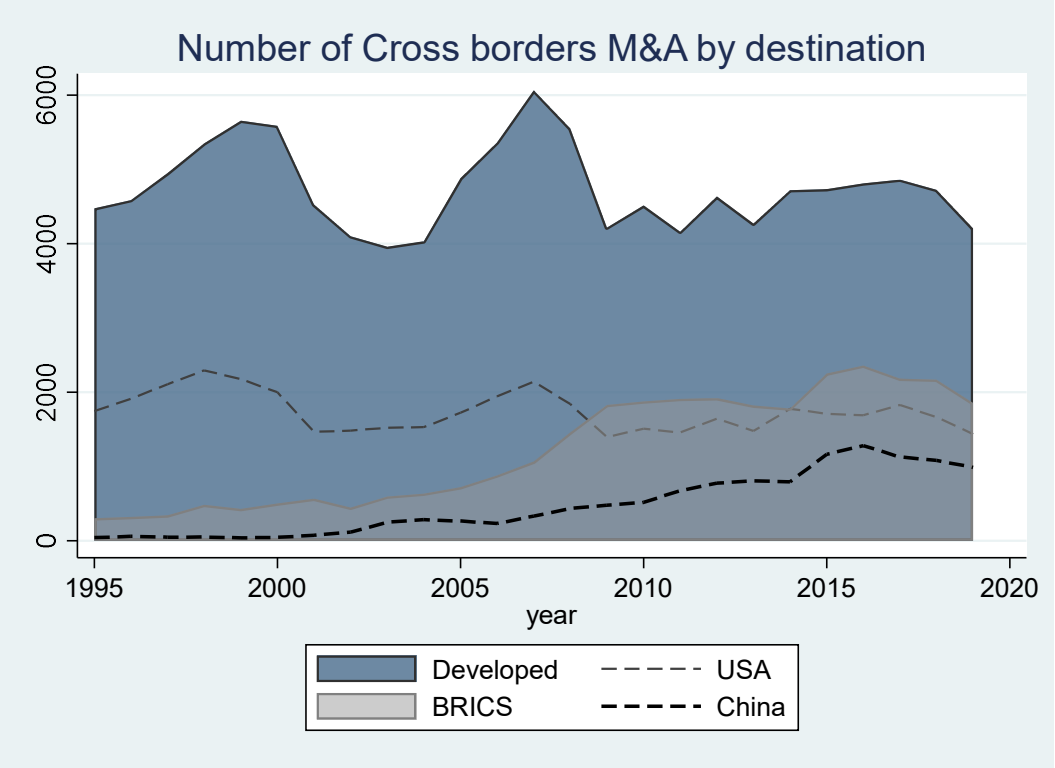
highest data availability), we calculate the GHG emissions per employee in each sector and country. This leaves us with a sample of 29 countries with information regarding GHG per employees at the sectoral level.

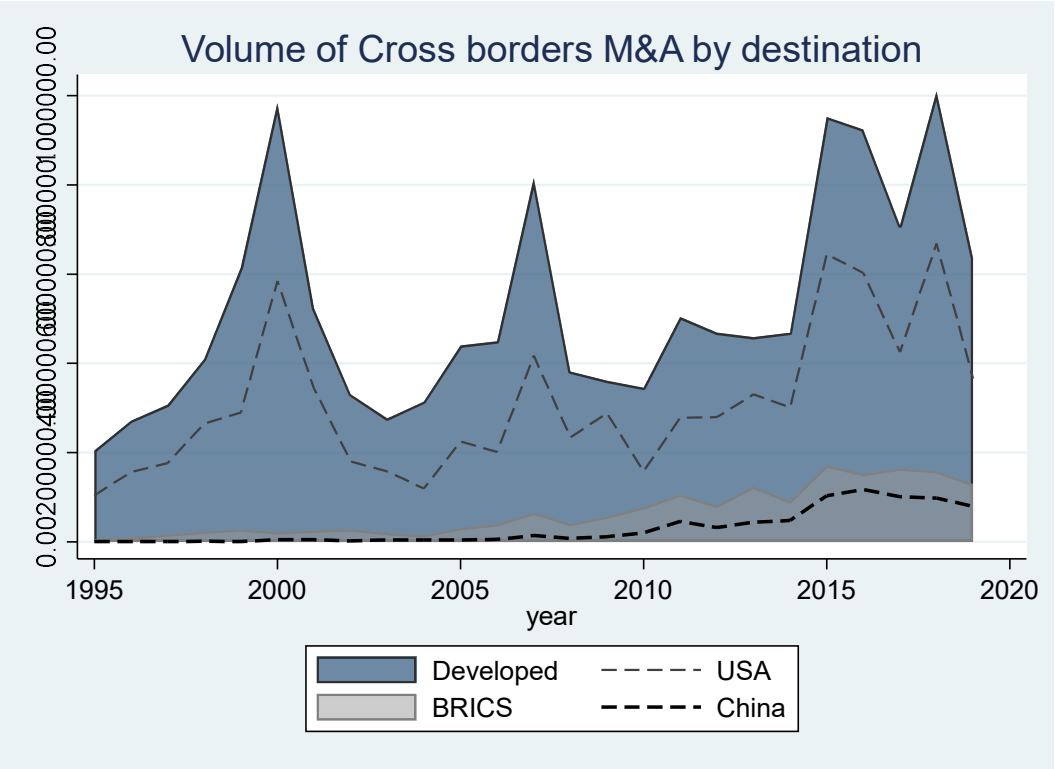
low polluting sectors in terms of number of projects (34.5% against 34.8%, on average). However, in terms of volume, cross borders M&As are larger in the high contaminating sectors than in the low contaminating sectors (76.6% against 41.2%, on average) which is mainly explained by the large amounts invested in Tobacco.

Overall, BRICS+ are the source of 6% and the destination of 13,5% of cross-border M&As in our sample (last rows of Table 2). Their relevance in both dimensions varies considerably across sectors. It is worth pointing that, BRICS+ countries attract a higher share of worldwide M&As in dirty sectors than in clean sectors, both in terms of number of projects (18% against 11,5%) and in terms of volume (9,3% against 5,2%). As shown in Table 2, M&As from developed countries and to developed countries represent the majority of M&As (81,4 in terms of number of projects and 88,5 in terms of volume) but these shares are lower in high contaminating sectors (76,9 and 86,1). As shown in Table 3, only 28% of cross borders M&A are realised in dirty sectors and this share is higher for M&As realised among developed countries.

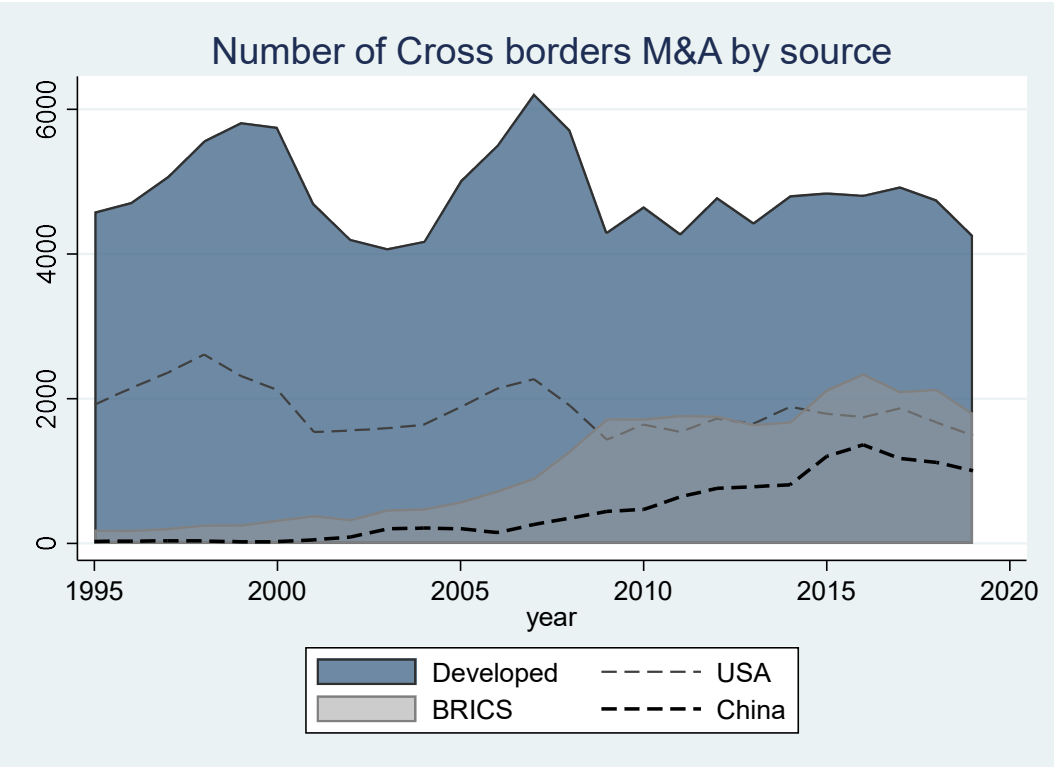
Graph 1 and Graph 2 show the evolution of M&As from 1995 to 2019. It points out the important surge in M&As originating from BRICS and flying to BRICS. At the same time, these graphs also show the importance of USA and China as a source and destination of cross borders M&AS.

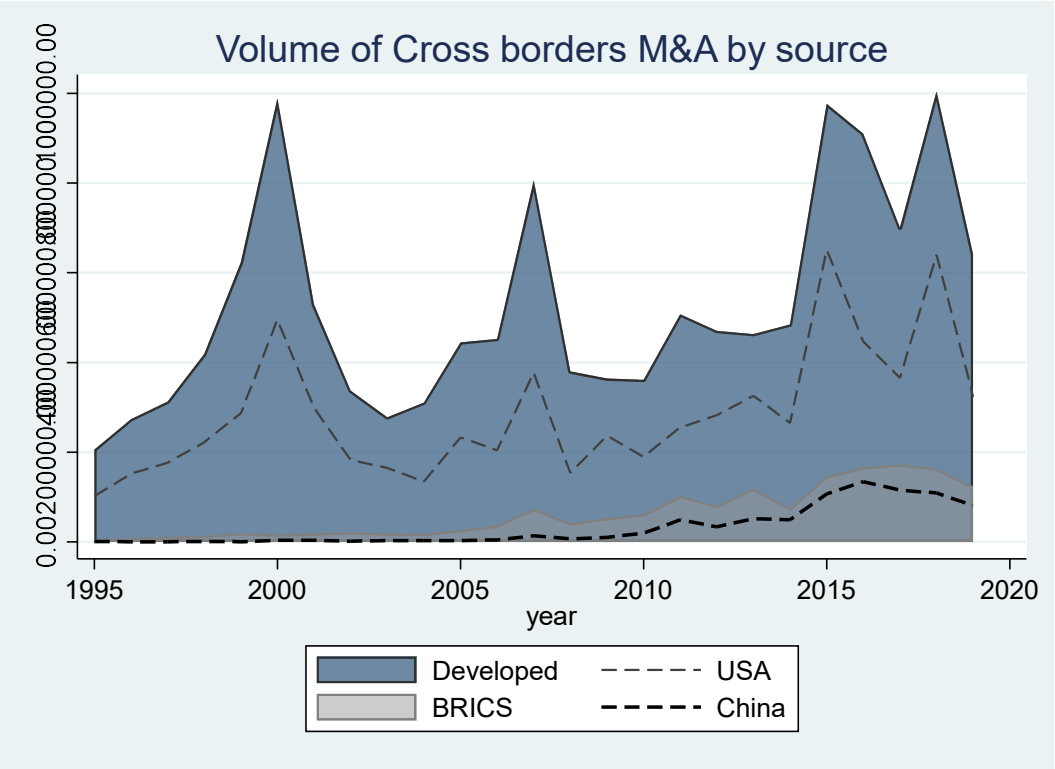
Graph 1: Cross borders M&A by destination, 1995-2019





Graph 2: Cross borders M&A by source, 1995-2019





Environmental regulation

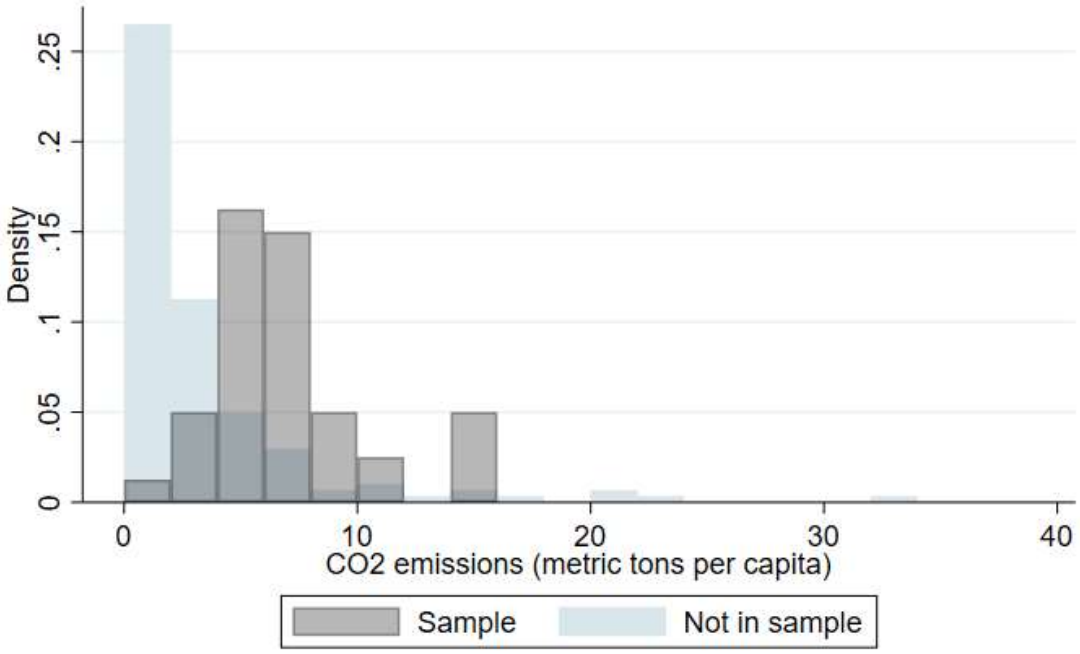
In order to measure countries' environmental policy stringency, we use the index proposed by Botta and Koźluk (2014)[11], updated by Krusse et al. (2022). This index has the advantage to be available since 1990 and until 2020, a period marked by substantial changes in governments' environmental policy. Furthermore, this index has been widely used by the previous literature that addresses the implications of environmental policy (e.g. Garsous and Kozluk, 2017; Martínez-Zarzoso and Oueslati, 2018; Mavisakalyan and Tarverdi, 2019; Wang et al., 2019). For our purpose (testing the PHH), EPS is considered as a more appropriate indicator than CO2 or SO2 emissions since the level of greenhouse gases emission is determined by economic activity, and could then be influenced by the level of FDI. In addition, if a positive relationship between FDI and countries' emissions were found, it wouldn't be clear whether this positive link is due to M&As being directed toward countries which have laxer environmental regulation, or if its driven by MNEs seeking to benefit from agglomeration economies (Wagner and Timmins, 2009). Alternatively, some studies use pollution abatement costs; this is a more precise measure but unfortunately with a limited country and period coverage (see Cole et al 2017). An even more precise measure consists in studying the impact of a specific change in environmental regulations (Hanna, 2010; Nuñez-Rocahs and Martínez-Zarzoso, 2019) but these natural experiments are scarce, and would considerably limit the group of countries and period subject of study.

Notwithstanding, EPS may not be accurate to assess environmental stringency in countries with a high share of agricultural production (Krusse et al. 2022 p10) since EPS does not include policies

[11] Stringency is defined as the degree to which environmental policies put an explicit or implicit price on polluting or environmentally harmful behaviour. The index ranges from 0 (not stringent) to 6 (highest degree of stringency). The index is based on the degree of stringency of 14 environmental policy instruments, primarily related to climate and air pollution.

that regulate emissions from agricultural production. Since we focus on M&As in manufacturing, we believe this is not a serious concern for our study. Likewise, the EPS index focuses on climate change and air pollution but does not take into account other important environmental domains such as water, biodiversity, or waste management (Krusse et al. 2022 p11). In comparison with other measures, another possible limitation of the EPS index proposed by Botta and Koźluk (2014) is that it only covers 40 countries[12]. Nevertheless, this is not a significant restriction for our analysis, since these 40 economies are the source and host of 90% of global cross-border M&As projects during the period 1995-2019. Moreover, as illustrated in Figure 1, our sample covers countries whose levels of pollution are relatively high in comparison with those which are not included in the analysis. Finally, this group of countries represents 81% of the global CO2 emissions[13].

Figure 1: Density of countries by level CO2 emissions metric tons per capita in 2019



Note: Authors' own elaboration. Data for 191 countries in the year 2019. Retrieved from World Bank's Development Indicators.

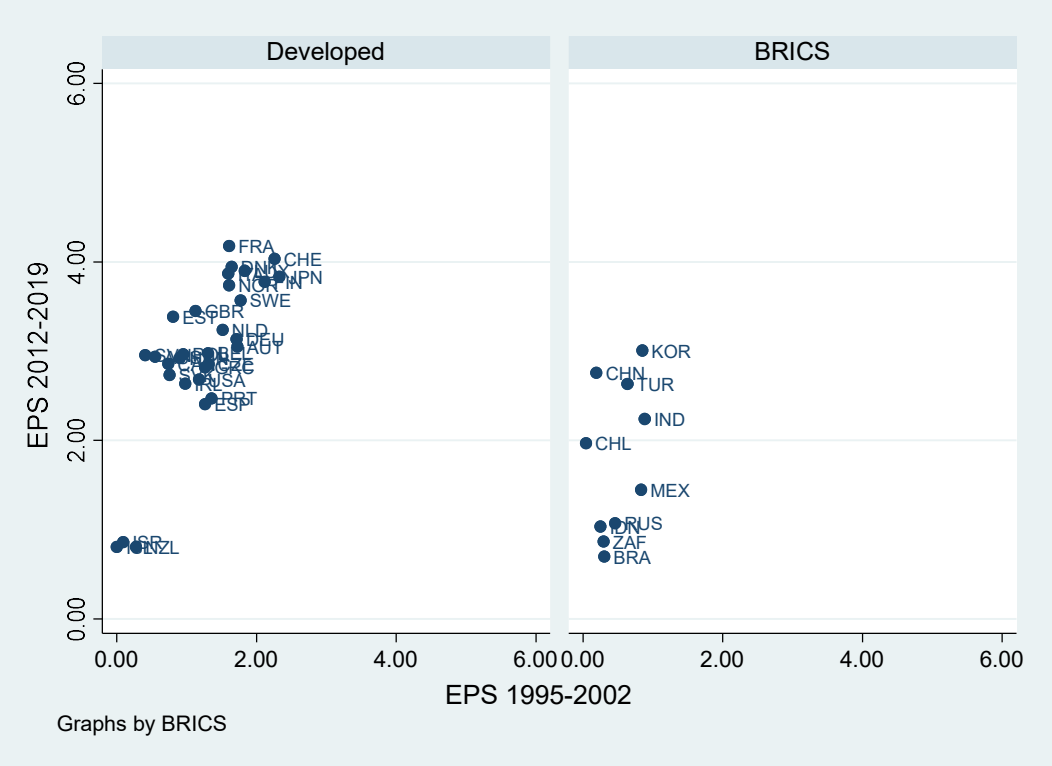
Even when considering countries with similar levels of development, the levels of strictness of environmental regulation differ widely among them. Figure 2 depicts the evolution of the Environmental Policy Stringency (EPS) for the countries of our sample distinguishing between BRICS+ and developed countries. On average, the policies have become tougher in all countries since 1995 even if the annual growth rate has decreased in last decade. However, the disparities remain high, echoing the fact that not all the countries jump to the green policies at the same rhythm. Additionally, the heterogeneity is high both among BRICS+ and developed countries even if, on average, the stringency of ER is higher among the latters. In 2019, the countries with

[12] For instance, the World Economic Forum survey on perceived environmental stringency by managers covers more than 140 countries, but it would limit our period of analysis to years 2008, 2009, 2011, 2013 and 2015.

[13] Calculations based on the CO2 emissions data from World Bank's Development indicator in year 2015 for 204 countries.

the most stringent environmental policies are France, Switzerland, Luxembourg and Norway and the laxer Brasil, Israel, South Africa and New Zealand.

Figure 2 EPS in BRICS and Developed countries



Source: OECD's EPS index (Kruse et al., 2022) Authors' own elaboration.

The EPS index can be decomposed in three sub-indexes which shed light on different aspects of ER. The dimensions considered are: Market based instruments (MBI) (e.g. taxes, permits and certificates), Non-Market Based instruments (NMBI) (e.g. performance standards) and Technology Support (TS) policies (R&D support, feed-in tariffs and auctions). MBI and NMBI are policies aiming at correcting negative externalities while TS intends to promote positive externalities arising from innovation in clean technologies. The increasing dispersion among countries in the overall EPS is driven by increasing dispersion in market-based and technology support policies (see below).

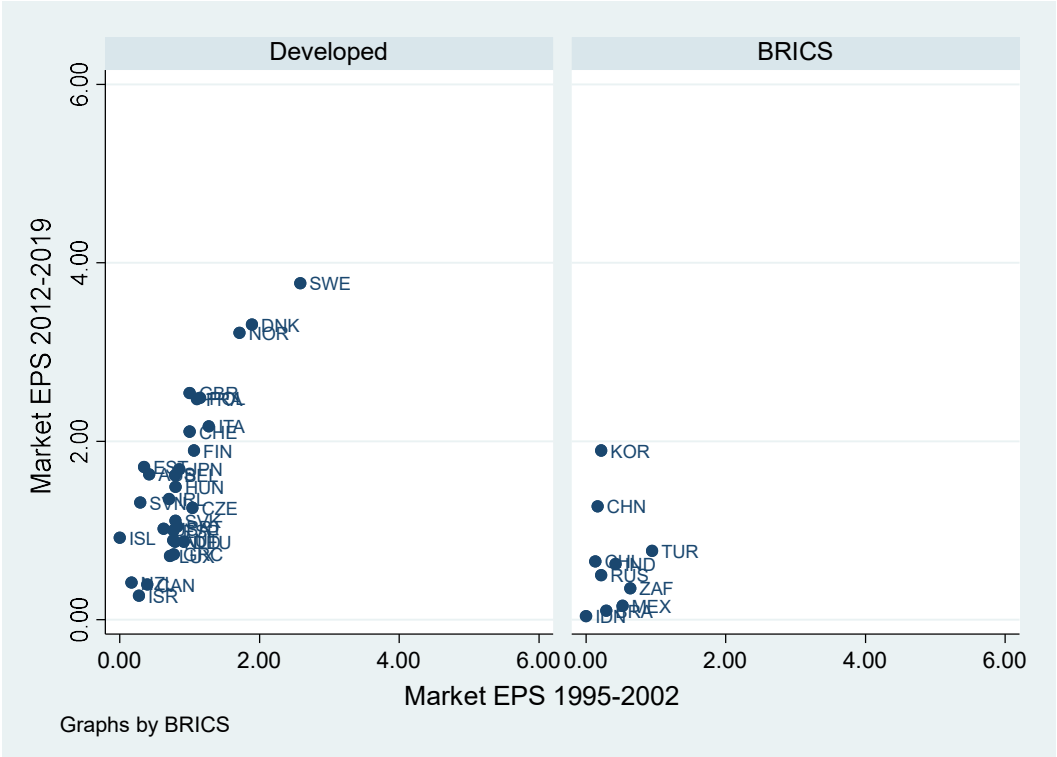
The stringency of NMBI has increased the most in absolute terms (Figure 4), followed by TS (Figure 5) and MBI (Figure 3). NMBI entails policies that fix Emission Limit Value for Nitrogen Oxides (NOx), Sulphur Oxides (SOx), Particulate Matter in the energy generation sector and Sulphur content limit for diesel. Comparing BRICS+ and developed countries, the difference in NMBI is salient. These instruments have been widely adopted worldwide with only 6 countries out of the 40 considered with indexes lower than 3: Indonesia and South Africa (2,25) and Brazil, Iceland, Israel and New Zealand (1,5). The pictures for NMBI and TS are completely different as the one observed for NMBI.

MBI include policies that put a price on pollution which includes CO2 Trading Schemes (average annual permit Price of allowances to emit CO2); Renewable Energy Trading Scheme (percentage

of electricity from green sources compulsory to obtain trade in renewable energy certificates[14]); Tax rate for CO2 emissions, Nitrogen Oxides (NOx), Sulphur Oxides (SOx), Fuel (Diesel). Considerable improvements have been made in this area both in developed and BRICS+ countries, on average. However, the average stringency is lower than for MBI and the dispersion among developed countries is wide. There are OECD countries with very lax ER while Denmark, France. Norway and Sweden stand at the front of developed countries regarding these measures.

TS entails policies that support innovation in clean technologies and their adoption, including public research and development expenditure on low-carbon energy technologies and renewable energy support for Solar and Wind[15]: A worrisome and not expected fact is the heterogeneity among developed countries is wider than for the other instruments. There are many developed countries where incentives to innovate in clean technologies are very low which make the net-zero transition in 2030 less likely. The results for BRICS+ are less surprising. In BRICS+, some progresses have been made but remain quite shy compared with NMBI and the levels are considerably lower on average than for developed countries.

Figure 3 Market based instruments in BRICS and Developed countries

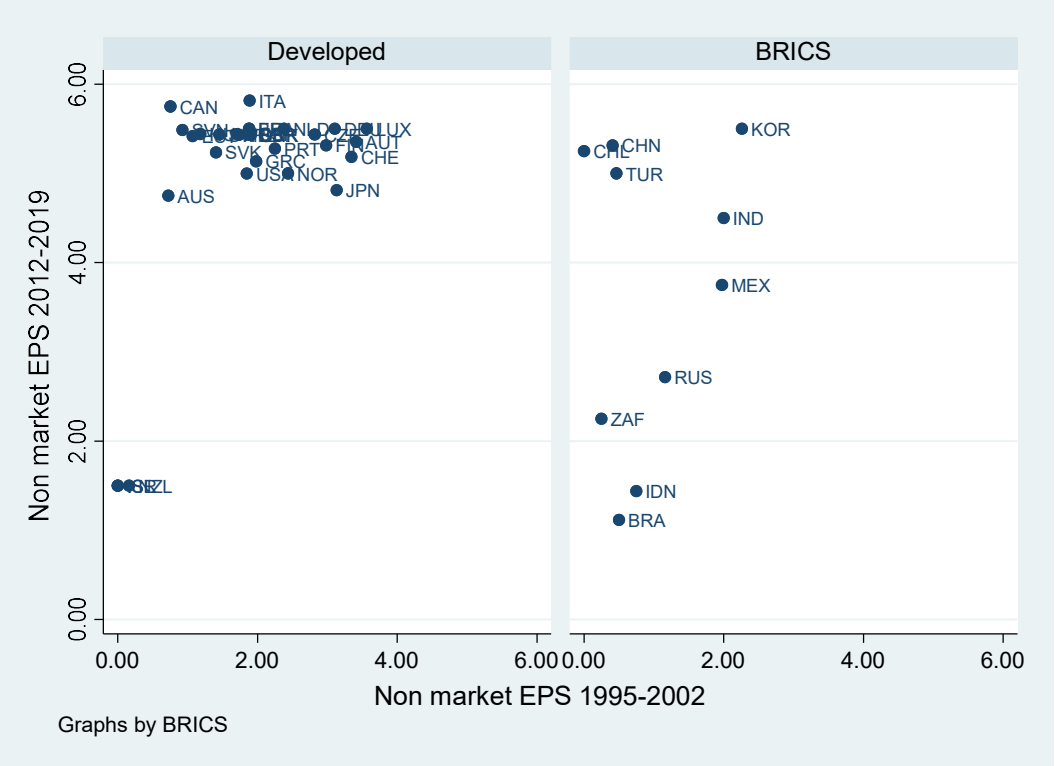


Source: OECD's EPS index (Kruse et al., 2022) Authors' own elaboration.

[14] "The onset of the emissions trading scheme in the European Union and in other jurisdictions have led to increase the prominence and stringency of this policy tool since the mid-2000s. ../.. Even so, the scope for greater pricing of emissions remains large in the majority of countries." Krusse et al. 2022 p 24

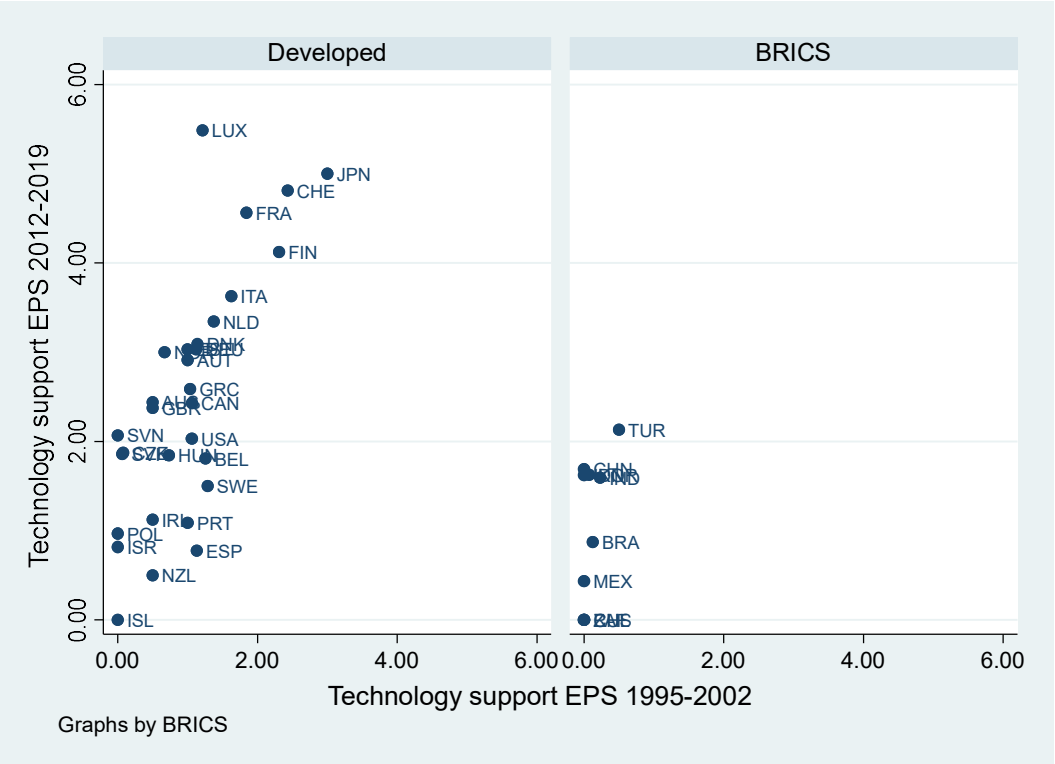
[15] "Because of the differing trend in technology support policies, a restricted version of the EPS index – excluding technology support policies – may be helpful for specific research purposes, for example when analysing the effect of environmental policies on firms in non-energy sectors. For instance, some non-energy firms may be less exposed to FITs or R&D subsidies for low-carbon energy technologies." feed-in tariffs (FIT) Krusse et al. 2022 p 27

Figure 4 Non Market based instruments in BRICS and Developed countries



Source: OECD's EPS index (Kruse et al., 2022) Authors' own elaboration.

Figure 5 Technology Support in BRICS and Developed countries



Source: OECD's EPS index (Kruse et al., 2022) Authors' own elaboration.

4. Results

General determinants of cross-borders M&As

Concerning the general determinants included in the benchmark models reported in Table 4, they have different influences on the extensive and on the intensive margins. Additionally, the effect on the extensive margin is more obvious for clean sectors. Overall, the goodness of fit is very good thanks to the wide range of fixed effects with very high R^2, in particular on the intensive margin.

On the extensive margins, trade agreements exerts a positive and significant impact This results would match with vertical, export platform and export supporting FDI while market access FDI would not be the dominant feature. Exchange rate has a non-significant effect which goes in the same line, since a negative effect would fit well with horizontal M&As where trade is substitute of FDI and reducing costs associated with exchange rate makes less likely to start cross borders M&A. Finally, investment treaties fosters M&As. This is an expected effect but rarely backed up by empirical studies using aggregated data since these treaties can vary a lot in nature and in contents. Then, turning to more detailed data allow to capture more accurately the influence of these agreements. Richer countries and countries with political stability attract more M&As and so do countries abundant in natural resources. Unemployment and patents have no significant effect. Overall, the characteristics included have a significant effect when all sectors are considered and for the sample of M&As flying to clean sectors, except unemployment and patents. This may be explained by the fact that the lion share of M&As are M&As among developed countries in clean sectors. In contrast, the characteristics of the host countries are less significant for the sample of M&As investing in dirty sectors. One interesting exception is the fact that the more patents registered by the host countries, the higher the likelihood of attracting M&As in high pollutant sectors. One conjecture for this result is that countries with more patents perform better in green technology which is especially important in these sectors.

Results on the intensive margin are quite different. Among the macroeconomic characteristics of the host market, only the abundance in natural resources and BIT have a significant effect. The other variables do not influence the amount invested. This can be explained by the fact that these variables have a more obvious influence on the decision to invest depending on the vertical or horizontal nature of M&As while the amount invested is more related with firm-specific strategies (once sector's characteristics are controlled for). In contrast, M&As in countries abundant in natural resources have considerably larger amounts than in other countries, all else equal. As noted on the extensive margin, patents have a special influence in high pollutant sectors. We also find an unexpected negative effect of political stability on the amount invested in high pollutant sectors.

Effect of ER on cross-borders M&As

Turning to our variable of interest, the coefficient of the indicator of EPS in host countries is negative and more significant on the extensive margin (columns 1-3 of Table 4) than on the intensive margin (columns 4-6). Then, more stringent environmental policies tend to reduce the number of new cross-borders M&As in the host, compared to domestic M&As. This would corroborate the PHH. The negative influence of EPS in attracting new M&As projects is

confirmed both for clean and dirty sectors. In the same line, EPS has a negative influence on the amount invested in dirty sectors while no influence in clean sectors.

Table 4: The effect of EPS on M&As

	(1) Extensive	(2) Extensive-low	(3) Extensive-high	(4) Intensive	(5) Intensive-low	(6) Intensive-high
GDP pc	0.197**	0.235**	0.131	0.053	-0.554	-1.282
	(0.079)	(0.099)	(0.139)	(0.519)	(0.625)	(0.827)
Unemployment	0.002	0.036	-0.079	-0.017	0.224	0.278
	(0.050)	(0.061)	(0.091)	(0.325)	(0.406)	(0.507)
Nat. resources	0.319***	0.372***	0.201*	0.981**	1.419***	0.432
	(0.064)	(0.079)	(0.111)	(0.394)	(0.524)	(0.615)
Patents	0.102**	0.060	0.209***	0.407	0.203	1.087**
	(0.041)	(0.051)	(0.076)	(0.321)	(0.354)	(0.503)
Exchange rate	-0.007	-0.006	0.006	-0.178	-0.057	-0.209
	(0.017)	(0.021)	(0.028)	(0.109)	(0.136)	(0.156)
Pol. stability	0.183***	0.209***	0.119	-0.207	0.053	-1.654***
	(0.059)	(0.073)	(0.104)	(0.337)	(0.473)	(0.575)
EPS	-0.443***	-0.376***	-0.708***	-1.082*	1.089	-1.698*
	(0.098)	(0.123)	(0.171)	(0.610)	(0.789)	(0.935)
BIT	0.264***	0.290***	0.255**	1.203***	0.166	2.303***
	(0.068)	(0.089)	(0.115)	(0.405)	(0.592)	(0.664)
RTA	0.117**	0.142**	0.058	0.369*	0.529**	0.009
	(0.048)	(0.058)	(0.091)	(0.223)	(0.268)	(0.356)
Observations	596953	380864	152877	596953	380864	152877

Note: Standard errors clustered at origin-sector and destination-sector in parenthesis. All estimates include Origin*Sector*Destination*Sector, Origin*Sector*Year, Destination*Sector*Year and INT*Year fixed effects. * p<0.10, **p< 0.05, *** p<0.01

Effect of ER on cross-borders M&As by source-origin flows

In the following, we disentangle the effects of EPS for four types of source-origin flows, depending if they originate from developed or BRICS+ countries and fly to developed or BRICS+. Overall, the negative influence of EPS in attracting new M&As projects is mainly explained by the M&As flying to BRICS countries. In contrast, more stringent policies in developed countries have the same influence on cross-border M&As than on domestic M&AS, except in the dirty sector where it discourages more investors from other developed countries.

Then, ER in developed countries is not so relevant for M&As decision of location than in BRICS+ in general. This fits well with the fact that investors from other developed countries are seeking market access and strategic asset when investing in similar countries and are not so affected by costs. However, investors from developed countries are less likely to invest in dirty sectors of other developed countries if environmental stringency is high which would fit with the PHH. In contrast, for investors from BRICS, stringency of environmental policies is not a significant determinant of the decision to run a M&A in developed countries. In both cases, ER of developed countries has no effect on the intensive margin, except for investments of BRICS+ in developed

countries in clean sectors where stringent ER would even attract larger amount of M&As. This fits well with the literature arguing that determinants of investments from emerging countries in developed countries do not seek efficiency but more asset seeking.

Environment policies implemented by BRICS discourage investors to acquire or fusion with companies established in these countries. Unexpectedly, The effect is larger in clean sectors. This apparently contra intuitive result receives a natural explanation when we disentangle the ER in different types. On the intensive margin, the amount invested in BRICS is not really sensitive to the EPS. More stringent policies reduce the amount invested by developed countries in BRICS regardless the intensity of contamination of the sector.

Table 5: The effect of EPS on M&As, Developed countries vs. BRICS + sum of coefficients test

	Extensive	Extensive-low	Extensive-high	Intensive	Intensive-low	Inteisve-high
Dev. to Dev.	-0.235**	-0.149	-0.549***	-0.904	1.090	-1.480
	(0.103)	(0.127)	(0.187)	(0.652)	(0.828)	(1.033)
BRICS + to BRICS +	-1.889***	-2.440***	-1.435***	-0.444	0.267	2.705
	(0.276)	(0.387)	(0.413)	(1.413)	(2.008)	(2.159)
BRICS + to Dev.	0.137	0.426	-0.445	1.486	3.783**	0.481
	(0.241)	(0.309)	(0.422)	(1.218)	(1.515)	(1.940)
Dev. to BRICS +	-1.497***	-1.754***	-1.386***	-1.755*	1.057	-2.491
	(0.184)	(0.240)	(0.298)	(1.013)	(1.440)	(1.562)

Note: Test of sum of coefficients from table 1. * p<0.10, **p< 0.05, *** p<0.01 Complete estimations available in Table 9

Effect of specific ER on cross-borders M&As

Table 5: The effect of EPS on M&As, Developed countries vs. BRICS + sum of coefficients test

	Extensive	Extensive-low	Extensive-high	Intensive	Intensive-low	Inteisve-high
Dev. to Dev.	-0.235**	-0.149	-0.549***	-0.904	1.090	-1.480
	(0.103)	(0.127)	(0.187)	(0.652)	(0.828)	(1.033)
BRICS + to BRICS +	-1.889***	-2.440***	-1.435***	-0.444	0.267	2.705
	(0.276)	(0.387)	(0.413)	(1.413)	(2.008)	(2.159)
BRICS + to Dev.	0.137	0.426	-0.445	1.486	3.783**	0.481
	(0.241)	(0.309)	(0.422)	(1.218)	(1.515)	(1.940)
Dev. to BRICS +	-1.497***	-1.754***	-1.386***	-1.755*	1.057	-2.491
	(0.184)	(0.240)	(0.298)	(1.013)	(1.440)	(1.562)

Note: Test of sum of coefficients from table 1. * p<0.10, **p< 0.05, *** p<0.01 Complete estimations available in Table 9

displays results for the sub-indexes of EPS: MBI, NMBI and TS. As mentioned earlier, MBI and NMBI measures intend to correct negative externalities regarding pollution while TS intend to foster positive externalities emerging from green technologies. All the specific policies have a more negative effect on the decision to run cross-borders M&As than on domestic M&As and the magnitudes of the effects are similar (column 1). Not surprisingly, NMBI affect negatively the decision to entry in dirty sectors. These measures, which have become more common in recent years, consist in quantitative limits in contamination which directly translate in limits in production which constrained especially the production in the dirty sectors. On the opposite,

MBI affect negatively the decision to entry in clean sectors because they increase the cost of production by imposing tax on emissions but are not an important constraint for dirty sectors. TS affect negatively the decision, both for clean and dirty sectors. Finally, we find no effect on the intensive margin, except for NMBI in dirty sectors, in line with the above result.

Table 6: The effect of EPS specific policies on M&As

	(1) Extensive	(2) Extensive-low	(3) Extensive-high	(4) Intensive	(5) Intensive-low	(6) Intensive-high
GDP pc	0.223***	0.269***	0.146	0.282	-0.224	-1.087
	(0.080)	(0.100)	(0.141)	(0.522)	(0.635)	(0.805)
Unemployment	0.013	0.068	-0.102	-0.008	0.314	0.120
	(0.051)	(0.062)	(0.093)	(0.324)	(0.409)	(0.511)
Nat. resources	0.318***	0.367***	0.203*	0.961**	1.348**	0.502
	(0.063)	(0.079)	(0.111)	(0.392)	(0.525)	(0.626)
Patents	0.085**	0.032	0.216***	0.337	0.100	1.124**
	(0.042)	(0.052)	(0.077)	(0.320)	(0.361)	(0.489)
Exchange rate	-0.007	-0.007	0.008	-0.188*	-0.065	-0.232
	(0.017)	(0.021)	(0.028)	(0.109)	(0.136)	(0.156)
Pol. stability	0.169***	0.170**	0.144	-0.090	0.101	-1.392**
	(0.059)	(0.074)	(0.105)	(0.344)	(0.485)	(0.586)
Non-Market EPS	-0.192***	-0.092	-0.463***	-1.067***	0.048	-1.737***
	(0.061)	(0.075)	(0.107)	(0.361)	(0.458)	(0.591)
Market EPS	-0.211***	-0.312***	0.026	-0.459	-0.360	0.301
	(0.078)	(0.097)	(0.137)	(0.448)	(0.572)	(0.750)
Tech. support	-0.150***	-0.169**	-0.187*	0.153	0.682	0.197
	(0.055)	(0.068)	(0.097)	(0.379)	(0.453)	(0.641)
BIT	0.264***	0.292***	0.256**	1.250***	0.225	2.340***
	(0.068)	(0.089)	(0.115)	(0.408)	(0.589)	(0.668)
RTA	0.122**	0.149**	0.058	0.382*	0.536**	0.010
	(0.048)	(0.058)	(0.091)	(0.221)	(0.267)	(0.355)
Observations	596953	380864	152877	596953	380864	152877

Note: Standard errors clustered at origin-sector and destination-sector in parenthesis. All estimates include Origin*Sector*Destination*Sector, Origin*Sector*Year, Destination*Sector*Year and INT*Year fixed effects. * p<0.10, **p< 0.05, *** p<0.01

Effect of specific ER on cross-borders M&As by source-origin flows

In the following, we disentangle the effects of specific policies for investments depending on the source and destination of M&As. First, we focus on M&As flying to developed countries which represent the lion's share of M&As and where ER is, on average more stringent. Second, we analyze the effects of specific policies on M&As flying to BRICS.

For M&As flying to developed countries and originating from other developed countries, NMBI have a more obvious negative effect than other types of ER, in particular in dirty sectors. Since the intensity of these measures have increased in all developed countries and the limits values for NOx and SOx concern especially dirty sector, our results indicate that this more drastic move to a more stringent regulation may affect the decision of cross borders M&As more than domestic ones, as predicted by PHH. As regards MBI and TS, the effect may be less obvious for M&As among developed countries for several reasons: these measures have been unevenly

adopted among developed countries and their stringency remain, on average, low. Additionally MBI increase costs through taxes for CO2 emissions, NOx and SOx (among others) but these investments are not seeking efficiency gains but more focused on asset and strategy seeking, market access, which make them less sensitive to production costs.

For M&As flying to developed countries and originating from BRICS+, the previous results for overall EPS is maintained: none of the specific instruments have influence on the decision of BRICS+ to invest in developed markets. In contrast, TS would foster M&As flying from BRICS+ to developed countries in clean sectors and would considerably increase the amount invested. Then, the surprising result obtained for the overall ER is all explained by the fact that TS in developed countries attracts more M&AS projects and larger projects from BRICS+.

Concerning M&As flying to BRICS+ and originating from developed countries, both NMBI and MBI implemented by BRICS+ have a sizeable discouraging effects in the eye of investors from developed countries in line with the fact that these investors are especially interested in lowering their production costs. Then, laxer policies in BRICS+, could attract cross-borders M&As more than foster domestic M&As. NMBI have the same effects in clean and dirty sectors while MBI have more effects in clean sectors. We do not observe any effect on the intensive margin as observed with the aggregated index.

Regarding M&As where both investees and investors are from BRICS+, we have mentioned that stricter ER considerably reduce the number of projects among BRICS while it has no effect on the intensive margin. This effect is mainly driven by the effect of MBI in dirty sectors. The effect is large both on the extensive and on the intensive margins. A less expected result is the fact that NMBI has a negative impact in clean sectors.

Table 7: The effect of EPS specific policies on M&As, Developed countries vs. BRICS + sum of coefficients test

		Extensive	Extensive-low	Extensive-high	Intensive	Intensive-low	Intensive-high
Non-Market EPS	Dev. to Dev.	-0.154**	-0.066	-0.414***	-1.032***	0.073	-1.695***
		(0.062)	(0.076)	(0.111)	(0.369)	(0.465)	(0.603)
	BRICS + to BRICS +	-0.787***	-1.457***	-0.341	0.565	-1.407	3.224
		(0.261)	(0.395)	(0.378)	(1.401)	(2.207)	(2.103)
	BRICS + to Dev.	-0.033	-0.074	-0.046	-0.135	0.479	0.133
		0.173	0.212	0.311	0.786	1.052	1.201
	Dev. to BRICS +	-0.865***	-0.916***	-1.074***	-0.910	-0.326	-1.343
		0.174	0.233	0.287	0.929	1.534	1.570
Market EPS	Dev. to Dev.	-0.033	-0.107	0.181	-0.362	-0.319	0.504
		(0.083)	(0.101)	(0.151)	(0.484)	(0.609)	(0.838)
	BRICS + to BRICS +	-1.477***	-0.664	-2.566***	-4.602**	-1.520	-7.569***
		(0.404)	(0.506)	(0.740)	(1.874)	(2.524)	(2.736)
	BRICS + to Dev.	-0.436*	-0.220	-0.605	-0.169	0.819	-1.434
		(0.225)	(0.273)	(0.415)	(0.988)	(1.273)	(1.691)
	Dev. to BRICS +	-1.023***	-1.347***	-0.521	-0.753	-1.534	0.486
		(0.222)	(0.289)	(0.362)	(0.963)	(1.505)	(1.668)
Technology support	Dev. to Dev.	-0.084	-0.091	-0.141	0.296	0.618	0.579
		(0.059)	(0.073)	(0.108)	(0.431)	(0.493)	(0.796)
	BRICS + to BRICS +	-0.224	-0.264	-0.005	0.236	1.821	0.572
		(0.261)	(0.370)	(0.401)	(0.904)	(1.563)	(1.364)
	BRICS + to Dev.	0.200	0.404**	-0.121	1.262**	1.962**	1.120
		(0.142)	(0.182)	(0.245)	(0.626)	(0.915)	(1.141)
	Dev. to BRICS +	-0.005	-0.013	0.032	-0.661	1.262	-1.196
		(0.140)	(0.176)	(0.232)	(0.726)	(1.241)	(0.976)

Note: Test of sum of coefficients from table 1. * p<0.10, **p< 0.05, *** p<0.01. Complete estimations available in Table 10

5. Conclusions

The present work is one of the few empirical tests of the PHH for a large sample of countries, sectors and years. Moreover, the present work contributes to the literature by focusing on the case of cross-border M&As, which is quite relevant considering that environmental policy can affect differently greenfield investment and M&As, and since most FDI flying from and to developed countries consist in M&As. An important contribution of the study is to implement a structural gravity approach that accounts for omitted bias, border effects and simultaneity bias that guarantees that we capture the effect of ER and only the effect of ER on M&As decisions. Additionally, to the best of our knowledge, this is the first study applying this method to bilateral FDI at the sector level.

We tend to confirm the PHH: adopting "green" policies could make the country less attractive in the eye of potential foreign acquirers of local firms. This especially the case of policies that put quantitative limits to emissions in sectors of destination contaminate more than the average, as measured by greenhouse gases emissions per employee. In contrast, policies that increase the price of emissions have a more obvious negative impact in clean sectors.

The effects of ER also differ depending on the type of investors and investees. For investors from developed countries investing in other developed countries, ER that fix limit on greenhouse gas emissions reduce the likelihood to invest in dirty sectors and the amount while other measures such as taxes on emissions and technological support have no obvious effect. ER has a different impact on investments from BRICS+. In general, the decision of BRICS+ to invest in developed countries is not influenced by ER. The only exception is the positive effect of TS in clean sectors. When developed countries and BRICS invest in emergent countries, the negative effect of ER (both emissions limits and taxes on emissions are large). In these cases, an important determinant of investments is to lower production costs and stringent ER is not compensated by sufficient advantages.

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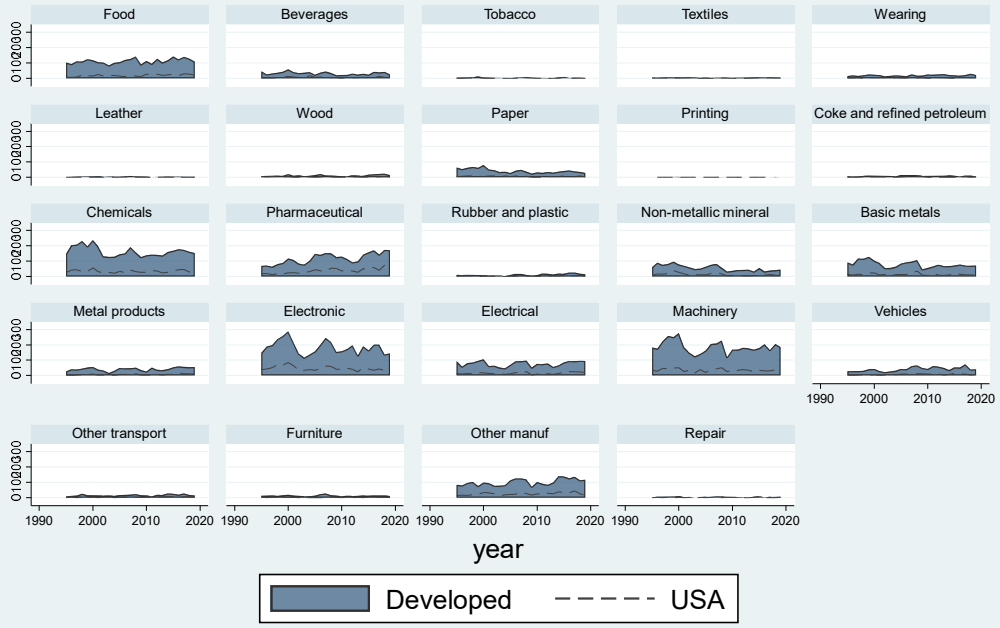
7. Appendix

Table 8: Sectors' classification, GHG per employee and M&As

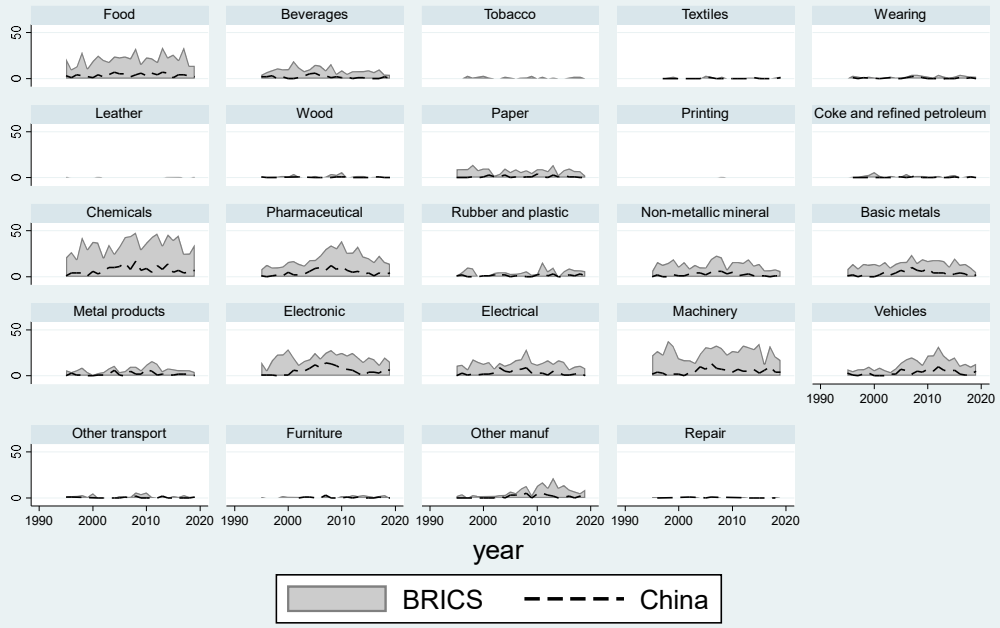
Sector of destination	GHG per employee	Level of pollution	Nb of Outward M&A from BRICS in total M&As, %	Nb of Outward M&A in BRICS in total M&As, %	Volume of Outward M&A from BRICS in total M&As, %	Volume of Outward M&A in BRICS in total M&As, %	Nb of Inward M&A in domestic M&A, %	Volume of Inward M&A in domestic M&A, %
Manufacture of food products	18.2	High	6,3	16,9	8,4	7,1	26,9	50,6
Manufacture of beverages	18.2	High	8,0	23,6	1,7	11,5	29,9	371,2
Manufacture of tobacco products	18.2	High	3,0	19,4	0,0	4,7	76,1	88,6
Manufacture of textiles	6.7	Low	8,1	13,3	14,9	4,3	29,3	37,5
Manufacture of wearing apparel	6.7	Low	6,4	10,2	2,1	3,9	22,8	29,9
Manufacture of leather and related products	6.7	Low	4,0	7,9	1,4	0,8	29,9	67,5
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	8.2	Low	5,5	10,5	8,6	5,3	24,6	27,2
Manufacture of paper and paper products	45.4	High	3,1	14,5	5,8	8,2	42,0	39,5
Printing and reproduction of recorded media	3.5	Low	2,6	5,0	2,2	3,2	29,5	26,9
Manufacture of coke and refined petroleum products	1531	High	11,6	17,2	11,0	18,2	27,3	25,6
Manufacture of chemicals and chemical products	129.3	High	5,7	17,9	4,0	6,0	43,7	54,8
Manufacture of basic pharmaceutical products and pharmaceutical preparations	8.8	Low	7,7	13,3	1,6	3,2	43,1	59,8
Manufacture of rubber and plastic products	7.2	Low	4,8	15,0	7,4	7,5	39,5	53,3
Manufacture of other non-metallic mineral products	208.8	High	5,7	19,5	11,1	11,4	32,9	94,4
Manufacture of basic metals	243.1	High	9,9	17,8	13,9	11,3	33,5	46,4
Manufacture of fabricated metal products, except machinery and equipment	4.9	Low	5,2	12,1	3,1	10,9	33,2	41,2
Manufacture of computer, electronic and optical products	3.1	Low	5,6	8,9	7,1	4,2	35,1	24,5
Manufacture of electrical equipment	4.5	Low	7,2	15,4	9,2	5,3	40,0	60,5

Manufacture of machinery andequipment n.e.c.	5.2	Low	6,3	14,2	5,0	5,0	43,6	52,8
Manufacture of motor vehicles, trailers and semi-trailers	3.7	Low	13,9	24,6	9,1	13,5	32,2	37,4
Manufacture of other transport equipment	2.6	Low	9,3	10,3	7,0	3,7	28,4	18,8
Manufacture of furniture	3.6	Low	5,5	8,1	1,4	71,0	21,5	77,0
Other manufacturing	3.6	Low	3,5	7,7	0,7	1,4	35,8	31,2
Repair and installation of machinery and equipment	3.7	Low	1,5	6,2	2,4	0,4	20,4	60,4
Total			**13,5**	**6,0**	**4,7**	**7,2**	**34,7**	**53,4**
		High	*6,4*	*18,0*	*5,2*	*9,3*	*34,5*	*76,6*
		Low	*5,9*	*11,5*	*4,3*	*5,2*	*34,8*	*41,2*

Note: own's calculations based on Eikom Thomson Reuters, OECD's Air Emissions Accounts database and the Structural Analysis Database (STAN)



Graphs by Sector of destination



Graphs by Sector of destination

Table 9: The effect of EPS on M&As, Developed countries vs. BRICS +

	(1) Extensive	(2) Extensive-low	(3) Extensive-high	(4) Intensive	(5) Intensive-low	(6) Intensive-high
GDP pc	0.429***	0.541***	0.281*	-0.171	-0.811	-1.571*
	(0.088)	(0.112)	(0.151)	(0.568)	(0.734)	(0.902)
Unemployment	0.049	0.090	-0.044	-0.034	0.214	0.216
	(0.050)	(0.061)	(0.092)	(0.327)	(0.410)	(0.517)
Nat. resources	0.293***	0.334***	0.189*	0.855**	1.362**	0.294
	(0.063)	(0.079)	(0.110)	(0.399)	(0.540)	(0.627)
Patents	0.219***	0.207***	0.289***	0.416	0.146	1.149**
	(0.045)	(0.056)	(0.081)	(0.353)	(0.380)	(0.553)
Exchange rate	-0.007	-0.009	0.008	-0.184*	-0.067	-0.221
	(0.017)	(0.021)	(0.028)	(0.109)	(0.137)	(0.160)
Pol. stability	0.186***	0.201***	0.132	-0.268	0.036	-1.719***
	(0.059)	(0.073)	(0.104)	(0.336)	(0.472)	(0.575)
EPS	-0.235**	-0.149	-0.549***	-0.904	1.090	-1.480
	(0.103)	(0.127)	(0.187)	(0.652)	(0.828)	(1.033)
x BRICS + to BRICS +	-1.654***	-2.291***	-0.886**	0.461	-0.823	4.185**
	(0.269)	(0.377)	(0.403)	(1.375)	(1.979)	(2.126)
x BRICS + to Dev.	0.371*	0.574**	0.104	2.390***	2.692**	1.960
	(0.201)	(0.264)	(0.340)	(0.926)	(1.237)	(1.382)
x Dev. to BRICS +	-1.262***	-1.605***	-0.836***	-0.851	-0.033	-1.011
	(0.188)	(0.238)	(0.319)	(1.025)	(1.445)	(1.669)
BIT	0.279***	0.306***	0.268**	1.107***	0.188	2.221***
	(0.068)	(0.088)	(0.115)	(0.382)	(0.572)	(0.648)
RTA	0.125***	0.146**	0.067	0.339	0.458*	-0.002
	(0.048)	(0.058)	(0.092)	(0.225)	(0.277)	(0.351)
Observations	596953	380864	152877	596953	380864	152877

Note: Standard errors clustered at origin-sector and destination-sector in parenthesis. All estimates include Origin*Sector*Destination*Sector, Origin*Sector*Year, Destination*Sector*Year and INT*Year fixed effects. * p<0.10, **p< 0.05, *** p<0.01

Table 10: The effect of EPS specific policies on M&As, Developed countries vs. BRICS +

	(1) Extensive	(2) Extensive-low	(3) Extensive-high	(4) Intensive	(5) Intensive-low	(6) Intensive-high
GDP pc	0.492***	0.599***	0.348**	0.166	-0.311	-1.255
	(0.089)	(0.113)	(0.155)	(0.585)	(0.757)	(0.908)
Unemployment	0.075	0.134**	-0.045	-0.001	0.369	0.112
	(0.051)	(0.063)	(0.094)	(0.327)	(0.413)	(0.522)
Nat. resources	0.272***	0.319***	0.154	0.769*	1.287**	0.190
	(0.064)	(0.079)	(0.111)	(0.397)	(0.528)	(0.651)
Patents	0.222***	0.203***	0.315***	0.390	0.094	1.285**
	(0.046)	(0.057)	(0.084)	(0.360)	(0.388)	(0.560)
Exchange rate	-0.010	-0.013	0.006	-0.195*	-0.077	-0.238
	(0.017)	(0.021)	(0.028)	(0.109)	(0.136)	(0.157)
Pol. stability	0.204***	0.209***	0.172	-0.114	0.085	-1.371**
	(0.060)	(0.075)	(0.107)	(0.350)	(0.493)	(0.605)
Non-Market EPS	-0.154**	-0.066	-0.414***	-1.032***	0.073	-1.695***
	(0.062)	(0.076)	(0.111)	(0.369)	(0.465)	(0.603)
x BRICS + to BRICS +	-0.633**	-1.392***	0.073	1.597	-1.480	4.919**
	(0.259)	(0.391)	(0.373)	(1.358)	(2.190)	(2.020)
x BRICS + to Dev.	0.122	-0.008	0.368	0.897	0.406	1.827*
	(0.158)	(0.196)	(0.279)	(0.656)	(0.939)	(0.995)
x Dev. to BRICS +	-0.711***	-0.850***	-0.660**	0.122	-0.399	0.352
	(0.175)	(0.233)	(0.294)	(0.903)	(1.554)	(1.536)
Market EPS	-0.033	-0.107	0.181	-0.362	-0.319	0.504
	(0.083)	(0.101)	(0.151)	(0.484)	(0.609)	(0.838)
x BRICS + to BRICS +	-1.444***	-0.557	-2.746***	-4.240**	-1.201	-8.073***
	(0.411)	(0.514)	(0.755)	(1.906)	(2.538)	(2.903)
x BRICS + to Dev.	-0.403*	-0.113	-0.786**	0.194	1.138	-1.938
	(0.215)	(0.261)	(0.397)	(0.909)	(1.158)	(1.484)
x Dev. to BRICS +	-0.990***	-1.240***	-0.701*	-0.391	-1.215	-0.018
	(0.235)	(0.301)	(0.395)	(1.027)	(1.562)	(1.870)
Tech. support	-0.084	-0.091	-0.141	0.296	0.618	0.579
	(0.059)	(0.073)	(0.108)	(0.431)	(0.493)	(0.796)
x BRICS + to BRICS +	-0.141	-0.173	0.136	-0.059	1.203	-0.007
	(0.265)	(0.372)	(0.410)	(0.978)	(1.602)	(1.571)
x BRICS + to Dev.	0.283**	0.496***	0.020	0.966**	1.344*	0.541
	(0.131)	(0.168)	(0.222)	(0.478)	(0.809)	(0.710)
x Dev. to BRICS +	0.078	0.078	0.173	-0.957	0.644	-1.775
	(0.148)	(0.186)	(0.252)	(0.810)	(1.291)	(1.243)
BIT	0.269***	0.315***	0.245**	1.175***	0.299	2.319***
	(0.068)	(0.088)	(0.116)	(0.388)	(0.590)	(0.675)

RTA	0.161***	0.196***	0.080	0.348	0.546**	-0.056
	(0.048)	(0.059)	(0.092)	(0.224)	(0.268)	(0.356)
Observations	596953	380864	152877	596953	380864	152877

Note: Standard errors clustered at origin-sector and destination-sector in parenthesis. All estimates include Origin*Sector*Destination*Sector, Origin*Sector*Year, Destination*Sector*Year and INT*Year fixed effects. * p<0.10, **p< 0.05, *** p<0.01