

Impact of Raw Material Export Restrictions on Employment: Evidence from Panel Data

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Abstract

The extractive industry typically contributes limited direct employment in host countries, prompting some nations to consider export restrictions on raw materials to enhance domestic job opportunities. However, scholarly opinions on the efficacy of these policies vary widely. This study addresses this gap by utilizing an extensive dataset spanning over a decade and encompassing diverse countries. Employing a fixed-effect Ordinary Least Square (OLS) regression model with panel data from 74 countries from 2009 to 2021, this paper shows that raw material export restrictions do not affect employment rates. This fact challenges the prevailing notion that export restrictions inherently boost domestic employment. Consequently, a more comprehensive strategy, including economic diversification, technological investment, and alternative job creation measures alongside export controls, is essential to effectively address employment challenges within the extractive sector.

Keywords:

raw materials, export restriction, employment, extractive industries

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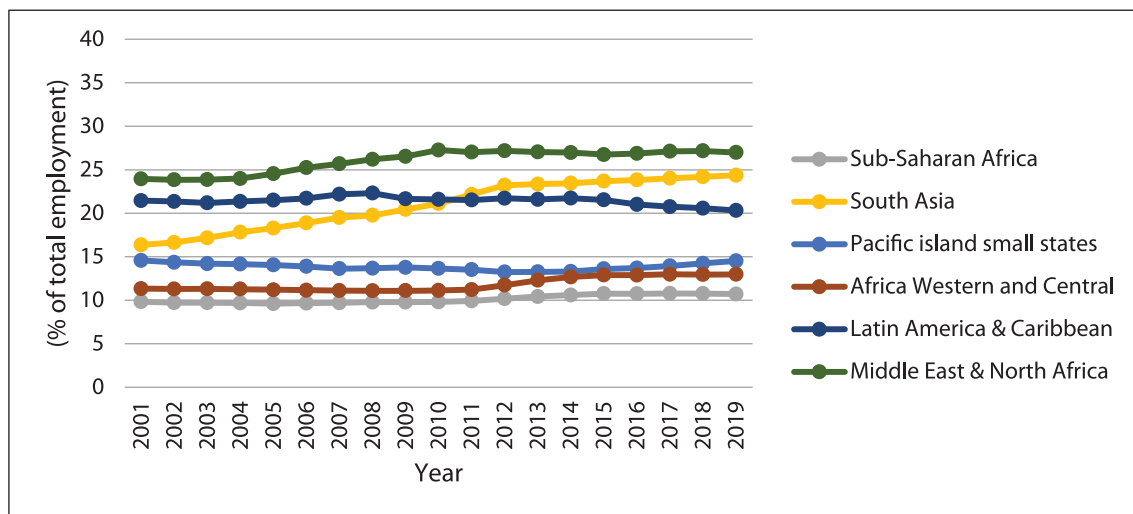
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INTRODUCTION

Over the last decades, countries around the globe have increasingly used restrictive measures on raw-material exportation, mainly to promote the development of higher-value downstream processing jobs on the domestic market (OECD, 2019). The World Trade Organization (WTO) asserted that since early 2000, at least 80 countries/ territories have implemented raw material export restriction policies, and more than 80% of the restrictions are still in force in 2022. While a growing number of empirical studies have identified the causal impact of imposing export restrictions on international trade (Melek & Ojeda, 2017; Wubbeke, 2013; Massari & Ruberti, 2013; Korinek & Kim, 2011; Balistreri & Worley, 2009) and the global value chain (Bown et al., 2021; Handley et al., 2020; Mancheri et al., 2019; Fajgelbaum et al., 2020; Fujio, 2013; Daudin & Schweisguth, 2011; Korinek & Kim, 2010) research examining its effect on the economies of exporter countries, particularly towards the country's employment, has been scarce.

It is imperative to note that for a country with high activity in extractive industries, its mining sectors arguably provide little direct employment (Addison & Roe, 2018; Aragón & Rud, 2013; Kinnaman, 2011; Latina et al., 2011; Matsushita, 2011; Kim J, 2010). Further, in their 2019 report, the OECD suggests that at the aggregate level, the mining sector usually occupies a small share of total employment (see Figure 1). Some countries seek to generate more jobs by imposing export restrictions on unprocessed materials. However, scholars are divided on the employment-generating effect of export restrictions where some argue to have a positive impact (Bernard et al., 2004; Brambilla et al., 2014; Ostensson, 2017; Vybaldina et al., 2016), while others suggest the reverse result (Fu & Balasubramnayan, 2005; Fung & Korinek, 2013; Korinek & Kim, 2010).

Figure 1. Employment in extractive industries as a percentage of total employment in selected regions



Source: OECD and World Bank (2019)

As Östensson (2017; 2019; 2020) and Roe (2017) suggest, an export restriction policy might encourage more processing industries in the downstream sectors and eventually generate more employment. With more raw materials available for domestic use, producer countries will have more options to diversify their products and arguably will attract more firms to create more job opportunities (Brown et al., 2021; Jacob & Pedersen, 2018; Östensson, 2017; Roe, 2017). It will also allow countries to specialize in resource-heavy produced goods (Brambilla et al., 2014; Roe, 2017; Yan et al., 2011). Additionally, restrictive measures on raw materials exportation will help to encourage higher transactions and trade activities since the producer country will be able to fully control the goods from the unprocessed materials and all its derivatives (Östensson, 2017; Roe, 2017).

However, opponents of export restrictions have long argued that this policy is apt to escalate the price of exported products, reducing export quantities (Korinek & Kim, 2011; Fung & Korinek, 2013; Kim, 2010). A decreased export volume will threaten the producer country's employment rate as they have a smaller demand for the goods. Although Korinek and Kim (2010) acknowledged that reduced raw material export could redirect a portion of supply to the local market, exerting a downward force on local prices, they further warned that this measure would establish a gap between domestic prices and the rates levied on international consumers. Subsequently, reduced exports due to export restrictions shift demand to other nations, potentially triggering a global price spiral if those nations respond with similar export-limiting measures. Hence, the objective of this policy, especially to generate more job opportunities in the producer country, appears to be challenging to achieve (Korinek & Kim, 2010; OECD, 2010).

This paper attempts to provide statistical evidence for the arguments above. It aims to estimate the impact of raw materials export restrictions on the aggregate employment rate in the host countries. While prior studies have explored the economic consequences of these policies, their implications for domestic job markets have received limited attention. This study addresses this gap by delving into the employment ramifications of raw material export restrictions. It attempts to introduce a new standpoint using an extensive dataset spanning over a decade and encompassing a diverse set of countries. The question of how raw material export restrictions affect the employment rate of the producer country will be a guide throughout this paper. Given the ongoing scholarly arguments on both proponents and opponents of raw material export restrictions, this paper used two-tailed hypothesis testing, arguing that raw material export restrictions affect producers' country employment rate. Lastly, the primary objectives of this study are twofold: first, to estimate the impact of raw material export restrictions on employment rates in producer countries. Second, to provide empirical evidence that informs the broader discourse on the employment implications of export control policies in the extractive sector. By examining these objectives, this research aims to offer a more comprehensive understanding of the multifaceted effects of export restrictions, especially in terms of their influence on domestic employment.

METHODS

This research used panel data consisting of 74 countries for the period of 2009 to 2021 (selected based on the availability of the data). Employing the Ordinary Least Square method, the paper utilized 3 (three) models of a regression equation.

$$Y_{i,t} = \beta_0 + \beta_1 X_{1i,t} + Z'_{i,t} \beta_2 + \mu_t + \delta_i T + \varepsilon_{i,t}$$

The dependent variable is the employment rate which is measured by employment to population ratio by using the total percentage (%) of workers aged 15 and above from the national estimate (modeled ILO estimates). The first model denoted the dependent variable when it regressed with the raw material export restrictions variable, which in this study, is represented by a dummy variable. The dummy will refer to export activity at the 6-digit level of the HS2007 classification. The export restriction here, due to the limitation of the data, will be broadly defined as all measures of restrictions (export prohibition, export quota, export tax, and export surtax), resulting producer country limiting the quantity of goods exported to foreign buyers. The first model of regression also includes the concentration index, which measures how exports of a country are concentrated on a few products or otherwise distributed in a more heterogenous manner among a series of products; the productivity index which serves as a comprehensive metric, evaluating the effectiveness of productive resources, entrepreneurial expertise, and the interconnectedness of production processes, which together determine the capacity of a country to produce goods; technological index, where it measures how countries estimate the use of machine and technology to produce goods; log of net foreign direct investment (FDI) where the data aggregates equity capital, reinvested earnings, other long-term and short-term capital, as presented in the balance of payments, using real (\$ constant) US dollars; and per capita gross domestic product which is a quantification of a nation's economic output per individual. This will be computed by dividing a country's GDP by its population and is expressed in real (\$ constant) US dollars.

Then, the second model of the regression includes all independent variables from Model 1 with an addition of time and country fixed effects. Lastly, the third model includes all independent variables from Model 1 and time and country fixed effect in Model 2 with an addition of low-income country interaction variable. The low-income country variable indicates a country that has a GDP per capita below \$ 12.962 USD (World Bank threshold to categorize low-income countries and high-income countries). Model 3 is presented with the intention to capture the differences in the effects of export restriction policy among low-income versus high-income countries.

It is imperative to note that most of the dependent variables in this study are factors related to firms' ability to produce goods, derived from the input-output analysis model. Referring to the Cobb-Douglas production function ($Q = f(K, L, P, H)$), FDI and GDP are proxies for monetary capital, while technology and concentration index are assets that are created for use in the production process. All these four variables will help to understand the physical capital (K) in the equation. Additionally, the productivity

index is a proxy for entrepreneurship (H) which informs the quality of the business intelligence that is applied to the production function.

In modeling the regression equation, this paper considered the following factors. First, the Hausman test is utilized to decide whether the model should use fixed effect or random effect, as this paper is interested in time-variant variables. Second, as understanding if the data is stationary is crucial before identifying the relationships between the variables, this paper also started the analysis by examining whether the stationary issues exist in the data. Third, this paper also checked for panel heteroskedasticity using the LR test to evaluate the difference between nested models. The result is then used to examine whether the panel is balanced and should any robust standard error model be incorporated. Following this, the paper then examined the serial correlation within the panel by conducting the Wooldridge test. Lastly, it also checked the contemporaneous spatial correlation.

The Hausman test conducted for the model suggests that a fixed effect is favored. Further, the result for the Fisher-type unit-root test based on augmented Dickey-Fuller maintains that the data is stationary in some panels. To rectify the issue, (n-1) time dummies are then included in the specification. This will help to account for “different y-intercepts” within annual cross-sections. Further, it provides a control for individual year effects (i.e., year-specific common shocks, which are constant across countries but vary by year). In addition, after conducting the LR-test, which shows that it is significant and has a balanced panel, this paper decided to use the country-clustered standard error. A serial correlation problem also exists in the panel based on the result of the Wooldridge test; hence, the Prais-Winsten transformation/AR (1) disturbance is then employed. Lastly, as the country-clustered standard error is already in use, the issue of contemporaneous spatial correlation has already been taken into account.

RESULT AND DISCUSSIONS

Table 1 provides statistical evidence about the effect of imposing raw materials export restrictions on host countries' employment, with and without a fixed effect. Model 1 contains the estimates for the effects of an export restriction without applying time and country fixed effects, Model 2 contains the estimates for the effect of an export restriction using time and country fixed effects, and Model 3 contains the estimates for the effect of export restriction when the low-income country interaction term is employed. The coefficient on the primary interest variable in Model 1 shows that imposing raw material export restrictions will decrease the employment rate. Model 2 and Model 3 show a similar result, where restricting the export of unprocessed material will decrease the employment rate, respectively. In addition, the more homogenous products of a producer country from the raw materials are, the more likely they have a lower employment rate. As suggested in Table 1, any additional point on the concentration index of a product will lead to a decrease of 16.61 percentage points (Model 2) and 15.88 percentage points (Model 3) in the employment rate. However, this result is not significant in Model 1.

In the same line, one additional point on the productivity index of a country will decrease the employment rate by around 0.40 percentage points for all models. However, this coefficient is not statistically significant. On the variable of technology index, at 10% and 5% significant levels, one additional point will increase the employment rate by 0.25 percentage points in Model 1, 0.40 percentage points in Model 2, and 0.37 percentage points for the low-income country interaction model (Model 3). Similarly, a 1% increase in log FDI will increase the employment rate by 0.17 percentage points in Models 2 and 3, but this estimation is not significant in Model 1.

Likewise, the log GDP per-capita variable suggests that a 1% increase in log GDP per capita is associated with an increase in employment rate by 0.0018, 0.0036, and 0.0034 percentage points in Model 1, 2, and 3, respectively. Additionally, as Model 3 suggests, compared to a high-income country, in a low-income country, the raw material export restriction will cause employment rates to increase by 0.21 percentage points. However, this result is arguable since the causality effect is not strongly established. Additionally, from the margin command estimation, the hypothesis that there is a statistically significant difference between rich and poor countries on the effect of export restriction on employment is also rejected. Accordingly, reflecting on the result, the hypothesis that export restriction on raw materials affects employment is rejected. The regression model does not hold statistically significant power to explain the causal relationship between the export ban and employment rate.

The findings of this study contradict the idea that limiting the export of raw materials can create job opportunities for the domestic markets, which has been a concern for many advanced and developing countries. These countries often resort to export restrictions policies such as export taxes, export quotas, export licensing, or complete export bans for various reasons, including employment purposes (Jacob & Pedersen, 2018; Östensson, 2017; Roe, 2017; Korinek & Kim, 2010). These policies may also serve political and economic goals, as they can favor specific producer and consumer groups. However, the regression analysis results in this research support the argument made by the World Trade Organization (2010) that export limitations are often deemed less effective in achieving distributional goals. Instead, alternative policy instruments like direct support or subsidies, as well as income taxes, could prove to be arguably more efficacious in accomplishing these objectives (Korinek & Kim, 2010; Östensson, 2017; Roe, 2017).

Although the result turns out to be insignificant in this regression, the trade policy theory, especially the Heckscher–Ohlin model, justifies the behavior of exporter countries that attempt to promote more down-streaming activities of raw materials and wish to generate more high-value-added goods by limiting their export of unprocessed goods. When an export restriction policy is imposed, as Fliess et al. (2017) assert, the price of the materials for non-domestic buyers will increase, and its supply to the global market will decrease. Subsequently, this will make more raw materials accessible for domestic use at a more affordable price below the world market. This condition will arguably lead to more domestic firms being encouraged to utilize the unprocessed material as an

input to expand, diversify, and promote their products to the local and global market at a more competitive price (Fliess et al., 2017; Kasahara et al., 2016; Bas, 2012; Milner & Tandrayen, 2007; Turco & Maggioni, 2013)

Table 1. Employment Rate and Raw Material Export Restriction in Three OLS models

Variables	Dependent Variable: Employment Rate		
	(1)	(2)	(3)
	Model 1	Model 2	Model 3
Export Restriction	-0.381 (0.618)	-0.260 (0.219)	-0.374 (0.229)
Concentration Index	18.52 (2.710)	-16.61** (6.676)	-15.88** (6.702)
Productivity Index	-0.470 (0.177)	-0.401 (0.317)	-0.408 (0.318)
Technology Index	0.250* (0.134)	0.402** (0.163)	0.375** (0.164)
Log FDI	2.111 (0.203)	0.175* (0.0913)	0.171* (0.0881)
Log GDP Per-capita	0.118*** (4.32e-06)	0.362*** (0.000112)	0.342*** (0.000103)
Low-Income Countries			-2.173*** (0.722)
Low Income with Export Ban			0.216 (0.428)
Constant	9.643 (7.064)	61.96*** (10.63)	63.87*** (10.78)
Observations	759	759	759
R-squared	0.203	0.252	0.274
AIC	5371.417	3000.549	2970.986
BIC	540.832	3028.333	3008.032
Country FE	NO	YES	YES
Year FE	NO	YES	YES
Number of Country	74	74	74

Standard errors are in parentheses. ***, ** and * indicates significance in a 99% confidence interval ($p < 0.01$), 95% confidence interval ($p < 0.05$) and 90% confidence interval ($p < 0.1$), respectively.

Similarly, Bernard et al. (2004) and Brambilla et al. (2014) further argue that export limitation effectively functions as an implicit form of subsidy for the downstream sectors by making production input more available at lower prices. This condition will enable a country to gain a larger share of the export market as their domestic firms are incentivized to have more variety of products, at least those that are resource intensive, and more market sectors to sell (Bernard et al., 2004; Brambilla et al., 2014). Bernard et al. (2004) and Brambilla et al. (2014) also maintain that in developing countries, in particular, the extractive industries continue to contribute significantly to the gross

domestic product (GDP), which shows that there has been negligible diversification away from these sectors. In this context, Bernard et al. (2004) and Brambilla et al. (2014) emphasized the significance of the role played by government policies in creating incentives for diversification, one of which is through raw materials export restriction. By imposing a raw material export restriction policy, a producer country is expected to have more downstream industries to produce higher value-added unprocessed materials; hence, the need for manpower will also increase (Bernard et al., 2004; Brambilla et al., 2014). Dergachova et al. (2021) suggest similar findings where if a country can diversify its extractive minerals into more semi or finished goods, they could generate more jobs as they will provide more options in the labor market.

Additionally, export restrictions are frequently implemented to foster the growth and development of downstream processing sectors within a country (Korinek & Kim, 2010). This approach is often driven by the desire to counteract or mitigate the effects of tariff escalation, a phenomenon where tariffs on processed or value-added products are higher than those on raw materials or primary goods (Korinek & Kim, 2010; Kasahara et al., 2016; Bas, 2012). These measures can be a strategic tool to leverage the market influence wielded by the country implementing them, particularly when that nation possesses a substantial share of the export market (Korinek & Kim, 2010). When a country holds a significant market share, it can use export restrictions to exert control and influence over international trade dynamics with its possessed raw materials. By strategically limiting the export of their materials, the country can effectively manipulate supply and demand, potentially driving up prices or negotiating more favorable trade terms. This practice allows the country to capitalize on its dominant position in export markets, shaping the economic outcomes to its advantage and reinforcing its position as a critical player in the global trade landscape (Fliess et al., 2017; Kasahara et al., 2016). In either case, as noted in the OECD report (2019), export restriction-applying countries adopt these measures to enhance their domestic welfare and economic well-being.

It is interesting to note, however, that despite the theoretical justification above, the regression result, although insignificant, has a negative coefficient sign for the export restriction variable in all models. These insignificant findings on the effect of raw materials export restrictions on employment rate and the coefficient signs in all models align with the OECD Trade Policy Studies report. In their papers entitled *The Economic Impact of Export Restrictions on Raw Materials* (2010) and *Aid for Trade: Economic Diversification and Employment* (2019), OECD affirms that export limitation on unprocessed materials will have detrimental impacts on resource allocation, global trade, and industries both on the exporter side and importer side. Thus, the theoretical assumption referred to here under the Heckscher–Ohlin model to explain the behavior of producer countries in imposing export restrictions seems not applicable in this context. This result could also be driven because raw materials and their dependent sectors make up such a low share of total employment, especially in developing countries.

OECD (2019; 2010) further maintains that rather than having the expected benefit of restricting raw material export as a subsidy for supplying cheaper materials for downstream industries, it is more likely that export restrictions have a detrimental impact on international trade and investments, which, in turn, can lead to a potential decline in the long-term supply of raw materials. By imposing such restrictions, countries disrupt the smooth flow of essential resources in global markets. This disruption disrupts the efficient allocation of raw materials and discourages foreign investments in the affected sectors due to the uncertainties surrounding export restrictions. Consequently, reducing foreign investments in raw material extraction and production may undermine the long-term supply capacity. This scenario raises concerns about raw material resources' sustainability and availability to meet future demands, posing potential challenges for industries reliant on these resources. This scenario will also cause uncertainty about raw material prices at the global level, which negatively affects the overall trade chain.

Lastly, the regression models also present an exciting finding that implies that producer country should diversify their products and produce more value-added goods by advancing their technological use to generate more job prospects in their extractive industries. When producer countries can diversify their product, the model shows that the employment rate can be positively affected (inferred from the significant coefficient of concentration index). Likewise, technology utilized by firms also positively affects the employment rate. Therefore, it is suggested that the producer country should invest more in technology to provide more choices and opportunities for processing the raw materials.

CONCLUSION

The main finding of this paper is that raw material export restriction has no causal effect on employment. There is insufficient statistical evidence to infer that the alternative hypothesis is true. The paper, thus, is not adequate to support the argument that restricting raw materials to export will shift the domestic firms' roles from only operating in upstream industries, such as mining, to mid and downstream, such as extracting and refining crude material, which can boost the job-generating effects for the host countries. In contrast, the implication of this paper might have supported the finding of the OECD's report (2010) that raw material export restrictions negatively impact industries in producer and importer countries. This paper also further informs us that producer countries need to diversify more of their products and improve their technological use in their firms to affect the employment rate from their extractive industries sectors positively.

Additionally, it is imperative to note that this paper uses a relatively broad definition of export restrictions. It includes all measurements listed in the OECD categories of export restriction activities, from export ban to export quota. Future research might consider using more specific definitions to capture more accurate estimations. In addition, another limitation of this study is that the employment data is collected from all sectors, focusing on something other than the industry that produces goods/services from raw

material production. Further, the raw materials data referred to here use the 6-digit level of HS2007 classification, which also has many categories, from aluminum to zirconium, where they are used in various industries. Therefore, a study focusing more on raw material employment and further specific industry classification will help explore the possible causal relationship between export restriction and employment. Lastly, future research might also consider adding more periods and countries to increase the study's sample size to get higher precision and more confidence in the estimates.

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