An implementation of climate-related financial policies to promote a nation’s participation in global value chains: evidence from an international database

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Abstract

Purpose – This study aims to investigate two issues: (1) a nexus between climate-related financial policies (CRFP) and global value chains (GVC) and (2) the government’s policies to help countries enhance the efficient use of CRFP in improving a country’s likelihood to participate in GVC.

Design/methodology/approach – To investigate the connection between GVC and CRFP, the authors incorporate that backward participation is measured using foreign value-added, while domestic value-added is used to measure forward participation, quantified as proportions of gross exports. The study analyses yield significant insights across a span of 20 developing countries and 26 developed countries over the period from 2010 to 2020.

Findings – Regarding the first issue, the authors affirm the presence of a linear link between GVC and CRFP, implying that involvement in CRFP is advantageous for both backward and forward participation. Furthermore, the authors identify long-term GVC and CRFP cointegration and confirm its long-term effects. Notably, the expression of a linear relationship between GVC and CRFP appears to be stronger in developing countries.

Research limitations/implications – The study findings, together with previous research, highlight the importance of financial policies relating to climate change (CRFP) in the context of economic growth. Climate change’s consequences for financial stability and GVC highlight the importance of expanded policymakers and industry participation in tackling environmental concerns.

Practical implications – Regarding the second issue, the study findings suggest critical policy implications for authorities by highlighting the importance of financial stability and expanded policymakers in promoting countries’ participation in GVC.

Originality/value – This paper investigates the link between GVC performance and CRFP, offering three significant advances to previous research. Moreover, as a rigorous analytical method, this study adopts a typical error model with panel correction that accounts for cross-sectional dependency and stationarity.

Keywords Climate-related financial policies, Global value chains, Long-term effects, Global sample

Paper type Research paper

1. Introduction

The significant increase in economic growth is strongly related to incorporation into a more globalized international economy. The Heckscher–Ohlin (HO) trade model emphasizes that nations manufacture commodities in accordance with their comparative advantages, which are based on their factor endowments, which include labor, capital, institutional skills and natural resources. Concurrently, there has been a split of production into discrete stages...
during the last two decades, maximizing the usage of variances in factor endowments and efficiency across diverse locales (Baldwin and Venables, 2013). These global value chains (GVCs) enable businesses to lower production costs across the manufacturing process. As GVCs become more prevalent in commerce, the idea of comparative advantage becomes increasingly granular, structuring trade in terms of manufacturing stages rather than traditional packaged commodities and services.

Only a few manufacturers have access to foreign markets, limiting GVC’s potential to develop and implement sustainability (Sachs et al., 2019). The growing, socially responsible agriculture goods market sector raises pricing and assists producers in controlling rising production costs caused by the consequences of climate change. However, the urgency of climate change continues to put a strain on agricultural and supply systems worldwide. Climate change difficulties may compel GVC members to gather and work in novel ways to confront a multidimensional issue that not only affects them collectively but is also too complex to be effectively addressed individually. This is partly because the effects of climate change are scattered throughout value chains, impacting various GVC players, goods and producing locations in varying ways (Hochachka, 2021, 2022, 2023). The concept that leading organizations should infuse sustainability principles across the whole value chain has given rise to a compliance-oriented framework that includes institutional codes of conduct, regulations, legal standards and auditing processes that primarily align with the leading companies’ values and ethical standards. Nonetheless, it has been revealed that the compliance-based approach falls short of its pledges to enhance working conditions (Locke et al., 2009; Lund-Thomsen and Lindgreen, 2014) and to foster more holistic sustainable development (Gereffi and Fernandez-Stark, 2018). This deficiency can be attributed to top-down, command-and-control government, at least in part (explained further below).

Traditional trade agreements are being reviewed in a new collaborative paradigm emerging inside GVCs, and instead, there is an emphasis on creating enduring, dependable relationships and strong cooperation between leading companies and manufacturers (Lund-Thomsen and Lindgreen, 2014). This increased level of collaboration modifies the dynamics of power distribution throughout a value chain, giving rise to relational value chains (Lund-Thomsen and Lindgreen, 2014). According to Gereffi and Lee (2016) and Pla-Barber et al. (2021), this type of value chain governance is differentiated by close interactions among engaged stakeholders, which are defined by a high degree of trust, cooperation and shared problem-solving. This governance method is “mentoring-driven,” according to Marchi et al. (2013), and is based on one-on-one, reliable encounters with suppliers from the first and second tiers. It is sometimes referred to as a “commitment approach,” and it entails a multifaceted fundamental cause investigation, information sharing, issue solving and the promotion of mutually beneficial best practices that benefit auditors, suppliers and the global marketplace.

The authors contend that climate-related financial measures should be implemented (CRFPs) and included as a critical aspect in understanding and controlling the dynamics of carbon dioxide emissions. CRFPs are primarily promoted by financial regulatory and central bank bodies with the goal of promoting green finance and mitigating financial industry risks connected with climate change. A recent study emphasizes the critical significance of these organizations in dealing with the climate catastrophe. According to the authors, adopting CRFPs by a country indicates its policy commitment to improving environmental performance and that increased implementation of these regulations will result in fewer emissions.

This idea is backed up by the fact that specific climate-related financial measures have been implemented to reduce emissions and incentivize capital redistribution toward green and sustainable businesses as part of a transition to a green economy. Additional initiatives, such as encouraging financial institutions to disclose their exposure to polluting assets or providing a thorough economic activity taxonomy, can also create favorable conditions for such investments. These initiatives can assist the economy in progressively cutting carbon emissions and transitioning to a carbon-neutral economy. Climate-related stress evaluations
and financial risk management systems that are climate-aligned are also available, and they can potentially improve environmental performance. And this point of view is shared by Wimbadi and Djalante’s (2020) research.

Once climate risks are brought to the financial sector’s notice, these rules incentivize consistently limiting their exposure to banking institutions’ “climate-sensitive” assets, limiting potential losses from extreme weather events connected to global warming. Because of the different economic restrictions adopted in recent years by European governments, the interconnection of financial policies relating to climate change and the difficult issue of improving environmental performance has grown more apparent. Despite their importance in establishing a climate-friendly financial landscape, De Haas and Popov (2019) observe that their association with improved environmental performance has received little attention.

This paper investigates the link between GVC performance and climate-related financial policies (CRFP), offering three significant advances to previous research. We seek the answers to the following research questions: (1) How do CRFP promote a country’s motivation to participate in GVCs? and (2) What are the government’s policies to help countries enhance an efficient use of CRFP in improving a country’s likelihood to participate in GVC? The research makes three key contributions to the existing body of knowledge. First, it is the first empirical study of the impact of CRFP on GVC involvement, providing insights across several dimensions. In our research, we use two crucial metrics: forward participation and backward participation, which measure international and domestic value-added in terms of gross exports, respectively. Backward participation calculates the foreign value-added incorporated into one’s exports, whereas “downstream” GVC participation measures the amount of value-added derived from foreign inputs in manufacturing export goods. The latter represents domestic value added inside third-country exports (“upstream” GVC participation) or value-added in intermediary items transported to a trade partner, who reprocesses and re-exports them. Second, as a rigorous analytical method, this study adopts a typical error model with panel correction that accounts for cross-sectional dependency and stationarity. For the dynamic panel data (a sample is small (N = 46 countries) and short period (T: 2010–2020)), the issue of stationarity and cross-sectional dependency should be taken into consideration, and the results obtained from previous approaches like fixed-effects, random-effects may be biased (Canh et al., 2020; Thanh et al., 2022).

Our findings can be further reinforced by employing feasible generalized least squares (FGLS) as well as the two-step generalized technique of moments (GMM) methodologies that account for heteroscedasticity and endogeneity issues. We also investigate the long- and short-term effects using autoregressive distributed lag techniques and pooled mean groups (PMG) to provide a thorough study. Thanh et al. (2022) and Ha and Thanh (2022) explain that PMG-ARDL may be applied while accounting, considering both country-specific and time-specific impacts. Third, this research compares the influence of climate policy on GVC involvement in developing and industrialized countries. As a result, we underline the need to examine the CRFP that has an impact on GVC involvement from the viewpoints of these two areas.

The paper is divided as follows. The literature review provides a summary of pertinent literature to understand the investigation. The “Data and Methodology” section describes the research methods and data sources used. The study’s findings are introduced and discussed in the section under “Empirical results” and “Discussion” Finally, the section “Conclusions and policy implications” presents concluding remarks and policy implications of the study.

2. Literature review
2.1 The advantages and disadvantages of government policies
According to Bair (2008), control by players in the chain and how these trailblazing businesses appropriate or share the produced value throughout the supply chain are
considered aspects of a value chain’s governance. Pla-Barber et al. (2021) highlight five GVC governance models: market, hierarchical, relational, modular, and captive. These models depend on the control distribution among actors and how value is appropriated. According to these experts, social and environmental issues will become more prominent in GVC decision-making, and, in highly unpredictable circumstances, value chain relational governance is the best way to manage these challenges. Pla-Barber et al. (2021) further explain relational chains defined by tight connections among actors because these interactions contain complicated information that is frequently implicit and difficult to transfer or learn. Marchi et al. (2013) explain the significance of relational networks as the product or manufacturing process becomes more complicated and how sustainability becomes a systemic component. When it comes to tackling climate effects and other sustainability-related challenges, high levels of reliance and inventiveness among GVC participants in relationally regulated chains may be essential. This will encourage improvements inside current systems by the persons interacting in and affecting them.

However, how to successfully use such learning for more general transitions toward sustainability is still a matter of debate (Augenstein et al., 2020). It can be difficult for pilot projects and small-scale innovations to address problems that extend beyond the boundaries of their own discrete systems because they are so constrained by a single value chain, rooted in a particular location and dependent on the context. The logistical difficulties of this are described by Lund-Thomsen and Lindgreen (2014). First, they highlight how pilot projects might not scale into large worldwide supply chains with hundreds of vendors; second, they highlight how it is challenging to authentically include the voices of suppliers, manufacturers, and communities from poor countries and how their exclusion unwittingly promotes existing inequities; and third, they raise the question of whether a collaborative approach would be more successful. Several suppliers in Asia and Central America effectively leveraged the cooperative policy paradigm to improve worker conditions; nevertheless, the firm did not adopt this strategy as its default strategy (Locke et al., 2009). Although collaboration pilot initiatives with a few carefully selected providers may be viable, it appears extremely difficult to reproduce such tight collaboration with several suppliers (Lund-Thomsen and Lindgreen, 2014).

The regulations exist, and logic in that particular discrete region is different, which is precisely why the “world within a world” may function there; nevertheless, scaling up these new game rules to a larger audience requires a different effort (Seyfang and Smith, 2007). A small-scale innovation should, on the one hand, contrast the present attitudes and behaviors of the ruling regime, but it also has to build enough conformity with larger-scale systems in order to have a meaningful impact on them (Seyfang and Smith, 2007). For instance, large corporate CEOs within their spheres of influence might be able to build more ethical and long-term business practices. However, when the overall economic structure is otherwise geared toward extractive and exploitative behavior, there are real barriers to the success of such single-actor efforts. New “rules of the game” or societal and political expectations, according to some academics, are required to encourage sustainability within businesses as well as throughout society and how the company operates (Waddock, 2020). Examples of this transition may be found in the broader economic environment, incorporating advancements toward a circular economy (Hofstetter et al., 2021) or a repair-based economy and regenerative principles (Morseletto, 2020). Worldwide value chains are networks that link members from different parts of the world not just to one another but also to worldwide marketplaces and are therefore referred to as the “infrastructure of international trade” (Bair, 2008). De Marchi et al. (2020) and Hofstetter et al. (2021) both highlight the significance of examining if the governance structure of GVCs promotes sustainability, as well as how suppliers might exercise agency and contribute to large-scale social and environmental transformations.
2.2 Upgrading through government policies

The coffee industry in Guatemala must adapt to a number of interconnected global realities, including the economic realities of global coffee markets, as well as the socio-economic realities of migration to the United States, which lead to greater local labor prices (Locke et al., 2009; Thanh et al., 2022), and the economic realities of climate change that increase the cost of production and necessitate the use of more farm inputs (Sachs et al., 2019). According to Fazey et al. (2018), these together are orders more complicated than the majority of problem-solving techniques can handle. The report by UN Environment (n.d.) explains that acknowledging the interdependencies between socio-economic systems and ecosystem integrity is necessary for effectively addressing “humanity’s transformative challenge” to safeguard ecological integrity. There is a need for new kinds of collaboration within and among coffee industry participants, as well as across sectors, according to Sachs et al. (2019), who explicitly mention the coffee industry. In such a situation, it is important to think about the potential for social and environmental improvement that relational value chains may offer.

The way in which upgrading is done contributes to the compliance model’s failure to have the desired effect. Using a compliance-based strategy might impede lead companies from reaching their capacity to spread sustainability throughout a value chain since suppliers could only agree on the surface to the importance of these codes of conduct and look for loopholes to avoid fully adhering to them. Locke et al. (2009) state that this is partly because of the interdependence and complexity of the relationships and their ability to disseminate sustainability across a value chain. A chain that is more relationally regulated, meanwhile, is founded on trust and relationship conventions and employs a self-enforcing strategy that is influenced by social standards such as aim consistency and reciprocity (Pla-Barber et al., 2021). Auditors interact with suppliers on mentorship and information exchange in these value chains and cooperative problem-solving. Suppliers “come to see these auditors as Allies and not foes” as a result and make use of a self-enforcing method (Locke et al., 2009). This is what Locke et al. (2009) refer to as a “commitment-oriented approach,” describing how it is not founded on the invention of a set of top-down ethical guidelines requirements but rather focuses on how those notions are implemented and executed via cooperative information exchange, problem-solving and the distribution of best practices. According to Marchi et al. (2013), the significance of this form of cooperation is highlighted in the process of creating successful green goods, which is accomplished through the creation of relational coordination mechanisms rather than market relations. The assumptions are examined in this relational approach to value chain governance that underpin these trading paradigms, critically assessing their theoretical and empirical limits and reflecting on who needs to adjust their behavior in light of the intricate, value chain-linked structure. This focuses on the opportunity for improvement in how trade interactions are handled across the value chain as opposed to what standards are rewarded and enforced.

2.3 Further empirical evidence

Empirical research has extensively examined the connections between trade and environmental policy. There is evidence that environmental factors have little or no influence on regulations on competitiveness, according to two recent analyses that summarize ex-post empirical methodologies. Dechezleprêtre and Sato (2017) reached the conclusion that strengthening environmental regulations does not adversely affect international competitiveness. Current environmental regulations have been shown to have little impact on the location of commerce and investment in comparison to other criteria like market circumstances and local workforce quality—Arlinghaus (2015), looking especially at articles assessing. In a similar way, the impacts of carbon pricing state that most of the studies examined failed to demonstrate any significant impact on competitiveness because of these policies. These views appear to be
consistent with Jaffe et al.’s (1995). Earlier studies seeking to establish the environmental regulations’ impacts on overall trade flows, net exports and estimates resulting from plant location selections were either modest, statistically insignificant, or not model-specific.

The consequences of pollution havens have been investigated in relation to trade flows, plant site decisions and foreign direct investment (Brunnermeier and Cohen, 2003; Kahouli et al., 2014). Earlier studies revealed comparative advantages were modeled using a Heckscher-Ohlin (HO) type of model, where factor endowments were used to explain comparative advantages (Grossman and Krueger, 1995), whereas gravity models are more frequently used in more recent studies, often supplemented with factor endowments and prospective trade drivers tied to policy.

Depending on the data’s availability and the issues of interest, approaches range from cross-sections to panels. The promise of panels in this regard is not usually completely realized, but other potentially major changes, such as endowments or policy, are only very limitedly controlled by the cross-sections. Van Beers and Van Den Bergh (1997) developed a gravity equation to show how environmental policy rigor affects bilateral exports in OECD nations. More strict rules have a detrimental and substantial influence on total exports but not “dirty” trade flows. Nevertheless, it has been suggested that their design is incorrect since it excludes phrases of multilateral resistance (MRTs) (Harris et al., 2000). The idea of MRTs, which was developed by Anderson and van Wincoop in 2004, refers to the notion that bilateral commerce may be driven not just in terms of bilateral trade costs but also in terms of comparable trade costs with the rest of the globe. Harris et al. (2000) attempted to overcome this problem by incorporating the importer- and exporter-included impacts into their gravity equation but were unhappy to discover that the indicator for environmental policy has lost statistical significance. MRTs have grown to be an important question in empirical trade literature, with the majority of writers advocating the adoption of different fixed effect structures that are either constant or change over time (Adam and Cobham, 2007).

Although there are compelling arguments to believe that the key variables (trade flows and GDP) are not stationary, time series features have not been a significant focus of study using gravity models. Static fixed effects estimate, despite representing longer-run correlations, appears to offer numerous advantages in practice. According to Santos Silva and Tenreyro (2022), the Poisson Pseudo Maximum Likelihood estimator has been recommended in the specific scenario of several “zero” data.

Several publications express specific concern about a potential endogeneity bias since trade might raise GDP per capita and hence increase the need for stricter environmental regulations. Environmental regulations have a more favorable influence on US import growth than previously assumed OLS, according to Ederington and Minier (2003) and Levinson and Taylor (2008), who instrument environmental policies including a wide range of environmental, economic, trade and political economy elements.

While some studies examine how environmental regulations affect total trade and competitiveness as a whole (Van Beers and Van Den Bergh, 1997), the majority are more interested in how regulations affect industries that produce large amounts of pollution because these industries are more likely to experience loss of competitiveness as a result of stricter regulations. In order to do this, research uses a variety of definitions of “dirty” and “clean” sectors, most commonly through a continuous or discontinuous definition of pollution or resource intensity. None of the articles, however, examine the sensitivity to various interpretations of what constitutes “dirty” vs “clean.” Kellenberg (2009) and Ederington et al. (2005) further separate “footloose” sectors, that is, industries that, according to their structure, are more prone to migrate (which is defined as low capital-intensity), pointed out that impacts are certainly considerable.

When it comes to proxies for how strict an environmental regulation should be, approaches diverge dramatically. One of the most often used EPS indicators in empirical research is the cost
of pollution abatement that businesses report, such as the expenses gathered by the US PACE survey (Grossman and Krueger, 1995; Levine, 1997; Levinson and Taylor, 2008; Tobey, 1990). Their fundamental shortcoming is the challenge of determining the impact of environmental regulations on the costs indicated by firm or plant-level surveys. Investments in the reduction of pollution, for instance, will be influenced by environmental regulations as well as the level of technology, competitive pressures, capital availability, resource costs, R&D policies, etc. Some of these problems may be addressed by integrating suitable controls in the study, such as those that may influence a firm’s choice to invest in capital, operational effectiveness, research and development, or company image (Botta and Kožluk, 2014). Due to respondents’ difficulty appropriately allocating spending to “environmental” aims, polls of this type might also have this issue. This is especially true for expenditures in integrated pollution management, which can have a significant impact on both production efficiency and pollution control (Brunel and Levinson, 2013). Therefore, there may be a bias in these surveys, which should include investment in end-of-pipe equipment, which is normally less cost-effective, and most prescriptive policies will most likely be pushed and less cost-effective regulatory initiatives. Last but not least, proxies that are based only on the harshness of policy instruments measuring present a compelling choice. The lead concentration restrictions for gasoline, for instance, are the topic of Broner et al. (2012). Composite indices that combine data from many instruments have also been suggested since such selected policies may not adequately reflect the general policy stringency. Although they only produced a composite, cross-country indicator for one year, Dasgupta et al. (2003) were among the pioneers in this field. The EBRD established the CLIMI index (Climate Laws, Institutions, and Measures Index) for 2010 based on UN country reports and UNFCCC submission reports. The majority of attempts create a single index using both policy and result data. The key obstacles to such an endeavor include the dearth of cross-country data, the index lacks temporal variation, making it in a panel dimension, unsuited for econometric analysis, and it is difficult to select and aggregate data across many policies.

The literature has indicated the nexus between climate change and GVC participation (Hochachka, 2021, 2022, 2023; Hofstetter et al., 2021; Lund-Thomsen and Lindgreen, 2014). Erdogan et al. (2021) highlight the role of natural resource, energy abundance and dependence in pursuing the goal of sustainable development by increasing the pressure on the environment. Hence, we believe that the focus of authorities should be paid to the financial policies to promote GVC involvement. The literature has kept silent on the link between CRFP and GVC involvement. Therefore, this paper will fill this gap by providing a theoretical and empirical discussion on this nexus.

Based on our discussion, we propose the hypothesis.

**H1.** CRFP enhance the likelihood of GVC participation.

### 3. Empirical methodology

The model used to examine the relationship between GVC and CRFP:

\[
\ln GVC_{it} = \beta_0 + \beta_1 CRFP_{i,t} + \beta_2 CONTROL_{i,t} + \varphi_i + \omega_t + \epsilon_{igt},
\]

where \(i\) and \(t\) indicate nation \(i\) and year \(t\), respectively. \(\varphi_i\) and \(\omega_t\) are incorporated into the model to take into consideration country and year-fixed impacts, and \(\epsilon_{igt}\) is the error term.

#### 3.1 Financial policy relating to climate change

A list of financial policies relating to climate change (CRFP) is the main explanatory variable. This statistic depicts the number of climate change-related financial policies introduced by nations every year from 2010 to 2019 and is sourced from D’Orazio (2021).
3.2 Global value chain

$GVC_{it}$, a quantitative statement serves as the primary independent indicator of participation (GVC), represented as a share of overall exports. The data is taken via EORA dataset (Lenzen et al., 2013), including 190 nations from stages 2000–2018. We also use backward and forward participation measures, which measure foreign and domestic value-added as percent of total exports, to understand better the link between GVC and Environmental Sustainability Performance (ESP). Backward participation focuses on foreign value-added integrated into a country’s exports or value-added derived from foreign inputs utilized in the production of export goods, demonstrating “downstream” engagement in GVC. Forward participation, on the other hand, evaluates domestic value-added in third-country exports or the value-added inside intermediate products shipped to a trade partner, indicating “upstream” GVC engagement. GVC is computed by adding together all GVC-related factors and dividing them by total gross exports. These GVC measurements provide a more exact portrayal of the GVC phenomenon and solve difficulties associated with the traditional methodology, which undervalues the participation of fewer export-oriented economies as shown by Ignatenko et al. (2019).

3.3 Control variables

The studies for CRFP by Le and Nguyen (2019) and Ha (2022) offer the foundation for our research. The amount of income is among the control variables (INC). This is estimated as the real gross domestic product of each individual (constant 2010 US dollar), trade share (TS), net foreign direct investment inflows (FDI) as a percentage of GDP, the degree of industrialization (IND), as measured by the amount of GDP added by the manufacturing sector, the environmental performance index (EPI), natural rents (NR), the level of government effectiveness (GE), the tax rate (TAX) and The World Development Indicators (WDI) give information on $EG$, $TS$, $FDI$, $IND$, $NR$ and $TAX$, which all provided by Table A1. Table 1 gives a comprehensive statistical explanation of all the features discussed. All variables’ correlation matrix is shown in Table 2, which suggests a relationship between GVC and CRFP.

The study begins by examining the cross-sectional dependence data (CD) using Pesaran’s (2021) empirical cross-sectional dependent tests. Following that, the study applies two unit-root tests to evaluate data stability in the presence of CD: the Levin–Lin–Chu test created by Levin et al. (2002) and the Im–Pesaran–Shin unit-root test developed by Im et al. (2003). Table 3 summarizes the findings, demonstrating that all variables being studied are cross-sectionally dependent. Furthermore, all variables are non-stationary until the first difference occurs, at which point they become stationary.

To assess the impacts of cross-sectional dependence (CD) and the first-differenced variable’s stationarity, we used standard error modeling with panel correction (PCSE) as outlined in Table 3. Following a comprehensive data-cleaning process that involves the elimination of gaps, missing observations and outliers, we ensure that our analysis is conducted with highly balanced data to support the applied tests and methods. The following stage entails empirical estimations, wherein we account for the interplay between digitization and exports, and due to limited data availability, all explanatory variables are one period behind. This approach is consistent with the methods employed by Sweet and Eterovic Maggio (2015) and Gala et al. (2018), who utilize the Feasible Generalized Least Squares (FGLS) model alongside Equation (1). Furthermore, we address potential endogeneity concerns through the application of the two-step system GMM approach in Equation (1), following the framework outlined by Ha and Thanh (2022) and Sweet and Eterovic Maggio (2015).

Furthermore, this article digs into a comparative examination of the differences between long- and short-term consequences. The technique established by Pesaran and Smith (1995)
for overcoming similar issues using autoregressive distributed lags is used to address this issue. Pesaran and Shin (1998) further contribute to the technique by estimating fixed effects and investigating endogeneity and causal linkages among variables. Following that, as shown in Table 4, we conduct the Pedroni test, the Kao cointegration test and the Westerlund test to assess the possible cointegration of two variables based on the frameworks offered by Pedroni (2004), Kao (1999) and Westerlund (2005).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Measure</th>
<th>Source</th>
<th>Obs</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRFP</td>
<td>Climate-related financial policies</td>
<td>Several climate-related financial policies per year are implemented by countries</td>
<td>D’Orazio (2021)</td>
<td>782</td>
<td>1.76</td>
<td>0.16</td>
<td>1.37</td>
<td>2.07</td>
</tr>
<tr>
<td>lnGVC</td>
<td>GVC values</td>
<td>The natural logarithm of GVC values</td>
<td>UNCTAD-EORA</td>
<td>782</td>
<td>1.67</td>
<td>0.17</td>
<td>1.23</td>
<td>1.99</td>
</tr>
<tr>
<td>lnFVA</td>
<td>FVA values</td>
<td>The natural logarithm of foreign value-added values</td>
<td>UNCTAD-EORA</td>
<td>782</td>
<td>1.78</td>
<td>0.15</td>
<td>1.42</td>
<td>2.14</td>
</tr>
<tr>
<td>lnDVA</td>
<td>DVA values</td>
<td>The natural logarithm of indirect value-added values</td>
<td>UNCTAD-EORA</td>
<td>782</td>
<td>0.10</td>
<td>0.16</td>
<td>0.00</td>
<td>0.87</td>
</tr>
<tr>
<td>EG</td>
<td>Economic growth</td>
<td>GDP per capita (in constant 2010 dollars)</td>
<td>WDI</td>
<td>782</td>
<td>24.82</td>
<td>24.67</td>
<td>0.55</td>
<td>112.08</td>
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<tr>
<td>TS</td>
<td>Trade share</td>
<td>Percentage of GDP</td>
<td>WDI</td>
<td>782</td>
<td>0.78</td>
<td>0.51</td>
<td>0.21</td>
<td>4.08</td>
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<tr>
<td>FDI</td>
<td>The net inflow of foreign direct investment</td>
<td>Percentage of GDP</td>
<td>WDI</td>
<td>782</td>
<td>−0.01</td>
<td>0.42</td>
<td>−4.13</td>
<td>1.77</td>
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<tr>
<td>IND</td>
<td>Industrialization level</td>
<td>Value added to the GDP</td>
<td>WDI</td>
<td>782</td>
<td>0.27</td>
<td>0.07</td>
<td>0.11</td>
<td>0.48</td>
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<td>EPI</td>
<td>Environmental performance index</td>
<td>Scaled from 0 to 100, 0 represents the worst performance, and 100 represents the best performance</td>
<td>YCELP</td>
<td>782</td>
<td>58.41</td>
<td>15.32</td>
<td>29.31</td>
<td>82.72</td>
</tr>
<tr>
<td>NR</td>
<td>Natural rents</td>
<td>The share of the sum of coal rents, mineral rents, natural gas rents, and forest rents to GDP (%)</td>
<td>WDI</td>
<td>782</td>
<td>3.19</td>
<td>4.90</td>
<td>0.00</td>
<td>32.01</td>
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<tr>
<td>DM</td>
<td>Level of democratization</td>
<td>The index of democratization</td>
<td>FSSDA</td>
<td>782</td>
<td>0.69</td>
<td>0.89</td>
<td>−1.00</td>
<td>2.35</td>
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<tr>
<td>TAX</td>
<td>Tax rate</td>
<td>Total tax and contribution tax rate (as the share of profit)</td>
<td>WDI</td>
<td>571</td>
<td>43.88</td>
<td>17.44</td>
<td>18.40</td>
<td>137.60</td>
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Table 1. Description of variables

Source(s): Authors’ calculations
<table>
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<tr>
<th></th>
<th>lnGVC</th>
<th>lnFVA</th>
<th>lnDVA</th>
<th>CRFP</th>
<th>INC</th>
<th>TS</th>
<th>FDI</th>
<th>IND</th>
<th>EPI</th>
<th>NR</th>
<th>GE</th>
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**Source(s):** Authors' calculations
3.4 The panel-corrected standard error model (PCSE)

Time-series cross-sectional (TSCS) data, which consists of repeated observations throughout time on fixed, cross-sectional units, are frequently used in empirical investigations. While this type of data is useful, it can be characterized by complicated error structures. When used to TSCS data with these errors, Ordinary Least Squares (OLS) can result in inefficient coefficient estimations and skewed standard error estimates. Under certain assumptions, Generalized Least Squares (GLS) can yield efficient and unbiased coefficient and standard error estimations. GLS, on the other hand, necessitates precisely describing comprehending the constituents of the error covariance matrix and the error covariance structure. When the structure of the error covariance matrix is known but the elements are unknown, feasible GLS (FGLS) is used. The analytical determination of FGLS finite sample characteristics is difficult.

The panel-corrected standard error (PCSE) model is recommended by Canh et al. (2020), Zakari et al. (2022) and other scholars. The K×K Sandwich matrix in the PCSE model is described as follows:

\[ X' \sum_{t=1}^{T} X = \sum_{t=1}^{N(t)} h_t(b)h_{t-j}(b)' \text{ with } h_t(b) = \sum_{i=1}^{N(t)} h_i(b) \]  

(6)

Estimated standard errors (SE) are consistent regardless of the panel's cross-sectional dimension N when cross-sectional averages are used. These PCSEs are resistant to broad types of cross-sectional (and temporal) dependency.
The PCSE approach is used because it offers an estimate that is devoid of autocorrelation, accurate in terms of standard error and less sensitive to outlier estimations. When working with dynamic heterogeneous panel data, the panel corrected standard error (PCSE) approach is also employed (Bailey and Katz, 2011; Reed and Webb, 2010).

3.5 Model description

The FGLS estimate is often used in panel data studies to adjust differences in error variance in order to overcome model defects in variable variance and autocorrelation.

The GLS (generalized least squares) estimate is calculated using the individual observations are given weights. The weights \( \omega_i \) are constructed in such a way that the derived coefficients are equitable, consistent and efficient. It is possible to show that if the weights are the inverse of the residual variance, the predicted coefficients will keep these features.

In matrix form, the GLS estimator is expressed as:

\[
\hat{\beta}_{GLS} = \left( X' \Omega^{-1} X \right)^{-1} X' \Omega^{-1} Y
\]

Or,

\[
\hat{\beta}_{GLS} = \left( \sum_{i=1}^{n} \frac{1}{\omega_i} x'_i x_i \right)^{-1} \left( \sum_{i=1}^{n} \frac{1}{\omega_i} x'_i y_i \right)
\]

Or,

\[
\hat{\beta}_{GLS} = \left( \sum_{i=1}^{n} \frac{x'_i x_i}{\sqrt{\omega_i} \sqrt{\omega_i}} \right)^{-1} \left( \sum_{i=1}^{n} \frac{x'_i y_i}{\sqrt{\omega_i} \sqrt{\omega_i}} \right)
\]

In GLS estimation, the coefficient vector, \( \beta \), may be approximated by applying OLS to the modified variables.

\[
y^* = \begin{pmatrix}
\frac{y_1}{\omega_1^{1/2}} \\
\frac{y_2}{\omega_2^{1/2}} \\
\vdots \\
\frac{y_n}{\omega_n^{1/2}}
\end{pmatrix}
\quad \text{and} \quad
X'^* = \begin{pmatrix}
\frac{x_{11}}{\omega_1^{1/2}} & \frac{x_{12}}{\omega_1^{1/2}} & \cdots & \frac{x_{1k}}{\omega_1^{1/2}} \\
\frac{x_{21}}{\omega_2^{1/2}} & \frac{x_{22}}{\omega_2^{1/2}} & \cdots & \frac{x_{2k}}{\omega_2^{1/2}} \\
\vdots & \vdots & \ddots & \vdots \\
\frac{x_{n1}}{\omega_n^{1/2}} & \frac{x_{n2}}{\omega_n^{1/2}} & \cdots & \frac{x_{nk}}{\omega_n^{1/2}}
\end{pmatrix}
\]

The inverse of the variance of the error in the individual observations was used to transfer the variables \( \omega_i^{-\frac{1}{2}} \) as the weights.

Since GLS is an application of OLS to weighted variables, it is sometimes called weighted least squares (WLS).
The WLS estimator minimizes the sum of the weighted squared residuals by $\omega_i^{-1}$:

$$S(\beta) = \sum_{i=1}^{n} (y^*_i - x^*_i \beta)^2 = \sum_{i=1}^{n} \frac{1}{\omega_i} (y_i - x_i \beta)^2$$

The WLS estimator of $\beta$ under the conditional variable variance, is consistent, impartial and asymptotically efficient.

When $\Omega$ is unknown, and the variance is expected to be exponential, the regression model is estimated using the maximum likelihood (ML) method or the two-step GLS method.

Assume that the mean and variance functions are provided:

$$y_i = x'_i \beta + \varepsilon_i$$
$$\sigma^2_i = \exp(z'_i \gamma) + v_i$$

The maximum likelihood function (ML) is as follows,

$$\ln L = \sum_{i=1}^{n} -\frac{\omega_i}{2} \left[ \ln 2\pi + z'_i \gamma - \frac{(y_i - x'_i \beta)^2}{\exp(z'_i \gamma)} \right]$$

in there.

$y_i$ is the dependent variable,

$x_i$ is the vector of $k$ independent variables in the mean equation,

$z_i$ is the vector of $m$ variables in the variance function,

$\beta$ is the vector containing unknown parameters in the mean function and

$\gamma$ is the vector of the unknown parameter in the variance function.

GLS estimation is performed to transform into a new model with the random error having a constant variance, and then use OLS estimation to estimate this new model.

When the variance of the residuals is unknown, the feasible generalized least squares (FGLS) estimation is applied, replacing $\Omega$ with $\hat{\Omega}$.

The estimate of the coefficient $\beta$ when the variance of the residual is known as follows:

$$\hat{\beta}_{FGLS} = (X' \hat{\Omega} X)^{-1} X' \hat{\Omega}^{-1} y$$
$$\text{var}(\hat{\beta}_{FGLS}) = (X' \hat{\Omega}^{-1} X)^{-1}$$

The application of the FGLS method requires a large sample size.

3.6 Two-step generalized method of moments (two-step GMM)

The Two-Step Generalized Method of Moments (GMM) estimator is an effective and reliable approach for getting estimates in balanced panel datasets. Certain preparatory tests may be performed to uncover possible endogeneity concerns that may lead to biased estimates if the dynamic panel estimation technique is not properly applied to ensure correct findings. The
Durbin–Wu–Hausman test may be used to determine probable simultaneity, starting with a simple multiple regression model. Following that, a fixed effect estimator can be used. If this estimator fails owing to dynamic endogeneity, the GMM estimator can be used by including the starting value of the dependent variable in the list of regressors.

The output of the two-step efficient GMM estimator is a consistent estimate of $\delta$ may be computed by GMM with an arbitrary positive definite and symmetric weight matrix $\hat{W}$ such that $\hat{W} \xrightarrow{p} W$. Common choices for $\hat{W}$ are $\hat{W} = I_k$ and $\hat{W} = S_{xx}^{-1} = (n^{-1}X'X)^{-1}$, where $X$ is an $n \times k$ matrix with $t^{th}$ row equal to $x_t'$. Then, a first step consistent estimate of $S$ is given by

$$\hat{S}(\hat{W}) = \frac{1}{n} \sum_{t=1}^{n} x_t' (y_t - z_t \hat{\delta}(\hat{W}))^2$$

The efficient two-step GMM estimator is thus defined as

$$\hat{\delta}(\hat{S}^{-1}(\hat{W})) = \text{argmin}_{\delta} \text{ng}_n(\delta) \hat{S}^{-1}(\hat{W}) \text{g}_n(\delta)$$

### 4. Empirical results

#### 4.1 Baseline results

Table 5 demonstrates the relationship between GVC and CRFP (CRFP) using PCSE, FGLS and two-step GMM estimations, in which GVC are measured by three aspects: GVC values' natural logarithm (lnGVC), logarithm of the natural logarithm of foreign value-added calculated using the natural logarithm is used to calculate backward participation (lnFVA) and the natural logarithm of forward participation measured by the natural logarithm of domestic value-added (lnDVA). As we expected, climate-related financial policies have a positive impact on GVC, and each of the coefficients is statistically significant. When TAX and RE are added, these indicators increase the effect of CRFP on GVC as the coefficients for these interactions are larger. The impacts of CRFP are similar to both PCSE and FGLS estimates. CRFP has a substantial beneficial impact on GVC, Forward and backward. The coefficients of CRFP in the PCSE and FGLS estimates are 0.41, which is significantly larger than the CRFP coefficients in the two-step GMM estimate. In the model with variables Forward and Backward, CRFP has a positive influence on backward across all metrics. Creating financial policies to address climate change, in general, helps to promote GVCs.

Considering lnGVC and Backward, in FGLS and PCSE estimates, the effect of INC remains statistically positive, while the effect of trade share (TS) is negative. However, the impact of TS on lnGVC becomes positive if more variables are added. FDI has no impact on lnGVC in all estimations. This means that the enhancement of FDI does not affect the increase of value chains. Moving on to the industrialization level (IND) and Environmental performance index (EPI), the statistics for these variables are noticeable. Two of three estimations are positive at a 1% significance level, except for a two-step GMM estimate. This result is opposite to natural rents (NR). Another factor to be taken into consideration is Government effectiveness (GE). The effect of GE is similar between PCSE and FGLS estimates. GE shows a positive relationship to all indicators, and each of the coefficients is statistically significant. Finally, the estimate shows that TAX positively impacts GVC while RE's influence is negative by adding more variables.

Along with increased GVC uncertainty, the governments should introduce financial supporting policies to enhance firms’ incentive and capacity to join in GVC (Dadush, 2023). Our paper provides empirical evidence to support this discussion. In a highly competitive
### Table 5.

Benchmark result

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<th>PCSE Alternative measures</th>
<th>lnGVC</th>
<th>FGLS Alternative measures</th>
<th>lnGVC</th>
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**Note(s):** Standard errors in parentheses  
***p < 0.01, **p < 0.05, *p < 0.1  
**Source(s):** Authors’ calculations
environment where the global consumers have raised environmental awareness, firms committing in the green consumption and green production to remain competitive in the global market (Kožluk and Timiliotis, 2016). While Kožluk and Timiliotis (2016) find that climate policies play no role in promoting international trade patterns but some significant influences on specialization. They contend that stringent climate policies may link to a corresponding advantage in “green” industries. The climate policies have a potential impacts on transforming GVC patterns toward the sustainability in a context of climate change (Hochachka, 2021, 2022, 2023).

Our paper shows that stringent climate policies have a favorable effect on backward and forward GVC. Backward participation focuses on foreign value-added integrated into a country’s exports or value-added derived from foreign inputs utilized in the production of export goods, demonstrating “downstream” engagement in GVC. Forward participation, on the other hand, evaluates domestic value-added in third-country exports or the value-added inside intermediate products shipped to a trade partner, indicating “upstream” GVC engagement. GVC is computed by adding together all GVC-related factors and dividing them by total gross exports. These GVC measurements provide a more exact portrayal of the GVC phenomenon and solve difficulties associated with the traditional methodology, which undervalues the participation of fewer export-oriented economies. Our paper reports a stronger influence of climate policies on forward GVC participation. These findings are critical for economists and policymakers in designing financial policies in encouraging firms to join in the global trading market. It is more likely that the climate policies are more efficient to help firms contribute more domestic value-added in third-country exports or the value-added inside intermediate products shipped to a trade partner.

In Table 6, we analyze the consequences of CRFP in the following analysis on GVC, considering developing countries and developed countries. We find that the effects of CRFP on three indicators are statistically larger in developed countries. Therefore, in poor nations, the occurrence of a linear association between GVC and CRFP is more common.

| Variables | Developing countries | | Developed countries | | |
|-----------|----------------------|----------------|---------------------|----------------|
|           | lnGVC Forward Backward lnGVC Forward Backward |
| LCRFP     | 0.56*** (0.089)     | 0.56*** (0.090) | 0.52*** (0.087)    | 0.24*** (0.057) | 0.22*** (0.050) | 0.27*** (0.053) |
| LINC      | 0.00 (0.000)        | -0.00 (0.000)   | 0.00*** (0.000)    | 0.01*** (0.000) | 0.01*** (0.000) | 0.01*** (0.001) |
| LTS       | 0.06*** (0.008)     | 0.00*** (0.009) | 0.00*** (0.007)    | 0.00*** (0.000) | 0.00*** (0.000) | 0.00*** (0.000) |
| LFDI      | 0.02 (0.016)        | 0.03* (0.016)   | 0.02 (0.016)       | 0.019 (0.010)  | 0.019 (0.011)  | 0.017 (0.011)  |
| LIND      | 1.69*** (0.124)     | 1.57*** (0.128) | 1.69*** (0.121)    | 0.080 (0.080)  | 0.080 (0.080)  | 0.078 (0.078)  |
| LEPI      | 0.01*** (0.001)     | 0.01*** (0.001) | 0.01*** (0.001)    | 0.00*** (0.000) | 0.00*** (0.000) | 0.00*** (0.000) |
| LNR       | -0.02*** (0.005)    | -0.02*** (0.006) | -0.02*** (0.005)  | -0.00*** (0.000) | -0.01*** (0.000) | -0.00*** (0.000) |
| LGE       | -0.03*** (0.012)    | -0.02 (0.012)   | -0.04*** (0.013)  | 0.005 (0.005)  | 0.005 (0.005)  | 0.005 (0.005)  |

**Table 6.** Financial-related climate policies and global value chains: developing and developed economies

**Note(s):** Standard errors in parentheses

****p < 0.01, **p < 0.05, *p < 0.1

**Source(s):** Authors’ calculations
Investigating the control variables, we recorded the positive impact of GDP per capita (INC) on GVC at a 1% significance level in developed countries. However, there is no impact of INC on lnGVC and Forward except for Backward in developing countries, which is in contrast with trade share (TS). Besides, in developed countries, TS’s impacts on Forward and Backward are statistically significant, with the coefficient respectively being 0.07 and –0.09. The effects of FDI on three indicators are negative in developing countries, while it only impacts positively on Forward at a 10% level in developed countries. This discovery implies that a change in FDI would lead to a decline in GVCs as well as domestic value-added and foreign value-added in the long term in developing countries, but it can promote only foreign value-added in developed countries. A notable result is that the most significant impact of industrialization level (IND) at 1% level is on lnGVC and Forward in developing countries (1.69). However, it decreases in developed countries. We imply that promoting the industrialization level gives us more effective results in value chains in developing countries than in developed ones. EPI shows a negative relationship to all value-added indicators in developed countries, and all coefficients are statistically significant, while this effect is negative in developing countries. It means that the environmental performance index (EPI) has an opposite direction to value chains in developed countries. These results contrast with government effectiveness (GE). Notable, natural rents (NR) negatively affect all indicators at a 1% significance level. We recorded that the impacts of NR are more prevalent in underdeveloped nations and statistically significant than those in developed ones. The conclusions of this research are essential because they inform policymakers and authorities in both developing and developed nations on how to improve the efficacy of the CRFP and encourage another implementation process toward sustainable value chains. Wonyra and Gnedeke (2022) demonstrate empirical evidence to show a nexus between climate change and GVC participation in developing countries. The similar findings are found in Africa (Ali and Gninigué, 2022). Wang et al. (2022) indicate the transmission role of pollution reduction in upgrading value-added within GVC and probability of GVC participation. Our findings are critical to suggest policy recommendation to design climate policies purposefully to help developing countries success in joining and competitive within GVC.

In Table 7, Panel A, an error-correcting mechanism is shown regarding climate-related finance policy’s long-term link and GVCs. This exemplifies both the short-run and long-run consequences of CRFP on GVCs with a full sample. This is the first research to shed light on this phenomenon. It indicates that CRFP have no statistically significant influence on GVCs (GVCs) in the short run. However, in the long run, CRFP coefficients have both positive and statistically significant impacts. These data provide empirical evidence that the influence of CRFP on GVCs is only visible in the long run, with no noticeable effects in the near term. Notably, the creation of CRFP contributes to the long-term promotion of GVCs.

Considering Panel B, we continue to investigate these relationships both in underdeveloped and developed nations. In the short-term, CRFP benefit the economy on all indicators in developed countries while they negatively impact Backward in developing countries. Meanwhile, the effects of CRFP in the long term on three dependent variables are similar in both levels of countries. The impact is significantly positive. The long-term impact in developed countries is quite considerable than in developing countries, which means enhancing CRFP will effectively sustain GVCs as well as encourage both domestic and international value-added in the long term, especially in developed nations.

5. Discussions
This paper investigates a nexus between CRFP and the GVC and suggests the government’s policies to help countries enhance the efficient use of CRFP in improving a country’s likelihood to participate in GVC. We develop a theoretical framework to extend the insight of the CRFP–GVC nexus. The implementation of CRFP plays a vital role in promoting GVC participation or scale-
up within GVC. While prior scholars investigate the influences of government interventions or simple considerations of government policies on some aspects of the economy and society without delving into other dimensions, we expect to provide a comprehensive understanding of the association between CRFP and GVC with theoretical reasoning and empirical support. We also distinguish between backward and forward GVC, in which the former is the foreign value-added embedded in own exports (backward or “downstream” GVC participation), and the latter is the domestic value-added embedded in third-country exports (forward or “upstream” GVC participation). This article extends and enriches the literature on the CRFP–GVC linkage.

We affirm the presence of a linear link between GVC and CRFP, implying that involvement in CRFP is advantageous for both backward and forward participation. Furthermore, we identify long-term GVC and CRFP cointegration and confirm its long-term effects. Notably, the expression of a linear relationship between GVC and CRFP appears to be stronger in developing countries. With these considerations, our paper expects to provide insights into the literature and help governments in the countries use CRFP more effectively, especially in enhancing GVC participation and ability to scale up within GVC.

6. Conclusions and policy suggestions
This article aims to investigate the impact of CRFP on GVC. The CRFP index helps us capture the effectiveness of CRFP in 20 developing countries and 26 developed countries
during the 2010–2018 period. Various measures of GVC involvement might also be utilized to put speculations concerning this relationship to the test. This paper seeks answers to issues: (1) a nexus between CRFP and GVC and (2) the government’s policies to help countries enhance the efficient use of CRFP in improving a country’s likelihood to participate in GVC. Regarding the first issue, promoting and improving CRFP has a favorable impact on GVC. More crucially, CRFP plays an essential role in strengthening GVCs and supporting local and foreign value-added in the long run, particularly in developed countries.

Regarding the second issue, our findings, together with previous research, highlight the importance of financial policies relating to climate change (CRFP) in the context of economic growth. Climate change’s consequences for financial stability and GVCs highlight the importance of expanded policymakers and industry participation in tackling environmental concerns. As a result, governments should prioritize expenditures in environmental and energy-related R&D to improve efficiency within GVCs. Businesses should integrate their operations with government rules, increase early-stage environmental investment, increase R&D efforts and patent creative solutions. We recommend that governments incentivize businesses to cut pollution emissions on a wide scale, with CRFP aiding mitigation efforts. In an unpredictable global economic context, this study can serve as a viable model for governments trying to build suitable tools and policies that utilize the link between CRFP and GVCs. Simultaneously, both emerging and established countries should fully implement CRFP in order to increase their share of gross exports via economies of scale and the learning effect.

GVC participation is not the ultimate goal of a country during its economic integration process. Instead, GVC participants are motivated to perform new activities in the chains with higher value-added for better profitability and stronger competitiveness. This move is known as GVC upgrading, which requires more intensive use of either capital or productive capabilities. Progressing to more efficient climate policies could be a viable path to either penetrate GVCs or move to higher ladders of value contribution in the chain. In this regard, although we find a stronger impact of climate policies on both backward and forward GVC participation among developed countries, as compared to that in the case of developing countries, our findings provide more meaningful implications for the developing counterparts. Specifically, given low human capital and starting point of low capabilities, developing economies are constrained in their abilities and motivation to improve national capabilities, hence, involve with “low financial resource and low production capabilities” vicious circle. This is also known as the “Quiescence Trap” or a trap of economic stasis where countries with few capabilities will have negligible or no return to the accumulation of more capabilities. Consequently, they are trapped in low value-added activities with little diversification and/or opportunity to move up in their chain. Our findings suggest that those countries should invest more financial resources purposefully mitigating environmental issues, that from preconditions for better accumulation and integration of knowledge for economic structural change and take some courage to jump out of the “safe zone” with low value-added activities to the production of more value-added goods and “greener” products. Although this process would not only incur risks but also take time to see some positive changes in GVC participation and upgrading, they would be rewarded with greater and more sustainable gains from GVCs.

There are two limitations to this article. First, GVC participation is affected to a greater or lesser extent by CRFP as the result of many factors, such as level of economic development, economic complexity performance and government effectiveness, among others. It is critical to consider these channels when examining the CRFP–GVC nexus. Second, it is also important to distinguish CRFP’s short-run and long-run influences on GVC. The use of a relatively short time duration may produce biased estimation, leading to unreliable findings. The study in the future should consider these issues in order to provide policymakers and economists with more insightful lessons on how they can promote the efficiency of CRFP and participation in GVC.
References


**About the author**

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