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EXAMINING THE RIPPLE EFFECT OF CORPORATES' ESG PERFORMANCE ALONG THE GLOBAL SUPPLY CHAINS

Key points:

- *Growing global awareness of environmental, social, and governance (ESG) issues has prompted corporates to integrate ESG practices into their business operations and increasingly, encourage their suppliers to do so as well. Meanwhile, sustainable finance is emerging as a catalyst for firms to expedite their green and sustainable transition.*

- *This study explores the impacts and implications of these developments on firms' ESG performance along global supply chains (GVCs). Specifically, we examine how the suppliers' ESG performance is influenced by customers' ESG performance and the market power as gauged by metrics from network analysis. ESG bonds-related factor is also included to assess the impact of sustainable financing on the ESG diffusion.*

- *We find evidence of a positive ripple effect from customer-driven ESG improvement along the GVC network. The strength and direction of the ripple effect depend on market power and the geographical location of customer-supplier pairs. Our analysis also reveals that customers who have issued ESG bonds have a stronger influence on their suppliers' ESG practices in cross-border supply chains. To promote the ESG ripple effects, central banks could improve the inclusiveness of sustainable finance by identifying and implementing financial inclusion policy solutions for GVC-linked firms that presently lack the capacity to assess sustainable finance.*

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I.   INTRODUCTION

Growing global awareness of environmental, social, and governance (ESG) issues has prompted corporates to integrate these considerations into their business operations and, increasingly, encourage their suppliers to do so as well. For example, the World Trade Organisation (2022) and the Asia Development Bank (2024) pointed out that trading can be a source of green technology diffusion among global value chains (GVCs). At the same time, sustainable finance (e.g. ESG bonds) is emerging as a significant catalyst for enhancing firms' ESG performance. Our study aims to explore the synergistic effects of these developments on firms' ESG performance.

Some studies have investigated the ripple effects of firms' ESG performance along GVCs. For instance, Tang et al. (2023) explored the transmission of ESG performance from customers to suppliers, and Li et al. (2023) examined the spillover effects of ESG practices among peer firms. Meanwhile, papers such as Chen et al. (2023), Gao and Liu (2023), Lei et al. (2023) and Zheng et al. (2023) showed that the issuance of green bonds would improve a firm's green performance. One of the main novelty of this study is to combine these two strands of literature, by conjecturing that having access to sustainable finance can amplify the positive ESG diffusion of GVC-linked firms to their suppliers. Another novelty of our study is that we broaden the scope of the existing analysis by incorporating: (i) network analysis techniques used in Chen et al. (2023) and Zhang (2021) to examine whether the spillover of ESG performance across firms depends on those firms' centrality in GVC networks, and (ii) firms' geographical information to distinguish between cross-border and domestic supply chain networks.

We take the following strategy in this paper. First, we apply network analysis techniques to a dataset of customer-supplier relationships declared by a global sample of firms to construct comprehensive GVC networks. Several network centrality metrics for firms in the GVCs are then compiled which, together with firm's ESG scores, form the baseline model of our regression analysis of ESG spillovers. As an extension of our baseline model, we assess the impact of having access to sustainable financing on ESG spillovers along cross-border and domestic supply chains, by introducing variables related to ESG bond issuance.
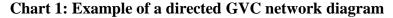
Our key findings are as follow. First, GVC network can serve as a channel for propagating improvements in ESG performance from customers to
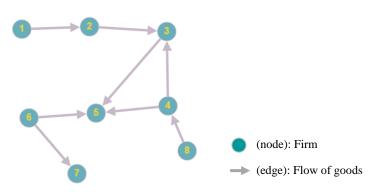
suppliers. We find evidence of a positive ripple effect from industry-driven, as well as customer-driven, ESG improvement along the GVCs. The strength and direction of this effect depend on factors such as the market power (proxied by the firm's centrality in the GVC network) and the geographical location of customer-supplier pairs. Additionally, our analysis reveals that customers who have issued ESG bonds could exert a stronger positive influence on their suppliers' ESG practices along cross-border supply chains, underscoring the role of sustainable finance in amplifying the positive ESG ripple effects. To foster the effects, central banks could promote the inclusiveness of sustainable finance by identifying and implementing financial inclusion policy solutions for GVC-linked firms.

The rest of this paper is structured as follows. Section II discusses our methodology and data, including an overview of network analysis. In Section III, we present the econometric framework and key findings. Policy implications from our study are presented in Section IV. Section V concludes.

II. METHODOLOGY AND DATA

Network analysis techniques are well suited for studying global supply chains. They offer a panoramic view of supply chain networks and provide meaningful metrics for regression analysis. In a directed GVC network, each node represents a firm, and each edge with an arrow represents a trade relationship and the direction of goods flow. For example, as illustrated in Chart 1, Firm 2 is a customer of Firm 1, and it is also a supplier of Firm 3.

Chart 1: Example of a directed GVC network diagram

Leveraging the network analysis techniques employed by Chen et al. (2023) and Zhang (2021), Chart 2 presents the GVC networks for 2020 and 2021, coloured according to each firm's ESG performance. The network chart is derived from the snapshots of global customer-supplier relationships provided

by S&P Capital IQ and ESG scores from Trucost. We categorise the node colour based on the firms' ESG score level: high (green), middle (yellow), and low (orange)[1]. In Chart 2, we find that the share of green nodes in the key GVC participation clusters (i.e. group of nodes with high density of edge connections, as pointed by the lilac arrows) apparently is higher than the rest in the network. This observation hints at a possible positive relationship between the GVC participation and ESG performance, and motivates us to investigate potential transmission channels of ESG practices along the GVCs.
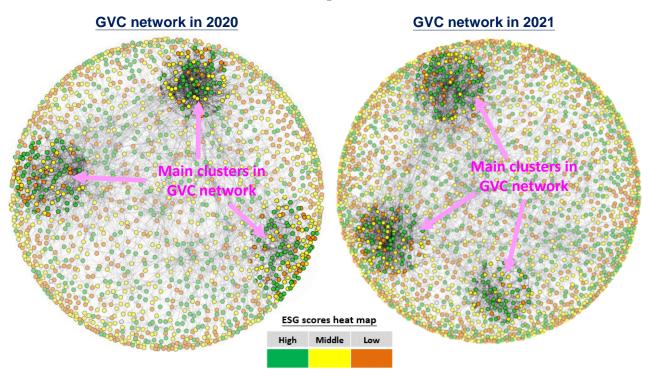
Chart 2: GVC networks and ESG performance in 2020 and 2021

Source: Capital IQ, Trucost and HKMA staff estimation.

To examine the transmission of ESG practice along GVCs, we conduct a firm-level panel data regression analysis to study the effect of customer ESG scores on supplier ESG scores as follows:

$$\Delta ESG_{it+1}^{S} = \beta_0 + \beta_1 \Delta ESG_{it+1}^{S\_ind} + \beta_2 \Delta rESG_{it}^{C} + \beta_3 DC\_gap_{it}^{C,S} + \beta_4 \Delta rESG_{it}^{C}$$
$$\times DC\_gap_{it}^{C,S} + \beta_5 Z_{it}^{S} + \varepsilon_{it} \tag{1}$$

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[1] We group all firms' ESG scores in the dataset into three quantiles. The group of high ESG scores (first quantile) represents a better ESG performance compared with the middle group (second quantile), while the group of low ESG scores (third quantile) mean they have relative poor ESG performance compared with the middle group.

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Our dataset consists of 5,725 customer-supplier relationships from S&P Capital IQ[2] and the pairs' corresponding actual ESG scores from Trucost[3], involving 2,178 firms from 50 countries, covering the period from 2020 to 2022. In this setup, each customer-supplier relationship i at time t is an observation, and the variables are defined as follows:

- ΔESG_{it+1}^{S} is the change in a supplier's ESG score in the year $t+1$ in a relationship i.

- $\Delta ESG_{it+1}^{S\_ind}$ is the change in an average ESG score of the supplier's industry in the year $t+1$ in a relationship i, and β_1 represents the effect of an improvement in industry-average ESG performance on that of individual firms.

- $\Delta rESG_{it}^{C}$ is the change in customer's ESG score in the previous year (i.e. year t) in a relationship i. Lagged term is chosen to address the potential issue of reverse causality. The coefficient, β_2, measures the effect from corresponding customers.

- Z_{it}^{S} is a vector of control variables pertinent to suppliers that may affect their ESG performance, including total revenue, net income margin and sales growth. ε_{it} is an error term.

More importantly, we introduce an independent variable, $DC\_gap_{it}^{C,S}$, representing the balance of market power in a given customer-supplier relationship i at time t in our regression. We conjecture that a firm's market power depends on the diversity of procurement/sales options. For example, a monopsony usually has a stronger market power and determines its trading rules with suppliers. To gauge this market power effect on ESG practice transmission, degree centrality is chosen as the proxy measure.[4] The differential of degree centralities (i.e. customer in-degree centrality minus supplier out-degree centrality) represents the difference between the number of alternative suppliers

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[2] S&P Capital IQ provides the bilateral trade relationships between firms. Nevertheless, it does not contain other trade information (e.g. types of goods trading and quantity of purchase) for each trade relationship.

[3] Given that not all firms provide comprehensive ESG metrics in their financial statements, Trucost also provides the modelled ESG scores based on the firm's peer ESG performance. However, we consider that the modelled scores might not reflect the actual firm performance and could cause biased estimation, so we do not include them in our dataset.

[4] In the field of network analysis, other centrality measures (e.g. betweenness centrality, PageRank centrality, etc.) can also serve as indicators in measuring the importance of a firm within a GVC network. In practice, however, firms are unlikely to have complete information of the GVC network to compute these centrality measures. On the contrary, firms may have a good understanding of their immediate counterparties (i.e. suppliers and customers). Therefore, degree centrality, which focuses on the number of linkages of neighbourhood nodes only, is considered an appropriate proxy for firms in their ranking assessment.

and the number of alternative customers in a relationship.[5] We standardise this differential as $DC\_gap_{it}^{C,S}$, and a higher value means a higher market power of the customer, relative to its supplier, and vice versa.

III. EMPIRICAL RESULTS

3.1 ESG ripple effects in the GVC network

The regression results of Equation (1) are presented in Table 1. As shown in Column 1 of β_2 coefficient, customers' ESG improvement has a positive and statistically significant impact on their suppliers' ESG scores. One possible explanation is that customers may exert pressure on their suppliers to improve their ESG performance when they have stepped on a sustainable pathway. The β_1 coefficient is also positive and statistically significant, implying that an industry-wide improvement in ESG standards would incentivise a firm to enhance its ESG performance. As many suppliers are the customers of other firms in a GVC network, these positive ESG impacts would spread to other GVC firms and generate a positive ripple effect.

Apart from the influences from the customers and peers, our result also indicates suppliers' ESG performance can be affected by the customers' market power. As indicated by β_3, a larger centrality difference between customers and suppliers would lead to an additional positive impact on supplier's ESG scores. It may reflect the fact that customers can enforce stricter ESG requirements or expectations on their suppliers by leveraging their market power.[6] To allow for the possibility that ESG diffusion from customers to suppliers also depends on the former's market power, we include a cross-term of customers' ESG scores and centrality differential, yet the coefficient (β_4) is statistically insignificant.

To check the robustness of our results, we present the winsorised results at 1st to 99th quantile to mitigate the outliners' effect. We also re-estimate Equation (1) with a balanced panel sample. The sample requires a relationship to be present in both 2020 and 2021. The result is presented in Column 2 to 4 of

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[5] Taking the simple GVC network in Chart 1 as an example, Firm 5 and 6 is a pair of customer-supplier relationship. Firm 5 (as a customer) has an in-degree centrality of 3 as it has three incoming edges from Firm 3, Firm 4 and Firm 6. On the other hand, Firm 6 (as a supplier), having two customers — Firm 5 and Firm 7, has an out-degree centrality of 2. If we compare the market power between Firm 5 and Firm 6 by using their differential of degree centralities (i.e. 3-2=1), Firm 5 has relatively more market power than Firm 6.

[6] According to the survey conducted by Economic Impact (2022), over half of the multinational corporates in the food and beverage and textiles and apparel sectors follow ESG-compliant sourcing practices when locating local suppliers.

Table 1. Overall, all of the key coefficients in Equation (1) remains positive and within a satisfactory significant level. From this point onward, we only present results based on winsorised data to mitigate the impact of outliners.

Table 1: Baseline model estimation and robustness tests

	Full sample (N=9,199)		Balanced sample (N=5,600)	
	(1) Not winsorised	(2) Winsorised	(3) Not winsorised	(4) Winsorised
Dependent variable	ΔESG_{it+1}^S			
Change in ESG scores of supplier's industry ($\boldsymbol{\beta_1}$)	0.6316*** (0.0616)	0.6423*** (0.0598)	0.7340*** (0.0772)	0.7195*** (0.0758)
Lag of change in ESG scores of customer ($\boldsymbol{\beta_2}$)	0.0222** (0.0095)	0.0249** (0.0098)	0.0234** (0.0117)	0.0207* (0.0119)
Lag of standardized centrality differential ($\boldsymbol{\beta_3}$)	0.0231*** (0.0065)	0.0225*** (0.0063)	0.0225** (0.0089)	0.0209** (0.0087)
Cross term of change in ESG scores of customer and centrality differential ($\boldsymbol{\beta_4}$)	0.0011 (0.0008)	0.0015 (0.0010)	0.0014 (0.0012)	0.0018 (0.0014)
Adjusted R-squared	0.0293	0.0302	0.0368	0.0359

Note: N stands for the total number of observations for each specification. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: HKMA staff estimation.

3.2 ESG ripple effects along cross-border and domestic supply chains

We further examine how the ESG ripple effect differs in cross-border versus domestic supply chains, by dividing our customer-supplier pairs into two subsamples: cross-border and domestic supply chain.[7] In addition, we replace the changes of overall ESG scores (ΔESG_{it+1}) in Equation (1) by its components: environmental (ΔE_{it+1}), social (ΔS_{it+1}), and governance (ΔG_{it+1}) scores on both sides. This enables us to identify which ESG components are more relevant to the cross-border and domestic supply chains respectively.

Table 2A summarises the regression results on the cross-border supply chains for each ESG component. We find that the environmental performance of suppliers is positively correlated with their cross-border customers, as indicated

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[7] Specifically, a trade relationship is considered as domestic when the headquarters of both supplier and customer are within the same jurisdiction, otherwise it would be considered as cross-border.

by the positive and significant coefficient β_2 in the first column. It aligns with the fact that environmental issues, such as raw material sourcing and carbon footprint, are more relevant in cross-border supply chains. Moreover, the environmental standards and regulations vary across regions, and customer firms might need to implement the highest standard of environmental protocols across the border of supply chains. It creates an opportunity for suppliers, particularly for those located in regions with loose regulations, to improve their environmental performance. Similar to the baseline estimation in Table 1, the suppliers' environmental scores are also positively influenced by their peers' environmental performance and the customers' market power, as shown by the coefficients β_2 and β_3 in the first column respectively. Meanwhile, we do not find conclusive evidence of spillover effects from customers to suppliers regarding the social and governance aspects of ESG.

Table 2A: Estimation of cross-border subsample with ESG components

	Cross-border customer-supplier relationship (N=5,798)		
Dependent variable	(1) ΔE_{it+1}^{S}	(2) ΔS_{it+1}^{S}	(3) ΔG_{it+1}^{S}
Change in ESG scores of supplier's industry ($\boldsymbol{\beta_1}$)	1.1736*** (0.0777)	0.8558*** (0.0701)	0.9901*** (0.0682)
Lag of change in ESG scores of customer ($\boldsymbol{\beta_2}$)	0.0272** (0.0138)	0.0146 (0.0153)	0.0063 (0.0136)
Lag of standardized centrality differential ($\boldsymbol{\beta_3}$)	0.0131*** (0.0034)	-0.0047 (0.0029)	0.0077** (0.0031)
Cross term of change in ESG scores of customer and centrality differential ($\boldsymbol{\beta_4}$)	0.0010 (0.0011)	0.0016 (0.0014)	0.0003 (0.0012)
Adjusted R-squared	0.0609	0.0543	0.124

Note: N stands for the total number of observations for each specification. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: HKMA staff estimation.

On the other hand, within domestic supply chains, customers' social performance tends to have a spillover effect on their suppliers, as indicated by the positive and significant coefficient β_2 in the second column of Table 2B. The potential reason could be that social issues, such as labour rights and work safety, are often geolocation-specific and sensitive to cultural norms. The discrediting of social issues can be widespread nationally through the local media, and damage the reputation and legitimacy of the firms involved. Similar to the

baseline estimation in Table 1, the practice of industrial peers also contributes to the improvement of suppliers' social scores, as indicated by the positive and significant coefficient β_1 in second column of Table 2B. On the other hand, we do not find conclusive evidence of spillover effects from customers to suppliers regarding the environmental and governance aspects of ESG.

Table 2B: Estimation of domestic subsample with ESG components

Dependent variable	Domestic customer-supplier relationship (N=3,401)		
	(1) ΔE_{it+1}^{S}	(2) ΔS_{it+1}^{S}	(3) ΔG_{it+1}^{S}
Change in ESG scores of supplier's industry (β_1)	1.0302*** (0.1115)	0.7027*** (0.0822)	0.5897*** (0.0714)
Lag of change in ESG scores of customer (β_2)	0.0074 (0.0159)	0.0400** (0.0170)	0.0212 (0.0161)
Lag of standardized centrality differential (β_3)	0.0201*** (0.0058)	-0.0013 (0.0044)	0.0136*** (0.0039)
Cross term of change in ESG scores of customer and centrality differential (β_4)	0.0015 (0.0019)	0.0004 (0.0021)	0.0005 (0.0015)
Adjusted R-squared	0.0452	0.0603	0.0827

Note: N stands for the total number of observations for each specification. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: HKMA staff estimation.

3.3   Impact of sustainable finance through GVC network

Sustainable financing (e.g. ESG bonds) is an innovative financial instrument that incentivises firms to expedite their green and sustainable transition. As far as green bonds are concerned, Chen et al. (2023) highlight that internal attention and external supervision act as dual reinforcing mechanisms for firms to enhance their green performance after issuing green bonds. Internally, green bond issuers tend to integrate green practices into their business operation, spurred by heightened ESG awareness after the bond issuance. Externally, these bond issuers are obligated to prepare sustainability reports and undergo regular assessments by external rating agencies. Any discrepancies in green practices will be documented and potentially have a negative impact on their future green financing activities. As green bonds are considered as a subset of ESG bonds, similar reinforcement mechanism should apply on ESG bond issuers.

To bolster ESG performance, ESG bond issuers may impose a higher ESG standard on their suppliers. For example, they might require the raw material suppliers to adopt greener production process or obtain specific green certificates. Such requirements would pressure upstream firms to enhance their ESG practices, thereby generating a positive ripple effect throughout the supply chain. To unveil this effect, we expand our baseline model to examine the potential impact of sustainable finance from customers to suppliers. A dummy variable of ESG bond outstanding issuance, $D_{it}^{C,S}$, is incorporated as an additional independent variable in Equation (2):

$$\Delta ESG_{it+1}^{S} = \beta_0 + \beta_1 \Delta ESG_{it+1}^{S_{ind}} + \beta_{2a} \Delta rESG_{it}^{C} + \beta_{2b} \Delta rESG_{it}^{C} \times D_{it}^{C,S}$$

$$+ \beta_3 DC\_gap_{it}^{C,S} + \beta_4 \Delta rESG_{it}^{C} \times DC\_gap_{it}^{C,S} + \beta_5 Z_{it}^{S} + \varepsilon_{it} \qquad (2)$$

For a pair of customer-supplier relationship i, $D_{it}^{C,S}$ is set to 1 if the customer has an outstanding ESG bond issuance at time t while the supplier does not.[8] For customers who have outstanding ESG bond issuance, the overall impact of ESG score on suppliers would be captured by $\beta_{2a} + \beta_{2b}$, and β_{2b} denotes the additional ripple impact from ESG bond issuance. We anticipate that the estimate of β_{2b} is positive if the ripple effect exists. The ESG bond issuance dataset is compiled from bond issuance records through various financial data service providers [9], following the construction methodology of green bond dataset introduced by Lau et al. (2022).

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[8] This condition can ensure that the change in ESG score of suppliers is driven by the ripple effect of ESG bond issuance from customers, not by the impact of own issuance. As a robustness check, we re-estimate (2) by relaxing the definition of $D_{it}^{C,S}$ to only consider the customer side, and the result are similar.

[9] It includes Bloomberg, Refinitiv, Dealogic and Climate Bond Initiative.

Table 3: Estimation of extended model with outstanding ESG bond issuance

	(1) Full sample (N=9,234)	(2) Cross-border (N=5,821)	(3) Domestic (N=3,413)
Dependent variable	ΔESG^{S}_{it+1}		
Change in ESG scores of supplier's industry ($\boldsymbol{\beta_1}$)	0.6377*** (0.0599)	0.7261*** (0.0798)	0.5020*** (0.0894)
Lag of change in ESG scores of customer ($\boldsymbol{\beta_{2a}}$)	0.0211** (0.0102)	0.0094 (0.0133)	0.0377** (0.0162)
Lag of change in ESG scores of customer dummy of customers with outstanding ESG bond ($\boldsymbol{\beta_{2b}}$)	0.0587* (0.0327)	0.0835** (0.0402)	0.0179 (0.0588)
Lag of standardized centrality differential ($\boldsymbol{\beta_3}$)	0.0222*** (0.0063)	0.0170** (0.0076)	0.0357*** (0.0114)
Cross term of change in ESG scores of customer and centrality differential ($\boldsymbol{\beta_4}$)	0.0012 (0.0010)	0.0013 (0.0012)	0.0013 (0.0019)
Adjusted R-squared	0.0304	0.0419	0.0163

Note: N stands for the total number of observations for each specification. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.
Source: HKMA staff estimation.

Table 3 presents our estimations of Equation (2). The estimation for cross-border supply chains (Column 2) indicates that β_{2b} was positive and statistically significant, and the combined coefficient is also larger than the baseline estimates (i.e. β_2) in Table 1, suggesting that customers with ESG bond financing apparently have an additional positive influence on suppliers' ESG practices. That said, the coefficient was insignificant for the estimation in domestic supply chains (Column 3), which may be attributed to the lower significance in full sample estimation (Column 1) compared to the cross-border sample estimation (Column 2).

The variation of significance between domestic and cross-border supply chain estimations is likely attributed to the distribution of ESG bond issuance across industries. Chart 3 shows the ESG bond issuers by industries in 2021, and nearly half of them belong to the semiconductor and automobile sectors, which are highly specialised and extensively present in the cross-border supply chain. To visualise the concentration of ESG bond issuers, we map the ESG bond issuers as green nodes into a network graph (Chart 4). The majority of firm connections with ESG bond financing (coloured edges) were concentrated in semiconductor and automobile sectors, while limited connections are found in customer-supplier pairs beyond these two industries.

This disparity helps explain the more pronounced impact of ESG bond financing in the cross-border supply chain, compared to the domestic supply chain.
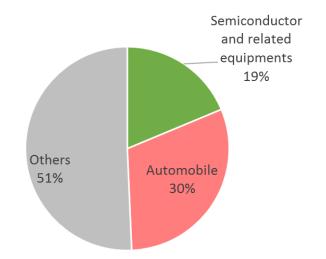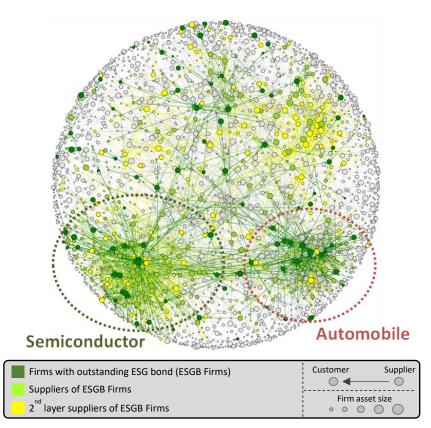
Chart 3: ESG bond issuers by industry in 2021

Sources: Capital IQ, Bloomberg, Refinitiv, Dealogic, Climate Bond Initiative, and HKMA staff estimation.

Chart 4: Customer-supplier connections of ESG bond financing in 2021

Note: The circles' labels represent the industries of majority firms in the clusters. Some of the firms within the circles may not belong to the labelled industries.

Sources: Capital IQ, Bloomberg, Refinitiv, Dealogic, Climate Bond Initiative, and HKMA staff estimation.

Theoretically, the positive ESG ripple effect should extend to all firms that are connected with the ESG bond issuers when the trade relationships are stable over time. The cohort chart (Chart 5) tracks the changes in ESG scores from 2020 to 2022 for ESG bond issuers, their suppliers and the second layer of suppliers. Compared with the industrial average, GVC-linked firms that are exposed to ESG bond financing, on average, show greater improvement in ESG performance in each cohort year. In particular, the positive differential of ESG scores narrowed from ESG bond issuers to their second-layer suppliers, indicating the diminishing positive ripple effect during the transmission. It provides evidence that ESG bond financing can enhance other firms' ESG practice extensively, particularly those GVC-linked firms that are unable to access sustainable finance.

Chart 5: ESG performance of GVC firms between 2020 and 2022

Sources: Capital IQ, Bloomberg, Refinitiv, Dealogic, Climate Bond Initiative, and HKMA staff estimation.

IV. POLICY IMPLICATIONS

To mobilise capital into sustainable development projects, central banks are endorsing various sustainable finance initiatives. Our findings suggest that expanding the inclusiveness of sustainable finance to downstream firms within GVCs (i.e. customers) could amplify the positive ESG ripple effects. However, the ESG bond financing coverage among GVC firms is still currently limited in scope. As shown in Chart 6, the overall share of listed GVC firms with ESG bond outstanding (green bar) in 2021 is predominantly large corporates (according to their asset sizes).

That said, this does not mean that the overall impact of sustainable finance on GVC-linked firms is limited. The indirect ESG influence on the other

upstream firms (e.g. suppliers and second layer of suppliers) is also substantial. Policymakers should, therefore, focus on encouraging large corporates to issue ESG bonds and broadening the reach of sustainable financing. Indeed, the HKMA has established Green and Sustainable Finance Grant Scheme in 2021[10], designed to facilitate eligible firms to issue ESG bonds in Hong Kong.
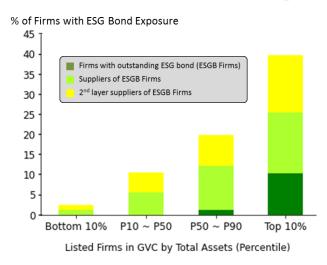
Chart 6: Share of listed firms with ESG bond exposure in 2021

% of Firms with ESG Bond Exposure

Legend:
- Firms with outstanding ESG bond (ESGB Firms)
- Suppliers of ESGB Firms
- 2nd layer suppliers of ESGB Firms

Listed Firms in GVC by Total Assets (Percentile)

Sources: Capital IQ, Bloomberg, Refinitiv, Dealogic, Climate Bond Initiative, and HKMA staff estimation.

On the other hand, small-and-medium enterprises (SMEs) face more challenges in accessing sustainable finance, particularly in the ESG bond market. Most of the sustainable finance, including ESG bonds and loans, require a sustainability assessment by external rating agencies and regular review to verify alignment with ESG targets. Unlike large corporates, many SMEs do not have resources for sustainable rating, and they are challenged by the minimum amount of ESG bond issuance.[11]

Nevertheless, sustainable finance can be made more accessible to SMEs through existing financial services. Our research suggests that SMEs with a large customer base, who are actively improving their ESG practices, are more likely to enhance their own ESG performance. Financial institutions may use SMEs' customer information (e.g. company names, sales revenue and ESG scores) as a complementary information in sustainability assessment. It would

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[10] The Green and Sustainable Finance Grant Scheme is a three-year programme announced in the 2021-22 Budget by the HKSAR Government, aimed at supporting green and sustainable bond issuance and lending in Hong Kong. The Scheme, which is managed by the HKMA, provides subsidies for eligible bond issuers and loan borrowers to cover their expenses on bond issuance and external review services.
[11] For example, green bonds are typically issued for $10 million to $100 million in the US, according to information from the US Department of Energy.

help to narrow the data gap in vetting SMEs eligibility for sustainable finance and lower the reporting cost.

In this aspect, central banks can facilitate financial institutions setting up a platform to seamlessly access SMEs' customer information. In Hong Kong, financial institutions can gather SMEs' business information through Commercial Data Interchange[12], which is a one-stop data platform to exchange SMEs' data with consent. Financial institutions can assess SMEs eligibility with the help of their customers' business relationships and ESG performance, and design suitable financial products (e.g. loans or credit lines) for eligible SMEs.

V. CONCLUSION

Our study finds positive ESG ripple effects from industrial peers and customers to suppliers within the GVC network. In other words, an improvement in customers/peers' ESG practices would enhance their suppliers' ESG performance. This effect would be more pronounced when the customers have a stronger market power, represented by the differential of degree centralities in a customer-supplier relationship. Specific channels of ESG practice transmission are also identified in our study. In particular, the spillover effects are significant for the environmental performance component in cross-border supply chains, while the social practice dimension experiences a significant spillover effects in domestic supply chains.

With sustainable finance gaining prevalence globally, our study shows that customers with outstanding ESG bond financing apparently have an additional positive influence on suppliers' ESG practices in the cross-border supply chain. It underscores the role of sustainable finance in amplifying the positive ESG ripple effects. To foster the effects and contribute to a more sustainable and climate-resilient world, central banks could take steps to promote greater inclusiveness of sustainable finance among large corporates and SMEs.

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[12] Commercial Data Interchange, which was launched in October 2022 by the HKMA, is a next-generation financial data infrastructure that aims to enable more efficient financial intermediation in the banking system and enhance financial inclusion in Hong Kong. With the consent of SMEs, their digital footprints, including e-trade declaration, e-commerce, supply chain, payment and credit reference data, can be exchanged with financial institutions at this data platform.

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