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Using Network Analysis to understand RCEP member positions in intra-RCEP trade and FDI

Faith TAN

Thi Hang BANH

Taojun XIE

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Using Network Analysis to understand RCEP member positions in intra-RCEP trade and FDI

Faith Tan, Banh Thi Hang, Xie Taojun[1]

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Abstract

With the significance of trade and FDI among RCEP economies, an in-depth understanding of the previous and current landscapes of the intra-RCEP networks lays a foundation for insights on the potential impacts of the agreement on regional trade and investment patterns.

This study employs network analysis to discern the positions held by RCEP member countries within the intricate web of intra-RCEP trade and FDI flows, with the objective of identifying key players, intermediaries, and relationships within the bloc. Sourcing trade and FDI flows data from BACI and Orbis; the research covers the time periods 1995 to 2021 for trade and 2013 to 2022 for FDI flows. Network analysis is applied to annual trade and FDI flows data to reveal network shifts over time.

We find that Japan initially occupied the central role in both the trade and FDI flow networks. China overtakes Japan to become the centre of the intra-RCEP trade network, while South Korea and Vietnam emerge as key figures within the intra-RCEP FDI flows network. These findings illuminate the evolving dynamics of the RCEP members' trade and investment networks. The shifts in critical figures of RCEP's trade and FDI flow networks have significant implications for understanding the region's changing relationships and the RCEP agreement's potential outcomes.

Keywords: RCEP, trade, foreign direct investment flows, network analysis, network centrality

[1] Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy, National University of Singapore. Faith Tan: faitht98@nus.edu.sg, Banh Thi Hang: hangbanh@nus.edu.sg, Xie Taojun: tjxie@nus.edu.sg

1. Introduction

As economic collaboration and integration become increasingly crucial for the prosperity of regions, the Regional Comprehensive Economic Partnership (RCEP) Agreement marks a significant step forward. Being considered the largest Free Trade Agreement (FTA), RCEP comprises 15 countries,[2] aiming to enhance economic ties and foster a beneficial partnership by expanding upon the pre-existing ASEAN Plus One FTAs (Ministry of Trade and Industry Singapore, n.d.). The legal text of the RCEP agreement encompasses a wide-ranging legal framework, including both trade and foreign direct investment (FDI) (ADB, 2022), emphasising the importance of these sectors in the RCEP economies.

The RCEP's considerable economic size underlines its importance, with its member countries collectively constituting 30% of global trade, 16% of global FDI stock and 24% of global FDI inflows (ADB, 2022). Notably, 50% of total RCEP trade comprised intra-RCEP trade, totalling 13% of global trade in goods in 2019 (Nicita et al., 2021), while intra-RCEP FDI flows account for 30% of the total FDI in the bloc (ADB, 2022). These figures not only illustrate the RCEP's dominance as a trading bloc but also underscore the intricate economic interdependencies that exist within its membership. The changes in the global trade network and the existing FTAs among RCEP member countries before RCEP came into force necessitate a comprehensive analysis of the intra-RCEP trade and investment interactions to provide a foundational understanding of the region's existing dynamics.[3] With the members comprising a significant portion of the global trade and FDI, identifying and understanding the intra-RCEP trade and FDI flow landscape can yield further insights into the main drivers and relationships contributing to the intricacies of the pre-existing economic interactions within the region.

Applying the network analysis method to the BACI-CEPII trade data and Orbis Crossborder investment data, we aim to map out and unravel the intricate patterns of trade and investment among RCEP members over time.[4] The study utilises the centrality measures, namely degree, weighted betweenness, and weighted closeness centrality, in the network analysis framework to identify the key players, intermediaries, and pivotal relationships within the RCEP. The construction and analysis of the network and graphs employ the R programming language (R Core Team, 2021) and the igraph package (Csardi & Nepusz, 2006). By comparing trade and FDI networks across different time periods, this study aims to trace the evolution of economic linkages within the RCEP, offering insights into the shifting landscape of regional trade and investment. The findings of this study will lay a groundwork for further exploration, aiming to contribute to the ongoing dialogue on economic integration and cooperation within the RCEP.

The rest of the paper is structured as follows. The methodological section comprises a thorough discussion of the data and variables used, paired with a step-by-step outline of the

[2] The 15 countries consist of, in alphabetical order, Australia, Brunei Darussalam (henceforth referred to as Brunei), Cambodia, China, Indonesia, Japan, Lao People's Democratic Republic (Laos), Malaysia, Myanmar, New Zealand, Philippines, Republic of Korea (South Korea), Singapore, Thailand, Vietnam.

[3] The RCEP FTAs consist of the ASEAN (AFTA), ASEAN-Australia-New Zealand (AANZFTA), ASEAN-China, ASEAN-Japan and ASEAN-Republic of Korea FTAs.

[4] Literature on the application of network analysis to study economics is widely available. For examples of international trade network analysis, see Schiavo et al. (2010) and De Benedictis & Tajoli (2011). For FDI, see Lima et al. (2020) and Kubelec & Sá (2010).

construction procedure of the network graphs. Subsequently, the "Deciphering the Network Graphs" section details the comprehension of each network graph, its centrality measures and other indicators. The ensuing discussion encompasses an elaboration on the findings of each graph, with a discussion of the trade graphs of 1995, 2010 and 2021 and FDI flow graphs for the years 2013, 2019 and 2022.[5] A comparison between the aforementioned time periods for each measure follows, supported by a detailed analysis of the intra-RCEP trade and FDI centres and a discussion of the linkages between the centrality measures. The report concludes with a comprehensive summarisation and discussion of future research opportunities.

2. Methodology

2.1. Data and the Proximity Measure

2.1.1. Data Sources

This study employs the BACI trade data from 1995 to 2021 and the Orbis FDI flows data spanning the time period 2013 to 2022. The BACI dataset consists of bilateral trade flow data for 200 countries at the "Harmonized System" product level (Gaulier & Zignago, 2010). The Orbis Crossborder Investment database contains bilateral FDI flow data at the project level (Bureau van Dijk, n.d.-b). In line with the scope of this paper, the data is aggregated at a yearly frequency for individual countries to allow for a more encompassing examination of the trends within the RCEP networks. Appendices A and B provide further insight into both data sets' data landscape and coverage.

2.1.2. Proximity Measure

To measure the strength of the connections between the RCEP members, we follow the research conducted by Lima et al. (2020) and adopt a proximity measure to assess the connection of each pair of countries. This further aggregates the data to a single annual bilateral trade or FDI flow value, which can be deployed in our analysis. Following this, a similar assumption must be made: the strength of the relationship of each country pair is directly proportional to the volume of trade, or FDI flows between the two countries, i.e., a higher annual bilateral value signifies a more robust relationship between the country pair. The formula of the proximity measure is as follows:

$$\Phi_{ij,k} = \frac{1}{|f_{ij,k}| + |f_{ji,k}|}$$

where $|f_{ij,k}|$ represents the inward trade volume or FDI inflows from country i to country j, for the year k, and $|f_{ji,k}|$ represents the inward trade volume or FDI inflows from country j to country i, for the year k (Lima et al., 2020).

Then, by definition, as the yearly proximity measure is derived from the inverse of the cumulative sum of bilateral trade or FDI flows between a pair of RCEP members, it can be deduced that a smaller proximity measure corresponds to a stronger relationship between the pair in that year.

[5] Due to a lack of data, Brunei is not present in the assessment of the 2019 FDI flows network and graph, while Brunei and Myanmar are not present in the assessment of the 2022 FDI flows network and graph.

2.2. Construction of the Network Graphs

The formulation of a network graph necessitates considering various dimensions of presentation, such as the network layout, edge lengths, and widths. Given the intention to signify the proximity measure through edge lengths to show the connections between the RCEP members, identifying a suitable layout to accommodate the various networks proved arduous. Consequently, a systematic approach to constructing the graphs was formulated. To derive the graphs for each year, the following procedure was executed:

1. Construction of the Minimum Spanning Tree
2. Finalization of the Network Layout
3. Incorporation of Secondary Lines

Each step will be covered in more detail in the sections below.

2.2.1. Construction of the Minimum Spanning Tree

To represent the most significant relationship pertinent to each intra-RCEP network member, we derive a minimum spanning tree (MST) from the original network. An MST is a network consisting of the most crucial connections that link all members (vertices), minimizing the total weight while ensuring all members are connected without any loops. In specific terms, an MST with n members will have n-1 connections (Prim, 1957). In other words, the MST helps simplify a complex network of relationships by connecting all members through the most significant and efficient pathways.

Prim's algorithm facilitates the generation of the MST, with the aforementioned proximity measures serving as the edge weights. The algorithm first selects an arbitrary starting vertex to serve as the initial base for the MST construction. From this vertex, the algorithm evaluates which edge of the starting vertex has the lowest weight. The identified edge and newly connected vertex are added to the existing graph if it does not produce a loop. This iterative procedure of edge selection continues until all the vertices are present in the network (Prim, 1957; Dutta et al., 2014). As such, under the assumption of no duplicate edge weights in the network, Prim's algorithm produces the same MST, regardless of the selected starting vertex, due to its "greedy" nature. This ensures we obtain a consistent composition of the MST structure.

Regardless, the resulting visualisation of the MST is insufficient to fulfil the main objectives. Hence, further steps are incorporated to better the network graph.

2.2.2. Finalization of the Network Layout

The objectives of establishing a presentable layout are straightforward: to use the edge lengths to represent the proximity measures and the vertex sizes to present the members' total volume of intra-RCEP bilateral trade or FDI flows. The latter allows for the network graphs to hold additional supplementary information. Upon the generation of the MST, a central vertex – the vertex with the most direct connections – is identified to serve as the foundation for the network.

Due to the non-uniform distribution of the proximity measures in the data, directly using these values as edge lengths poses a difficult task. Consequently, a scaling measure is

applied to the values, ensuring the visibility of the differences of the values within the graph. The coordinates of the remaining vertices are then calculated, taking the coordinates of the central vertex as the starting point. The vertex sizes present an identical issue and are scaled accordingly.

The resulting MST fulfils the objectives, resulting in a more visually accurate representation of the structure of the MST.

2.2.3. Incorporation of Secondary Lines

Despite the representation of the most vital relationships on the MST, many prominent underlying relationships within the intra-RCEP networks are omitted. Hence, this step aims to integrate this information into the existing network structure.

However, an additional challenge is presented in pursuing this aim: adding multiple new lines onto the MST with distance-accurate edge lengths violates several foundational distance inequalities, such as the triangle inequality (Hosch, n.d.). Instead of a partial inclusion or complete exclusion of this valuable information, we firmly establish that the edge lengths of the non-MST lines indicate the presence of a relationship between two members, and the respective edge lengths should not be used to determine the strength of this tie.

Consequently, the non-MST proximity values are identified and added to the existing graph to highlight significant underlying relationships within the intra-RCEP network. The combined span of the proximity values with values smaller than the median proximity measure value and all the MST values are designated as the "median level".[6] The entire span of the proximity values, including MST and non-MST proximity values, are identified as the "full network level".

Upon completion of this step, the establishment of the network graph is complete.

3. Deciphering the Network Graphs

In this section, a detailed explanation of the discernible features of the network graphs is presented. Within each network graph, multiple features represent a multitude of information. Each graph is distinctly specific to the context of either bilateral total trade or FDI flows and its year. Within the context of the paper, the terminologies "vertex", "node", and "RCEP member" are used interchangeably, as are the terms "proximity measure", "edge weight", and "edge length" synonymous. The two-digit ISO country codes identify the RCEP member and its corresponding node.

3.1. Edge Colours, Edge Lengths and Vertex Sizes

A metric in the graph that warrants observation is the colours of the edges. The edges encompassing the structure of the MST are black, while the dark grey edges consist of the non-MST median level proximity measures. The light grey edges depicted in the graph represent the values that lie within the network, which are part of neither the MST nor the median level.

Another trait of the network graph is the edge lengths of the black MST lines, which indicate the bilateral trade volume between that pair of members. However, as previously

[6] The proximity measures are inversely proportional to the volume of bilateral trade or FDI flows between the pair of members. Hence, the smaller values are more significant.

outlined, the edge lengths of the non-MST lines should not be considered when analysing the graph due to the methodology of their inclusion.

An additional discernible characteristic is the size of the vertex. Notably, larger vertices correspond to a greater volume of a member's total intra-RCEP bilateral trade or FDI flows.

3.2. Centrality Measures

This paper focuses on examining three distinct centrality measures: degree, betweenness and closeness centrality. At all levels, both the betweenness and closeness centrality measures have been weighted using the proximity measures as the edge weights, which ensures a more precise evaluation of the centrality of the vertices. Despite this, the weightage of the edges is not visually represented in the non-MST lines in the graph but is accounted for in the computation of the centrality measures. Each centrality measure can be interpreted similarly: the larger the value of the centrality measure, the more important a vertex is within the network.

Furthermore, the centralities can be discerned at three levels: the MST, median, and full network. In the context of the MST level, if a member attains a higher centrality value, that member has a greater relative significance in the strongest relationships and can be a hub within the RCEP network. Conversely, for the median, a member is more prominent within the network's underlying moderately strong relationships if it holds a higher centrality value. At the full network level, the RCEP member is central to the entire RCEP network.

With weighted centralities, if a member possesses the highest centrality at the MST level but not at the median or full network level, it can be concluded that the member does not maintain the same influence in the underlying connections as it does in the MST. Alternatively, if the member obtains the highest centrality at all three levels, the member's presence in the network is significant.

3.2.1. Degree Centrality

Degree centrality (often referred to as "degree") refers to the number of direct connections a member has with other members in the RCEP network, where a direct connection is established when the shortest path between two members includes only them, without any other members in between (Zhang & Luo, 2017). The more direct connections a member has (i.e., a high degree centrality), the more active they are considered within the network, potentially indicating a trade/investment hub within the network.

We calculate degree centrality at different levels. The MST level focuses on the most essential connections within the network. A member with the highest degree centrality at the MST level has the greatest volume of direct connections among the strongest trade/investment relationships within RCEP. At the median network level, this indicates a member has a high count of direct moderately strong intra-RCEP relationships. However, assessing the degree centrality rank at the full network level does not yield additional insights into the significance of a member in the intra-RCEP network because all RCEP members are connected, resulting in similar or identical values.[7]

[7] In the case of complete data availability for all RCEP members, this value is $n - 1 = 14$, where $n = 15$ is the number of RCEP members. A value of less than 14 would indicate either missing data or a lack of connection. However, inferring either of the outcomes directly from the data is not feasible.

3.2.2. Betweenness Centrality

Betweenness centrality measures how often a member (vertex) lies on the shortest path between two other members (vertices) in the network (Lima et al., 2020). A member (vertex) with high betweenness centrality is considered more critical because it plays a role as an important intermediary where trade/investment is more likely to flow through them when connecting other members through the shortest paths. A country with a higher betweenness centrality at the MST level indicates a closer trade relationship between the country and the central members of the RCEP network. At the median level, the RCEP party has a more significant intermediary role among the moderately strong relationships in the network. A higher betweenness in the full network underscores the member's importance as an intermediary within the entire RCEP network.

3.2.3. Closeness Centrality

Closeness centrality measures a vertex's closeness to other vertices in the network, i.e., it measures the total distance from other nodes to a given node (Marsden, 2005). This measure reflects how "close" a member is to all other members in the network. A higher closeness centrality indicates a member has a shorter average distance to all other members, suggesting the stronger the member's relationship with other RCEP members. The prominence of this value at the MST level implies that a member is very well-connected to others within the most robust intra-RCEP relationships. A high closeness value within the scope of the median level indicates that a member has deeper connections in the intra-RCEP moderate relationships. At the full network level, a higher closeness suggests more significant ties with fellow members within the network as a whole.

3.2.4. Links between Centrality Measures at the MST level

By definition, each centrality measure quantifies a different aspect of a node's prominence in the network. Nevertheless, the centrality measures used in this analysis have similar dependencies – the number of connections (trade or FDI relationships) and the edge weights (volume of bilateral trade or FDI flows) between them. Assessing the relationship between these variables in the context of the intra-RCEP trade networks could provide further insight into the interpretability of these centrality measures and the networks themselves.[8]

Scatterplots detailing each pair of centrality measures at the MST level, namely, degree-betweenness, degree-closeness, and betweenness-closeness, were plotted for trade and FDI flows.[9] A linear and quadratic best-fit line was introduced to determine if there is a relationship between the centrality measures.

4. Discussion of the Network Graphs

Within this segment, an in-depth analysis of the network graphs and the network's centrality measures is conducted, detailing the inferred observations of each time period using the

[8] A significant volume of literature on the correlation between centrality measures across varying networks is widely available. For examples, see Oldham et al. (2019), Valente et al. (2008), Li et al. (2015), etc.

[9] Due to the inherent nature of the MST, there are a significant number of observations with the minimum value across both centrality measures. These are removed to facilitate better understanding of the relationships.

previously outlined measures. This allows the formation of a foundation to discern intra-RCEP relationships. Following the discussion of the individual graphs, a comparative examination across the span of all periods follows, allowing the visualisation of how the key figures holding positions of importance have shifted over time.

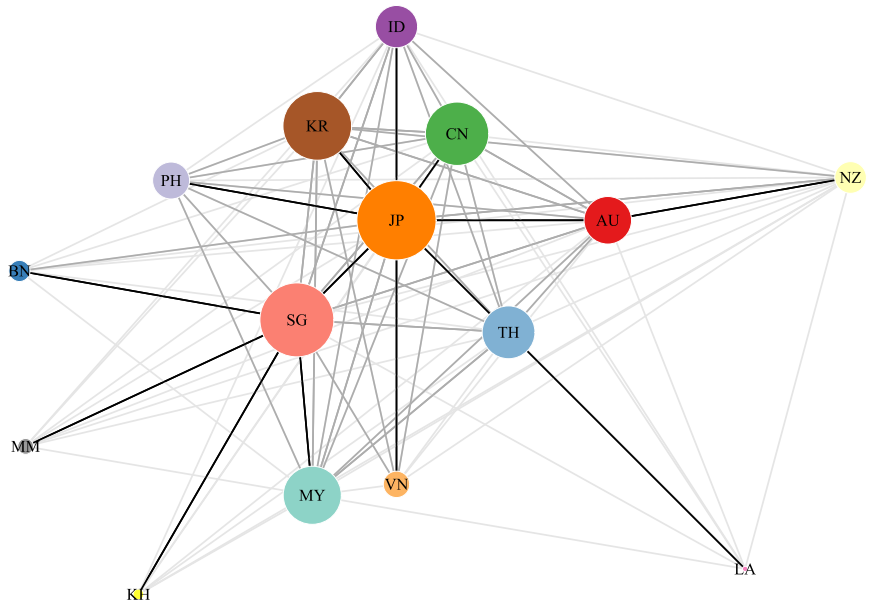
The data spans 1995 to 2021 for trade and 2013 to 2022 for FDI flows. The first and last years of available data and a relative midpoint year are selected for detailed analysis to visualise the most drastic changes over time.

4.1. Trade Network Graphs

4.1.1. The Intra-RCEP Trade Network in 1995

Given Japan's status as one of the top traders in the world in 1995 (World Integrated Trade Solution, n.d.-d), it is unsurprising that in Figure 1, Japan has the largest vertex size, signifying its role in fostering the most intra-RCEP bilateral total trade in 1995. Of note is Japan's connections with Australia, China, Singapore, and South Korea that lie within the MST, as these members reside among Japan's top export and import partners (World Integrated Trade Solution, n.d.-c).[10][11] Furthermore, the China-Japan pair emerges with the shortest edge length within the MST, aligning with their position as the most prolific bilateral trade partners within RCEP.

Figure 1: *Network graph of intra-RCEP bilateral total trade in 1995*



Source*: Authors' computation using BACI data.*
Note*: The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

Table 1: *Top 3 of the Centrality Measures of the 1995 intra-RCEP Trade Network*

Centrality	Rank

[10] Namely, in 1995, South Korea and Singapore were among the top five countries to which Japan exported, while China, South Korea and Australia were among the top five countries from which Japan imported goods.
[11] While "Other Asia, nes" (not elsewhere specified) is among Japan's top exporters, the breakdown of countries is not available.

		1	2	3
MST	Degree	Japan	Singapore	Australia, Thailand
	Betweenness	Japan	Singapore	Australia, Thailand
	Closeness	Japan	Singapore	China
Median	Degree	Singapore	Japan	Korea
	Betweenness	Japan	Singapore	Australia, Thailand
	Closeness	Japan	Singapore	China
Full Network	Betweenness	Japan	Singapore	Australia, Thailand
	Closeness	Japan	Singapore	China

Source*: Authors' computation using BACI data.*

From Table 1, an examination of the centrality measures within the network underscores Japan's remarkable centrality. Japan attains the highest degree in the MST, indicating its pronounced volume of direct connectivity within the strongest intra-RCEP relationships. Conversely, in the context of the median level, Singapore holds the greatest degree centrality, a phenomenon that underscores its extensive direct ties, particularly with fellow ASEAN members.

Japan's notable prominence becomes apparent through the attainment of the highest betweenness centrality values for the MST, median and the full network. Holding this position highlights Japan's role as an intermediary, facilitating connections within the relationships among RCEP members. Upon further examination of the closeness centralities, Japan, Singapore and China's strong ties with other RCEP members are revealed. These three members obtain the greatest closeness centralities throughout, accentuating the depth and strength of their associations within the intra-RCEP network.

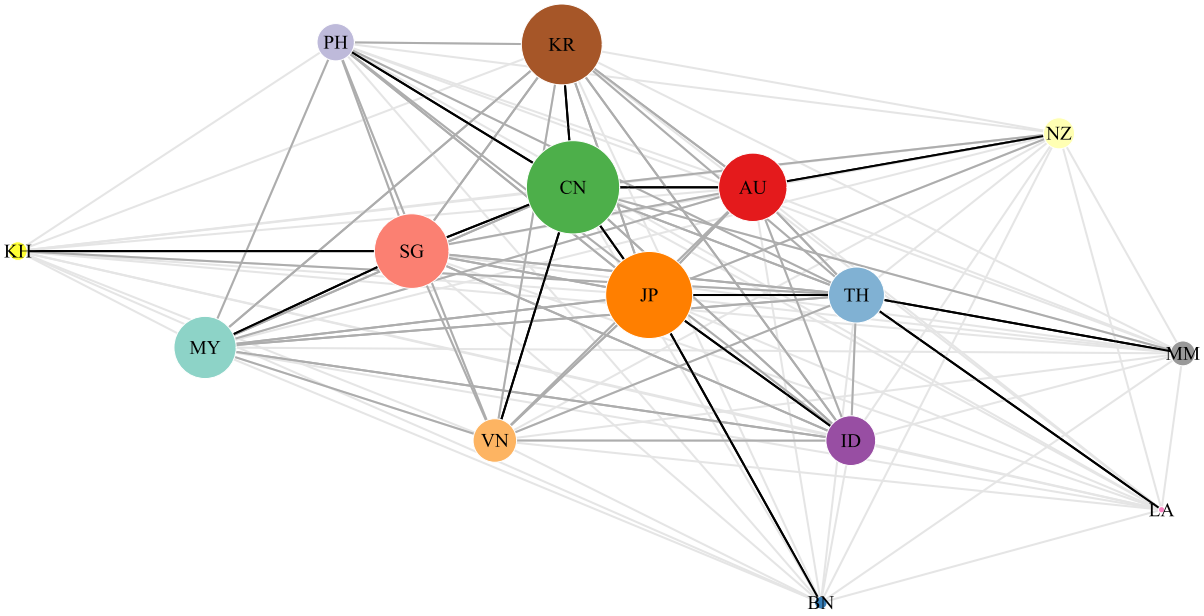
Examining the ranks of the members within the intra-RCEP 1995 trade network illuminates Japan and Singapore's pivotal roles as trade epicentres, with the two parties attaining recurring high positions across the centrality measures.

4.1.2. The Intra-RCEP Trade Network in 2010

With China's rise as one of the top global traders in 2010 (World Integrated Trade Solution, n.d.-e), we observe a shift in the largest vertex size. As seen in Figure 2, compared to 1995, in 2010, China has the largest vertex size, with Japan following closely behind, having the second largest vertex. This indicates China's ability to foster the most significant bilateral trade in the intra-RCEP 2010 trade network, supported by China's prominent trade relationships with Japan and South Korea (World Integrated Trade Solution, n.d.-a).[12][13] The China-Japan pair maintains its position with the shortest edge length within the MST as the intra-RCEP pair with the most significant volume of bilateral total trade.

Figure 2*: Network graph of intra-RCEP bilateral total trade in 2010*

[12] In 2010, both Japan and South Korea were among both China's top importers and exporters.
[13] While "Other Asia, nes" (not elsewhere specified) is among China's top importers, the breakdown of countries is not available.



Source*: Authors' computation using BACI data.*
Note*: The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

Table 2*: Top 3 of the Centrality Measures of the 2010 intra-RCEP Trade Network*

Centrality		Rank		
		1	**2**	**3**
MST	Degree	China	Japan	Singapore, Thailand
	Betweenness	China	Japan	Singapore, Thailand
	Closeness	China	Japan	Korea
Median	Degree	Thailand	China, Japan	Singapore
	Betweenness	China	Japan	Thailand
	Closeness	China	Japan	Korea
Full Network	Betweenness	China	Japan	Thailand
	Closeness	China	Japan	Korea

Source*: Authors' computation using BACI data.*

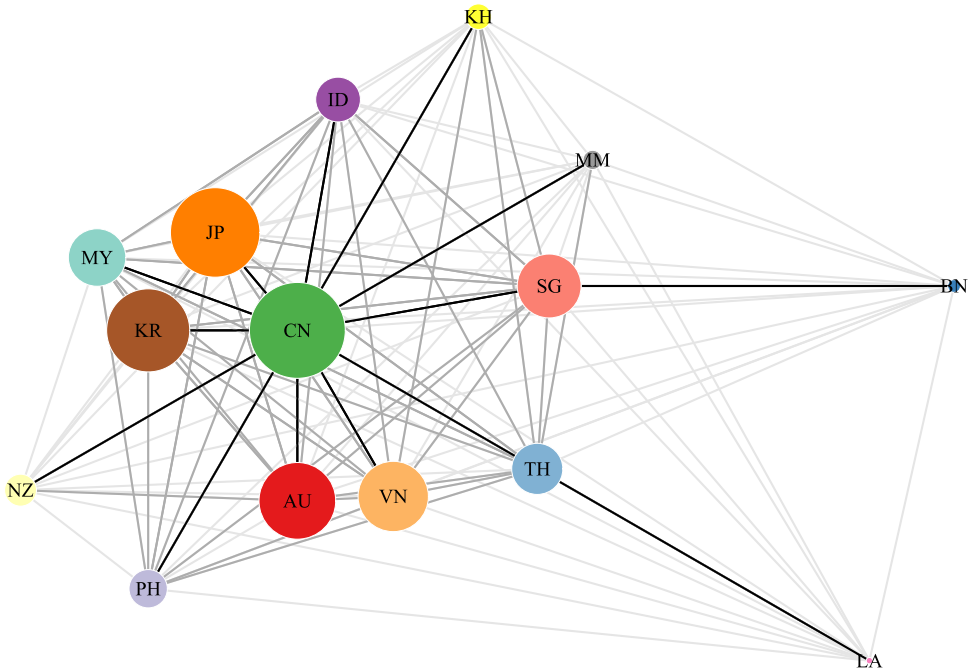
When further examining the centrality measures, China's rise to prominence in the intra-RCEP trade network of 2010 is visible. China holds the highest degree in the MST, highlighting the volume of its direct connections within the strongest intra-RCEP relationships. Interestingly, Thailand obtained this position for the median, illuminating its numerous direct connections with other RCEP members within moderately strong relationships.

China's position as a prominent intermediary for the intra-RCEP relationships is evident from its betweenness centrality values for the MST, median level and full network. Hence, it can be inferred that China facilitated many connections within the intra-RCEP trade network in 2010. The depth of China's, Japan's, and South Korea's ties with the other members of RCEP are illuminated, as the three members have the greatest closeness centralities throughout all levels.

From a rank-wise perspective, China is revealed to hold a pivotal role in the 2010 intra-RCEP trade network, followed closely by Japan, with both parties holding recurring high positions throughout the MST and the full network for all centrality measures. In addition, Thailand is well connected in the network with a significant number of connections.

4.1.3. The Intra-RCEP Trade Network in 2021

Figure 3: *Network graph of intra-RCEP bilateral total trade in 2021*



Source*: Authors' computation using BACI data.*
Note*: The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

In 2021, China maintains its position as the member with the largest vertex size, while the China-Japan pair still holds the shortest edge length within the MST. Hence, China was able to foster the highest volume of bilateral trade in the intra-RCEP network in 2021 and have the greatest bilateral trade with Japan out of all pairwise combinations of the RCEP members. Notably, China is the most vital trading partner for all other RCEP members, barring Brunei and Laos. It has significant trade with Australia, Japan, South Korea and Vietnam (World Integrated Trade Solution, n.d.-b).[14]

Table 3 further proves China's remarkable importance within the 2021 intra-RCEP trade network. Holding the highest degree in the MST, China has a volume of strong, direct connections. However, China shares this position with Thailand at the median level, magnifying Thailand's many underlying direct connections within the intra-RCEP network.

[14] While Other Asia, nes (not elsewhere specified) is among China's top importers, the breakdown of countries is not available.

Table 3: *Top 3 of the Centrality Measures of the 2021 intra-RCEP Trade Network*

Centrality		Rank		
		1	2	3
MST	Degree	China	Singapore, Thailand	Other RCEP members[15]
	Betweenness	China	Singapore, Thailand	Other RCEP members
	Closeness	China	Japan	Korea
Median	Degree	China, Thailand	Singapore	Vietnam
	Betweenness	China	Singapore, Thailand	Other RCEP members
	Closeness	China	Japan	Korea
Full Network	Betweenness	China	Singapore, Thailand	Other RCEP members
	Closeness	China	Japan	Korea

Source*: Authors' computation using BACI data.*

By attaining the greatest betweenness centrality at all levels, China's significance as an intermediary in RCEP is outlined, with Singapore and Thailand following behind. The occurrence of the other RCEP members holding the third rank in betweenness centrality is worth highlighting. This is mainly due to the many direct connections between China and the other RCEP members. From the MST in Figure 3, it can be observed that China was the trading partner with the highest bilateral trade volume with 12 of the remaining 14 RCEP countries.

Compared to 2010, China, Japan and South Korea retain their positions as the members with the most substantial intra-RCEP ties as a whole. This is unsurprising, given the strength of China's ties with Japan and South Korea.

Upon further examining the centrality measure ranks, China stands out with the recurring highest positions through all the centrality measures. While not as significantly important as China, Singapore and Thailand prove to be well-connected and influential intermediaries within the network. Japan also has relatively close ties to other members of the intra-RCEP network.

4.1.4. Time Comparison of the Trade Networks

Table 4 illuminates Japan's dominance in the intra-RCEP trade network in 1995, with Japan holding most of the positions of importance. This link shifted in 2010, with China overtaking Japan to become RCEP's leading trade centre. It maintained this role in 2021, with China holding all positions of importance. While Singapore was notably the most well-connected at the median level in 1995, Thailand took this role in 2010. It shared this position with China in 2021, allowing for the inference that China's intra-RCEP relationships became more prominent in 2021.

Although the shift in the trade centre of RCEP from Japan to China is reflected throughout the three specified periods, further exploration can reveal the exact year in which this transition began.

[15] In Table 3, "other RCEP members" refers to: Australia, Brunei, Cambodia, Indonesia, Japan, South Korea, Laos, Myanmar, Malaysia, New Zealand, Philippines, and Vietnam.

Table 4: *Time comparison of the top-ranked RCEP member(s) in the intra-RCEP trade networks*

Measure	1995	2010	2021
Largest Vertex	Japan	China	China
Shortest Edge Length	China-Japan	China-Japan	China-Japan
Degree Centrality (MST)	Japan	China	China
Degree Centrality (Median)	Singapore	Thailand	China, Thailand
Betweenness Centrality (MST)	Japan	China	China
Betweenness Centrality (Median)	Japan	China	China
Betweenness Centrality (Full Network)	Japan	China	China
Closeness Centrality (MST)	Japan	China	China
Closeness Centrality (Median)	Japan	China	China
Closeness Centrality (Full Network)	Japan	China	China

Source*: Authors' computation using BACI data.*

Table 5: *Time comparison of the top 1 RCEP member(s) in the intra-RCEP trade networks at the MST level*

Year	Degree	Betweenness	Closeness
1995	Japan	Japan	Japan
1996	Japan	Japan	Japan
1997	Japan	Japan	Japan
1998	Japan	Japan	Japan
1999	Japan	Japan	Japan
2000	Japan	Japan	Japan
2001	Japan	Japan	Japan
2002	Japan	Japan	Japan
2003	Japan	Japan	Japan
2004	Japan	Japan	Japan
2005	Japan	Japan	Japan
2006	Japan	Japan	Japan
2007	China	China	China
2008	China	Japan	Japan
2009	China	China	China
2010	China	China	China
2011	China	China	China
2012	China	China	China
2013	China	China	China
2014	China	China	China
2015	China	China	China
2016	China	China	China
2017	China	China	China
2018	China	China	China
2019	China	China	China
2020	China	China	China
2021	China	China	China

Source*: Authors' computation using BACI data.*

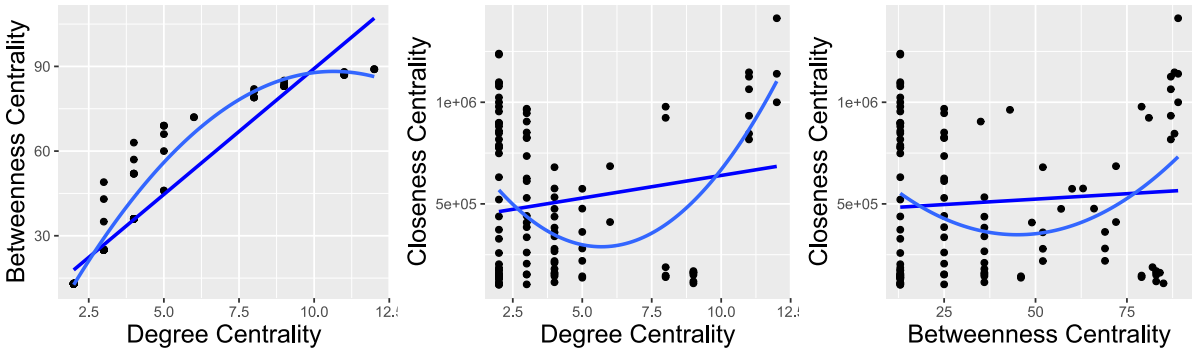
The transition of the trade centre in the intra-RCEP network from Japan to China began in 2007 when China obtained all positions of importance (Table 5). Despite China holding the highest degree centrality in 2008, Japan had the highest betweenness and closeness centrality. However, by 2009, China fully solidified itself as the intra-RCEP trade hub, holding this position until 2021.

This result is unsurprising, given China's ascent to the role of ASEAN's largest trading partner in 2009, a position it has held since then (The ASEAN Secretariat, n.d.). Despite the challenges of the COVID-19 pandemic, China was able to rebound from its effects in 2020 (OECD, 2022), allowing for its growth of exports of goods to ASEAN to be maintained from 2010 to 2021 (The ASEAN Secretariat, 2020; The ASEAN Secretariat, 2022).[16] Concurrently, ASEAN's exports of goods to China observed an increasing trend within the same time period (The ASEAN Secretariat, 2022), showcasing bilateral growth. This rise and its previously mentioned global trade prominence solidified China's network dominance in and after 2009.

A possible explanation for this phenomenon is China's intra-RCEP trade agreements, particularly with ASEAN. From 1995 to 2021, China entered into the ASEAN-China FTA (ACFTA) for trade in goods in 2005 (The ASEAN Secretariat, n.d.) and various bilateral FTAs with other RCEP members.[17][18] The ACFTA was found to have increased bilateral trade flows between ASEAN and China (Sheng et al., 2014), further driving trade growth between the two regions. While other intra-RCEP FTAs have been signed within the same time period,[19] the bilateral trade between ASEAN and the +1 countries has not changed as significantly as with China (The ASEAN Secretariat, 2020; The ASEAN Secretariat, 2022).

4.1.5 The Links Between Trade Centrality Measures

Figure 4: *Correlation plots of MST-level trade centrality measures with the best-fit linear and quadratic line*



Source*: Authors' computation using BACI data.*

The scatterplots in Figure 4 reveal the relationships between all pairs of centrality measures. Degree-betweenness displays a strong positive relationship, indicating that countries that are

[16] See Appendix A, Figures A1, A2 and A3 for additional information on the inflows and outflows of intra-RCEP trade in 1995, 2010 and 2021.
[17] As of 2021, China's bilateral FTA partners included Singapore, New Zealand and Australia.
[18] The ASEAN-China Free Trade Agreement (ACFTA) is also commonly referred to as the China-ASEAN Free Trade Agreement (CAFTA).
[19] For example, to name a few; the ASEAN-Australia-New Zealand FTA (AANZFTA), the ASEAN-Japan Comprehensive Economic Partnership (AJCEP), the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), etc.

intermediaries are likely to have multiple RCEP trading partners. As such, a country's status as an intermediary is an avenue for penetration into the intra-RCEP trade network.

Meanwhile, the degree-closeness relationship suggests that countries with a high degree centrality are somewhat likely to have a high closeness centrality. Hence, a country requires a higher number of trade relationships with other RCEP members before it is able to expand trade volumes with them.

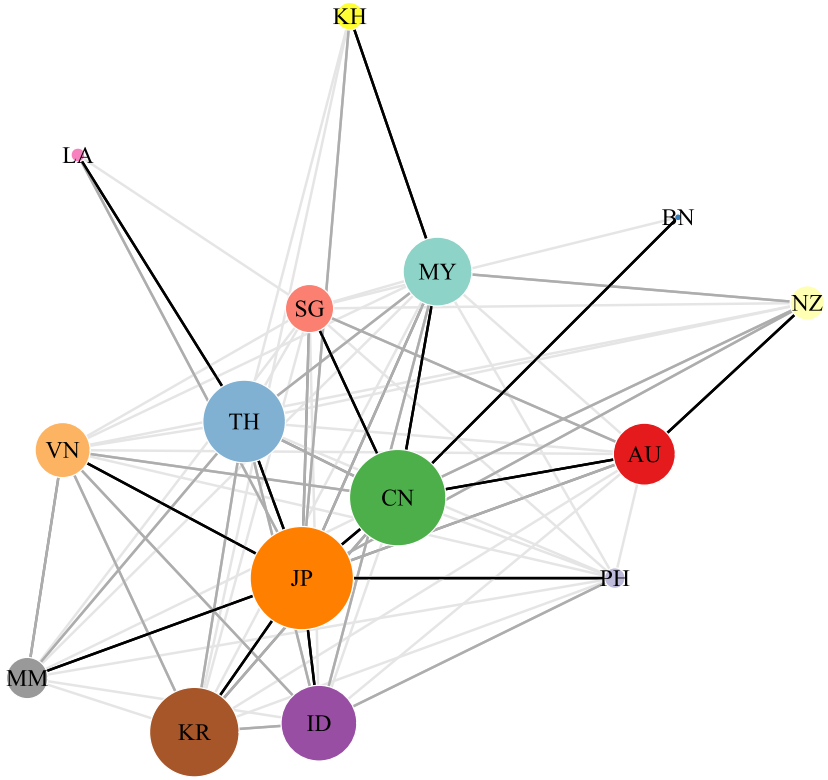
The relationship of betweenness and closeness centrality is weak. This reveals that countries that are prominent intermediaries may not necessarily be closely connected to other countries within RCEP. Given the overall structure of the MST, this result is unsurprising, as many nodes are often connected to only one or two other nodes.

4.2. FDI Flows Network Graphs

4.2.1. The Intra-RCEP FDI Flows Network in 2013

As seen in Figure 5, Japan's strength as the member facilitating the highest volume of bilateral FDI flows in 2013 shines through, having the largest vertex size in the network, with China following behind. The shortest edge length in the MST is between China and Japan, with this pair having the highest pairwise volume of bilateral FDI flows.

Figure 5: *Network graph of intra-RCEP bilateral FDI flows in 2013*



Source: *Authors' computation using Orbis data.*
Note: *The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

Table 6: *Top 3 of the Centrality Measures of the 2013 intra-RCEP FDI Flows Network*

Centrality		Rank		
		1	**2**	**3**
MST	Degree	Japan	China	Australia, Malaysia, Thailand
	Betweenness	Japan	China	Australia, Malaysia, Thailand
	Closeness	Japan	China	Indonesia
Median	Degree	Japan	China	Thailand
	Betweenness	China, Japan	Australia, Malaysia, Thailand	Other RCEP members[20]
	Closeness	Japan	China	Indonesia
Full Network	Betweenness	China, Japan	Australia, Malaysia, Thailand	Other RCEP members
	Closeness	Japan	China	Indonesia

Source*: Authors' computation using Orbis data.*

By examining the centrality measures in Table 6, Japan's importance in the intra-RCEP FDI flows network is accentuated. The volume and strength of Japan's intra-RCEP relationships are emphasised through its position as the RCEP member with the greatest degree and betweenness centralities throughout all levels, its strength as a well-connected member and intermediary within the network illuminated. Japan, China and Indonesia's ties with other RCEP members prove to be relatively strong, with these three members holding the highest closeness centralities.

In discussing the overall ranks within RCEP's FDI flows network in 2013, Japan stands out as the member with recurring top positions, followed by China. Both parties show strength across all the centrality measures, highlighting their prominence in the intra-RCEP FDI flows network. The reveal of Japan and China as central figures within the network is unsurprising. Aside from the significant FDI flows from Japan to China, these members were among the top 10 investors in ASEAN in 2013 (The ASEAN Secretariat & UNCTAD, 2014).

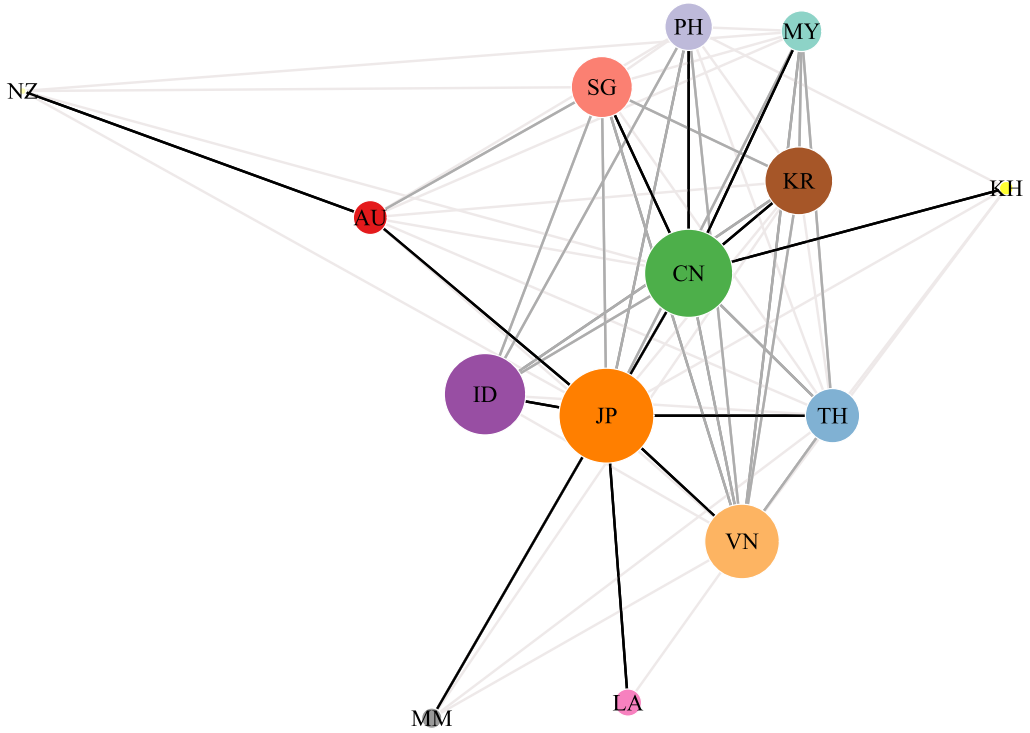
4.2.2. The Intra-RCEP FDI Flows Network in 2019

Table 7, assessing the centrality measures of the RCEP members, unveils Japan's significance in the intra-RCEP FDI flows network of 2019. Similar to 2013, Japan dominates the region, holding all the top positions of importance across all centrality measures. This indicates that Japan has a high volume of direct connections, is an important intermediary within the intra-RCEP FDI flows network and has strong ties with other RCEP members. China trails behind, consistently maintaining its second position through all the measures of importance.

Interestingly, Indonesia holds the third highest closeness centrality within the 2013 intra-RCEP FDI flows network, resulting from the high amount of FDI flows from Japan to Indonesia.

[20] In Table 6, "other RCEP members" refers to: Brunei, Cambodia, Indonesia, South Korea, Laos, Myanmar, New Zealand, Philippines, Singapore, and Vietnam.

Figure 6: *Network graph of intra-RCEP bilateral FDI flows in 2019*



Source: *Authors' computation using Orbis data.*
Note: *The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

Table 7: *Top 3 of the Centrality Measures of the 2019 intra-RCEP FDI Flows Network*

Centrality		Rank		
		1	2	3
MST	Degree	Japan	China	Australia
	Betweenness	Japan	China	Australia
	Closeness	Japan	China	Indonesia
Median	Degree	Japan	China	Vietnam
	Betweenness	Japan	China	Australia
	Closeness	Japan	China	Indonesia
Full Network	Betweenness	Japan	China	Other RCEP members[21]
	Closeness	Japan	China	Indonesia

Source: *Authors' computation using Orbis data.*

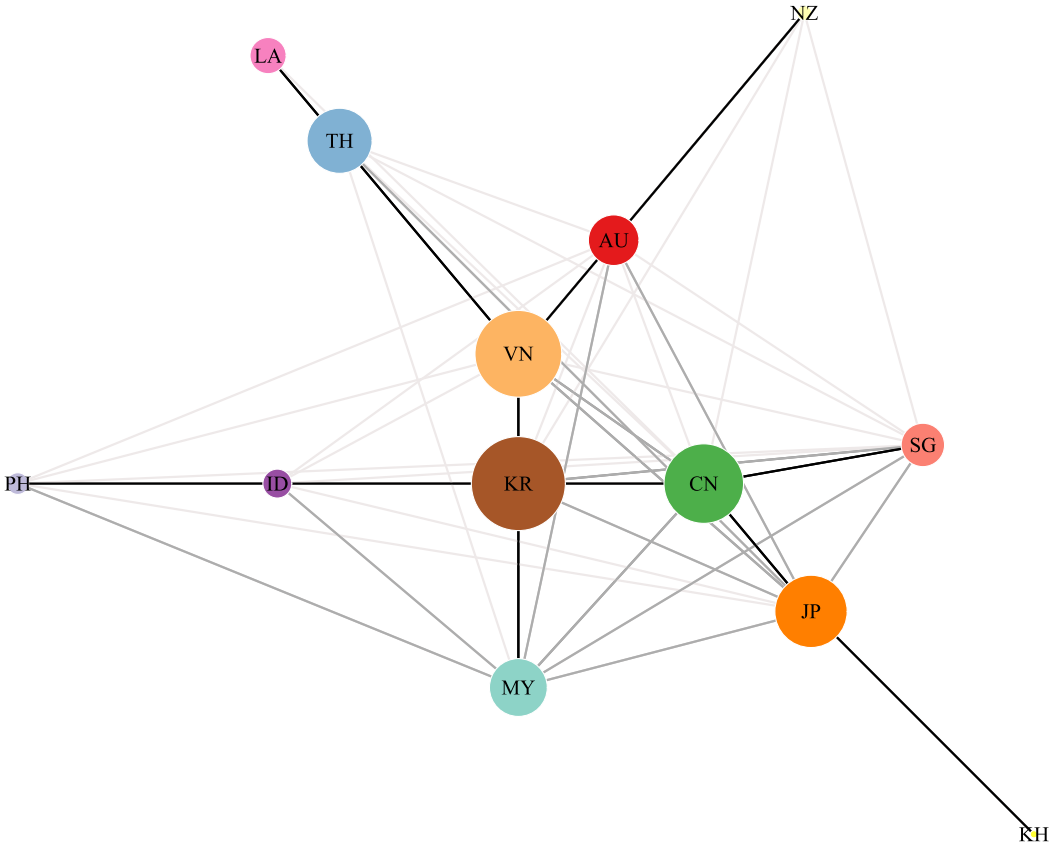
4.2.3. The Intra-RCEP FDI Flows Network in 2022

As seen in Figure 7, South Korea overtakes Japan to attain the largest vertex size, underscoring its ability to facilitate the largest intra-RCEP bilateral FDI flows in 2022. The shortest edge length is between Laos and Thailand, with the South Korea-Vietnam pair following behind.[22]

[21] In Table 7, "other RCEP members" refers to: Australia, Cambodia, Indonesia, South Korea, Laos, Myanmar, New Zealand, Philippines, Singapore, and Vietnam.
[22] Due to the size of South Korea and Vietnam's vertices, the KR-VN edge length appears to be shorter than the LA-TH edge.

This change is heavily influenced by South Korea's investment in Vietnam,[23] allowing the pair to rise as more influential figures in the network.

Figure 7: *Network graph of intra-RCEP bilateral FDI flows in 2022*



Source: *Authors' computation using Orbis data.*
Note: *The black, dark grey and light grey lines indicate the MST, median and full network levels, respectively.*

Table 8: *Top 3 of the Centrality Measures of the 2022 intra-RCEP FDI Flows Network*

Centrality		Rank		
		1	**2**	**3**
MST	Degree	South Korea	China, Vietnam	Australia, Indonesia, Japan, Thailand
	Betweenness	South Korea	Vietnam	China
	Closeness	South Korea	Vietnam	China
Median	Degree	Japan	Malaysia	South Korea
	Betweenness	Vietnam	South Korea	Australia, Indonesia, Japan, Thailand
	Closeness	Vietnam	South Korea	China
Full Network	Betweenness	Vietnam	South Korea	Australia, Indonesia, Japan, Thailand

[23] See Appendix A, Figure A6 for further information on the direction and volume of FDI flows between South Korea and Vietnam.

	Closeness	Vietnam	South Korea	China

Source*: Authors' computation using Orbis data.*

Upon a more thorough examination of the centrality measures, as seen in Figure 7, the rising importance of South Korea and Vietnam within the intra-RCEP FDI flows network is apparent. Notably, South Korea claims the highest degree centrality in the MST, accentuating the volume of its direct connections within the most robust intra-RCEP relationships. As observed in 2019, Japan retains this title at the median level in 2022, maintaining its strength as the RCEP member with the highest direct connections.

With high betweenness centrality positions, South Korea and Vietnam demonstrate proficiency as intermediaries throughout the intra-RCEP FDI flows network in 2022. While South Korea's prominence as an intermediary for the strongest intra-RCEP relationships is highlighted, Vietnam's strength in underlying relationships is seen. This pattern is observed in the closeness centrality, allowing for the inference that South Korea and Vietnam's ties with other RCEP members are relatively strong.

In contrast to the years 2013 and 2019, where a single member stood out as the most pivotal, the landscape of 2022 is not as straightforward to assess. The patterns of the FDI flows networks appear to be more sporadic, though this effect may be partially attributed to the post-pandemic effect of COVID-19. South Korea assumes greater significance in the most vital relationships, while Vietnam is more prominent in the underlying relationships within RCEP. Additionally, Japan showcases that it is well-connected to other members with moderately strong relationships in 2022.

4.2.4. Time Comparison of the FDI Flows Networks

Table 9*: Time comparison of the top-ranked RCEP member(s) in the intra-RCEP FDI flows networks*

Measure	2013	2019	2022
Largest Vertex	Japan	Japan	South Korea
Shortest Edge Length	China-Japan	Indonesia-Japan	Laos-Thailand
Degree Centrality (MST)	Japan	Japan	South Korea
Degree Centrality (Median)	Japan	Japan	Japan
Betweenness Centrality (MST)	Japan	Japan	South Korea
Betweenness Centrality (Median)	China, Japan	Japan	Vietnam
Betweenness Centrality (Full Network)	China, Japan	Japan	Vietnam
Closeness Centrality (MST)	Japan	Japan	South Korea
Closeness Centrality (Median)	Japan	Japan	Vietnam
Closeness Centrality (Full Network)	Japan	Japan	Vietnam

Source*: Authors' computation using Orbis data.*

Table 9 reveals Japan's pivotal role in the intra-RCEP FDI flows network in 2013 and 2019, with Japan holding all positions of importance throughout both years. However, this link shifted in 2022, with South Korea and Vietnam emerging as the most significant figures in the network, surpassing Japan. As previously mentioned, the link between South Korea and Vietnam is a huge driver of this change. South Korea is the largest source of FDI to Vietnam, with prominent South Korean firms pumping investment into Vietnam (Bao, 2022). Moreover, Vietnam also shows strong relationships with other RCEP members in 2022, particularly

Singapore and Japan (Ministry of Planning and Investment, 2022). This further establishes Vietnam's position as a key figure within the 2022 network. Overall, in 2022, South Korea is more vital toward the most robust relationships, while Vietnam's prominence in the underlying intra-RCEP relationships is evident. Nonetheless, Japan remains notably well-connected in 2022.

Table 10: *Time comparison of the top 1 RCEP member(s) in the intra-RCEP FDI networks at the MST level*

Year	Degree	Betweenness	Closeness
2013	Japan	Japan	Japan
2014	China	China	China
2015	Japan	Japan	Japan
2016	China	Japan	Japan
2017	China	China	China
2018	China	China	China
2019	Japan	Japan	Japan
2020	China	China	China
2021	China	China	China, South Korea
2022	South Korea	South Korea	South Korea

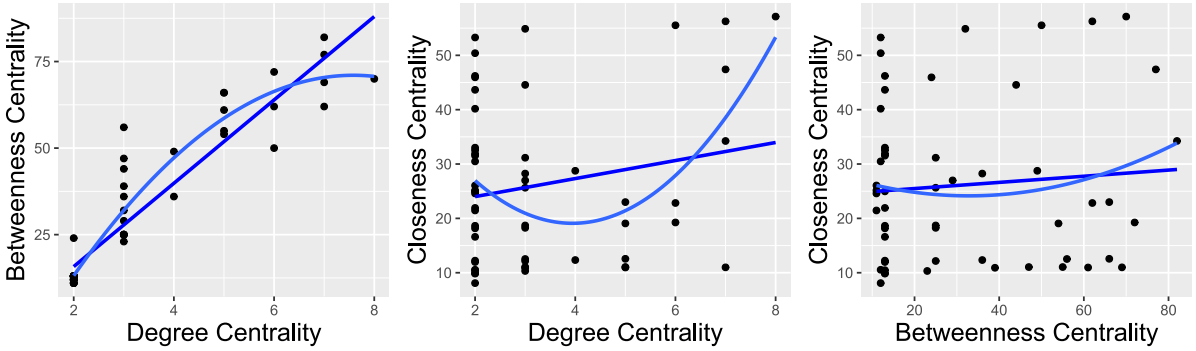
Source: *Authors' computation using Orbis data.*

The changes in the top-ranked RCEP members over time are interesting to observe. A periodic oscillation in the member with the highest centrality in the intra-RCEP network is revealed. In particular, Japan and China show alternating dominance as the FDI centre of RCEP. This pattern abruptly halts in 2022, when South Korea overtakes Japan and China to assume the role of the intra-RCEP FDI hub.

South Korea's first appearance as the RCEP member with the greatest closeness centrality in 2021 is of particular interest. This suggests the establishment of increased underlying FDI flows between South Korea and the other RCEP members, particularly with Vietnam and other ASEAN economies. The further development of these economic ties led to its prominence within the intra-RCEP FDI network in 2022.

4.2.5 The Links Between FDI Centrality Measures

Figure 9: *Correlation plots of MST-level FDI centrality measures with the best-fit linear and quadratic line*



Source: *Authors' computation using Orbis data.*

Figure 9 evidences the relationships between each pair of centrality measures. The results are similar to that of the trade centrality measures. Hence, we can make similar conclusions. Degree-betweenness showcases a strong positive relationship, allowing for the inference that being an intermediary in the intra-RCEP FDI landscape allows for penetration into the network. The FDI degree-closeness relationship suggests a moderate positive trend. As such, the expansion of FDI flows volumes to other RCEP countries requires a high number of pre-existing relationships. Once again, betweenness and closeness centralities have a weak relationship, indicating that countries that are prominent intermediaries may not be close to other RCEP countries as a whole.

5. Conclusion

The trajectory of the intra-RCEP trade network observed a shift in RCEP's trade centre over time. A deeper examination of the 1995 trade network revealed Japan as RCEP's trade centre, along with Singapore's prominence in intra-RCEP connections being illuminated. Singapore's close ties with other ASEAN members, such as Brunei and Malaysia, are noteworthy. Subsequently, upon examining the 2010 and 2021 networks, China overtook Japan as the trade centre within RCEP, corroborated by the centrality measures and other visual indicators. Thailand's connectivity within the intra-RCEP network is also unveiled by its high degree centrality.

In the landscape of the intra-RCEP FDI flow networks, Japan dominated the networks of 2013 and 2019, accentuating its prominence in both strong and underlying relationships. Within the 2022 network, South Korea and Vietnam's growing importance in the intra-RCEP FDI flows network is observed. South Korea is more vital for the strongest relationships, and Vietnam's important role in underlying relationships is evident. Interestingly, the Laos-Thailand pair held the highest pairwise bilateral FDI flows in 2022. Japan is still notably well-connected with other RCEP members, evidenced by its high degree centrality. To encapsulate the full extent of this shift, a subsequent study with both FDI flows and stock could provide further insights into the evolving dynamics of the intra-RCEP FDI networks.

Furthermore, when observing the weighted betweenness and closeness centrality measures at the median and full network levels, the difference in the members holding the top ranks is minimal. It can then be inferred that the proximity measures with values greater than the median have little effect on the respective centrality measures. Concerning trade, this phenomenon likely stems from the diverse trade flows in the RCEP bloc, where China, Japan and South Korea constitute almost 60% of trade in the region, and Brunei, Cambodia, and Laos comprise 1% (Nicita et al., 2021).

Looking forward, we identify several avenues for future research. Firstly, we aim to uncover the determinants of changes in the trade and FDI networks by assessing other factors and variables. Secondly, an in-depth inspection of the networks at an industrial or sectoral level can reveal additional insights into important figures in significant intra-RCEP industries, supply chains and specialisations or comparative advantages of the RCEP members. Lastly, though the paper's focus specified intra-RCEP relationships, the methodology can be expanded to include other significant economic partners of the RCEP members.

To conclude, overall, the positions of the RCEP members in both intra-RCEP trade and FDI flows have changed with time, with China's rise to prominence in intra-RCEP trade and

South Korea and Vietnam’s amplified significance as crucial figures within the intra-RCEP FDI flows network.

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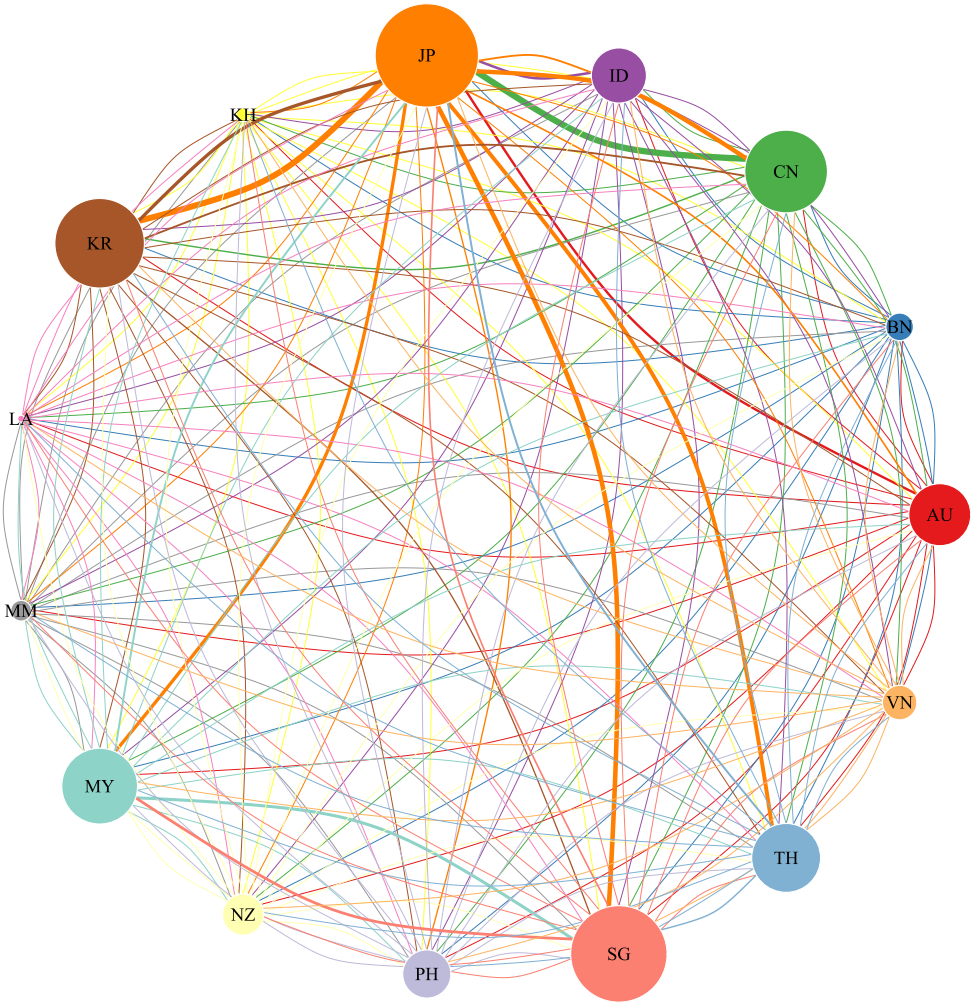
Appendix A

Intra-RCEP Trade and FDI Flows Plots

The appendix consists of supplementary network graphs that provide an in-depth visualisation of the raw data used in the study. The edge widths correspond to the volume of trade flow, while the edge colours reflect the country the flow originates from. The node size is proportional to the volume of total annual bilateral trade; hence, the larger the node, the greater the volume of total bilateral trade that country has for the year.

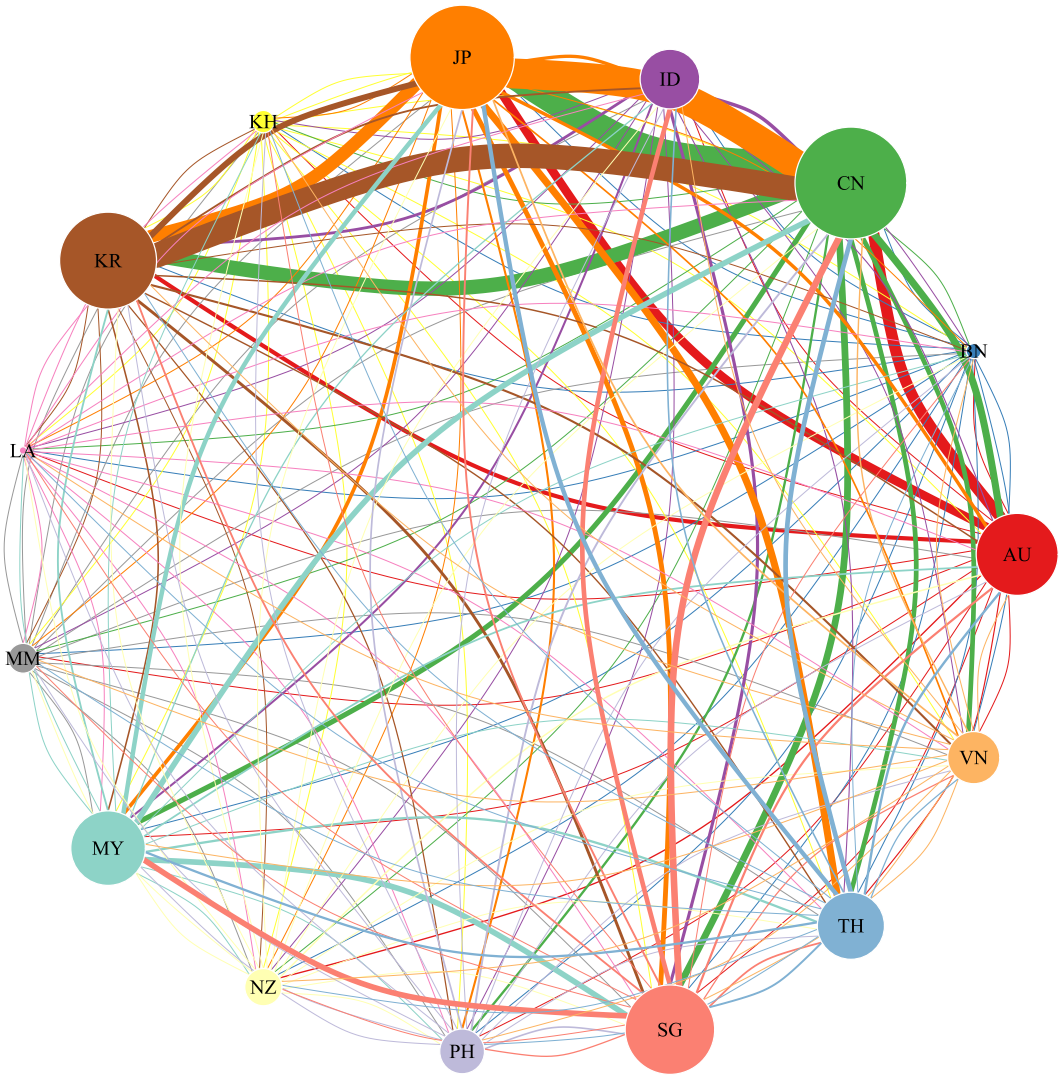
The graphs are comparable within the same measure, as the same scaling factor has been applied, i.e. a wider edge originating from Japan to China in the 2010 trade flows graph compared to the Japan-China edge in the 1995 graph allows for the inference that Japan's exports to China increased from 1995 to 2010.

Figure A1: *Intra-RCEP Trade Flows for the year 1995*



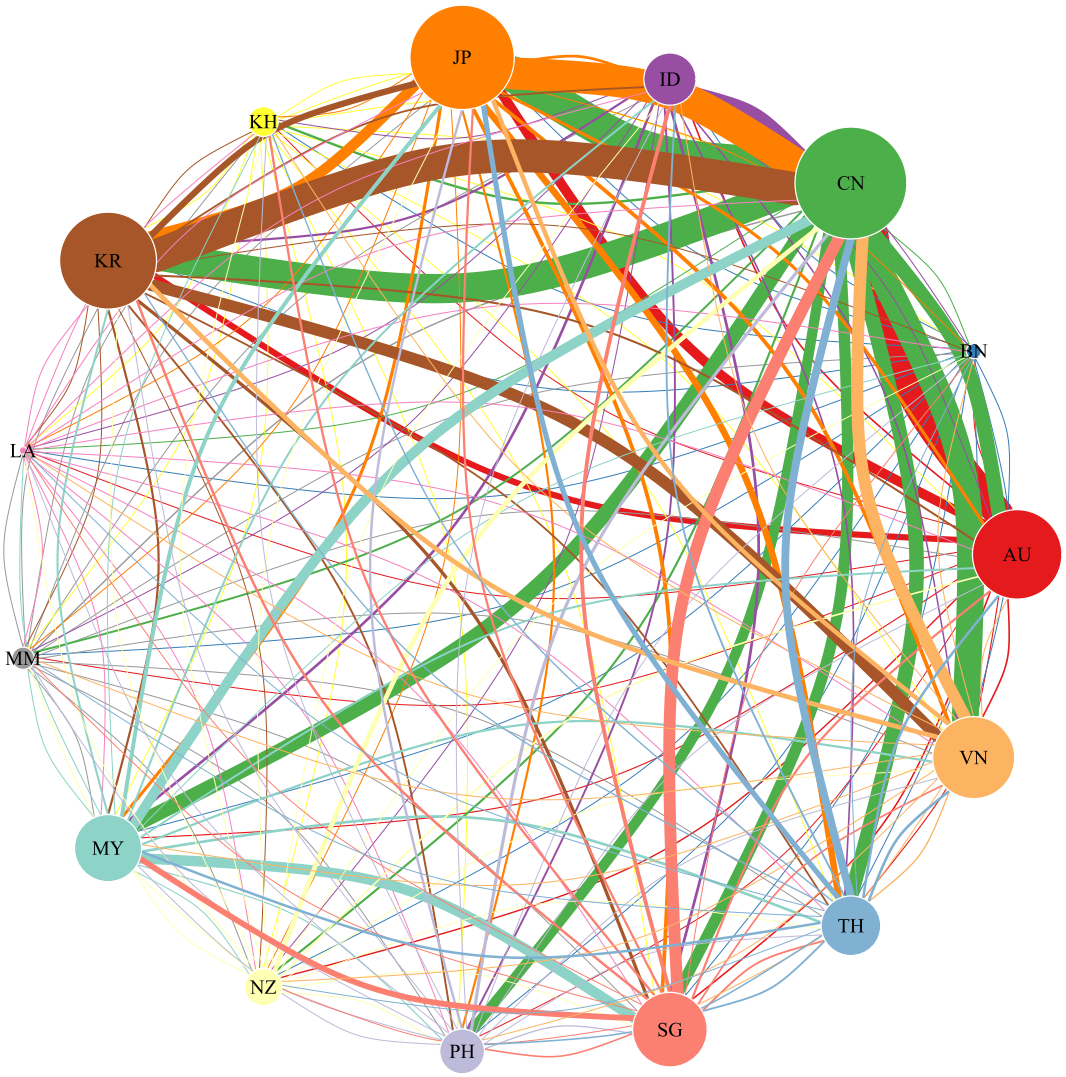
Source: *Authors' computation using BACI data.*

Figure A2: *Intra-RCEP Trade Flows for the year 2010*



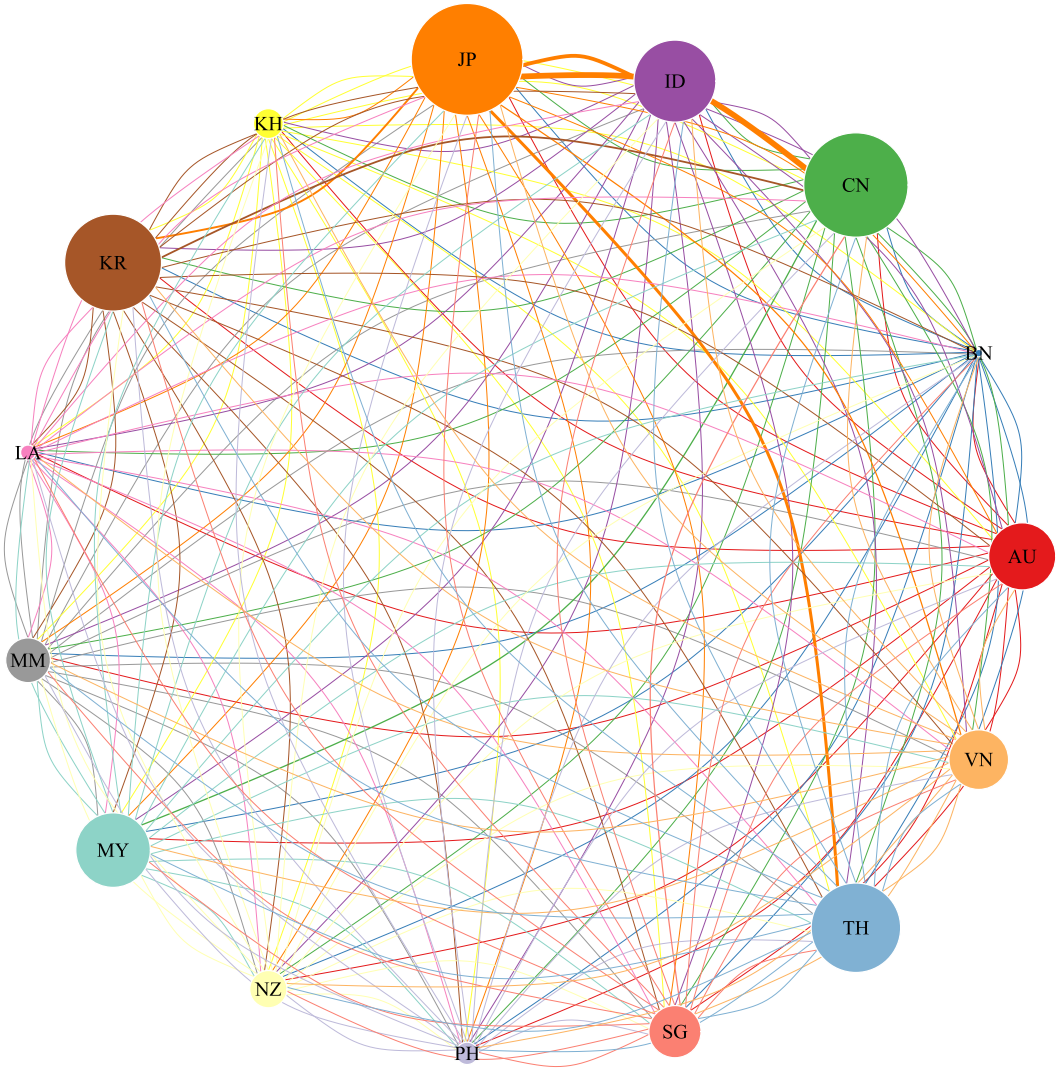
Source*: Authors' computation using BACI data.*

Figure A3: *Intra-RCEP Trade Flows for the year 2021*



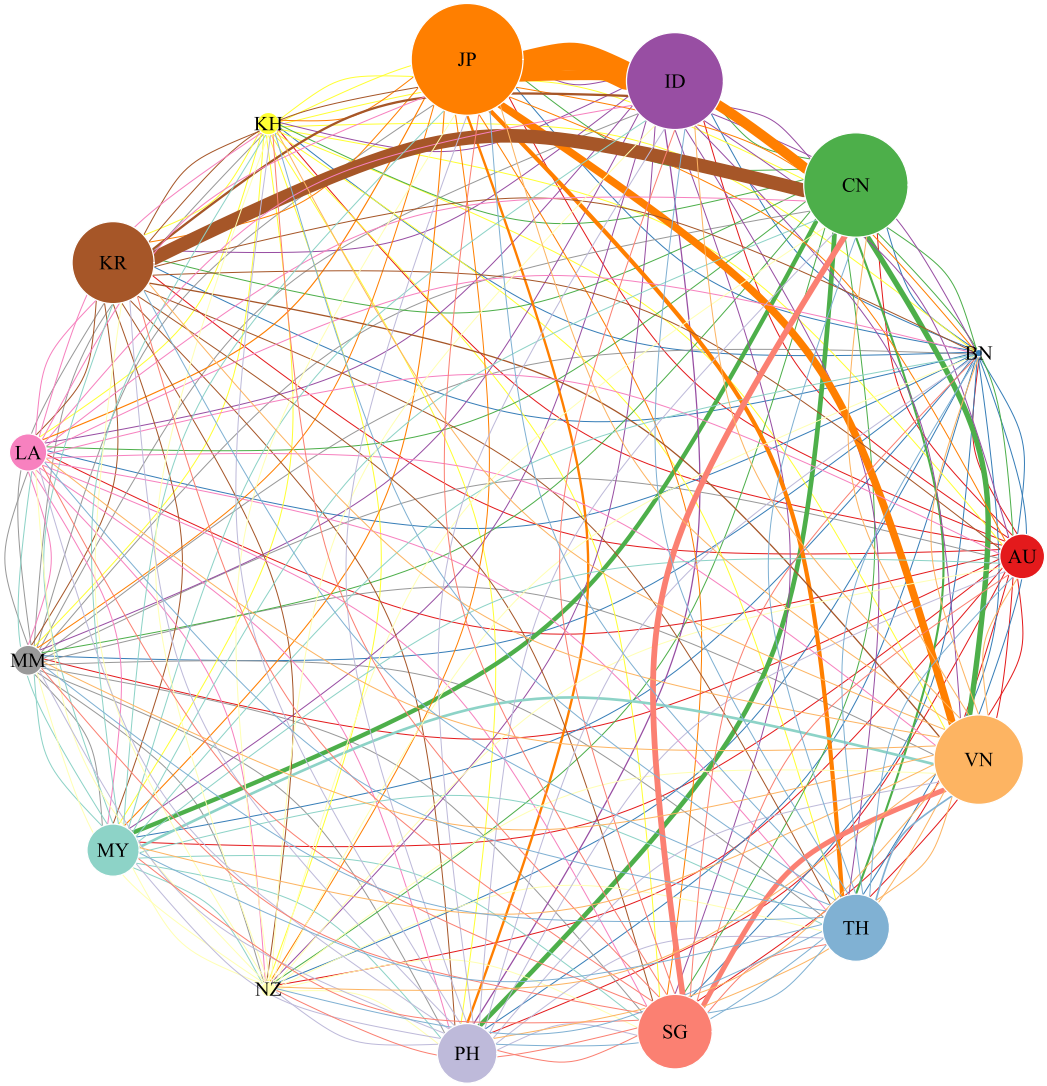
Source*: Authors' computation using BACI data.*

Figure A4: *Intra-RCEP FDI Flows for the year 2013*



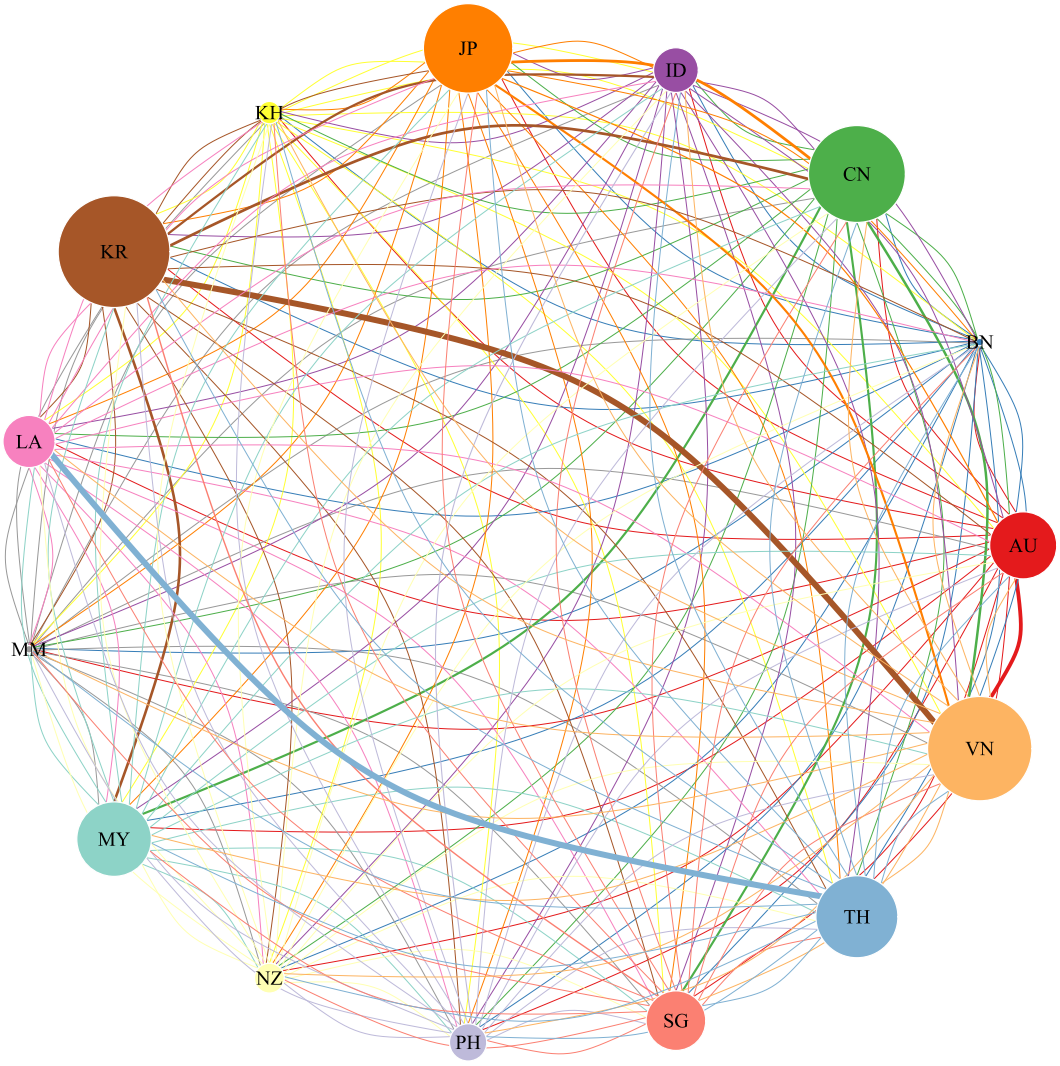
Source*: Authors' computation using Orbis data.*

Figure A5: *Intra-RCEP FDI Flows for the year 2019*



Source*: Authors' computation using Orbis data.*

Figure A6: *Intra-RCEP FDI Flows for the year 2022*



Source: *Authors' computation using Orbis data.*

Appendix B

Comparison of Orbis and WDI FDI Data

The year of investment is not among the variables within the Orbis cross-border database. As such, the year of project announcement served as a proxy for the year of investment. The usage of the proxy necessitates a comparison to assess the spread of the data on an annual basis.

For comparison's sake, the variables "Foreign direct investment, net inflows (BoP, current US$)" and "Foreign direct investment, net outflows (BoP, current US$)" from the WDI database were utilised (World Bank, n.d.). Henceforth referred to as the WDI FDI data, these variables consist of the net FDI inflows/outflows at an annual country level. The Orbis FDI was then aggregated on the same basis.

To compute the annual country-level shares of FDI inflows, the following formula was utilised:

$$Share_{i,j,inflows} = \frac{Orbis\ FDI_{i,j,inflows}}{WDI\ FDI_{i,j,inflows}}$$

where i is the destination of the FDI flows, j is the year of investment, $Orbis\ FDI_{i,j,inflows}$ is the net Orbis FDI inflows to country i for year j, and $WDI\ FDI_{i,j,inflows}$ is the net WDI FDI inflows to country i for year j.

Additionally, the country-level shares of FDI outflows for each year were also constructed as follows:

$$Share_{i,j,outflows} = \frac{Orbis\ FDI_{i,j,outflows}}{WDI\ FDI_{i,j,outflows}}$$

where i is the source of the FDI flows, j is the year of investment, $Orbis\ FDI_{i,j,outflows}$ is the net Orbis FDI outflows from country i for year j, and $WDI\ FDI_{i,j,outflows}$ is the net WDI FDI outflows from country i for year j.

The results of the share computation are presented in Tables B1 and B2 below.

Table B1*: Share of FDI Inflows, by Destination and Year*

Destination of FDI	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AUS	0.17	0.36	0.25	0.23	0.26	0.23	0.28	1.21	0.24	0.20
BRN	0.01	0.05	0.16	-*	7.51	0.04	-	24.38	-	-
KHM	1.02	0.44	0.39	0.24	1.33	0.72	0.26	0.04	0.04	0.02
CHN	0.16	0.23	0.17	0.30	0.50	0.50	0.38	0.20	0.15	0.16
IDN	0.31	0.38	1.58	7.19	1.39	0.58	1.19	1.04	0.40	0.28
JPN	0.85	0.36	1.13	0.33	1.33	0.20	0.19	0.07	0.85	0.32
KOR	0.36	0.94	2.25	0.22	0.39	0.65	0.34	0.33	0.21	0.35
LAO	0.61	0.60	1.84	0.31	0.10	0.20	1.25	1.01	0.05	9.03
MYS	0.59	1.68	1.16	0.67	1.12	1.42	0.93	1.65	1.15	0.78

MMR	1.26	1.53	0.87	1.02	1.53	0.88	0.66	0.39	0.15	-
NZL	-	0.37	-	0.32	0.52	0.37	1.88	0.12	1.41	0.16
PHL	0.55	1.12	1.87	0.30	2.48	1.21	1.10	0.20	0.20	0.49
SGP	0.11	0.16	0.12	0.17	0.09	0.15	0.10	0.07	0.09	0.12
THA	0.45	1.71	0.84	1.87	0.67	0.90	1.59	-	0.31	0.52
VNM	0.40	1.77	1.73	1.53	1.31	2.12	1.72	0.61	2.88	0.84

Source*: Authors' computation using BACI and WDI data.*

Note. ***-** *indicates that insufficient information was available to calculate the share.*

Table B2*: Share of FDI Outflows by Source and Year*

Source of FDI	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
AUS	-*	0.15	0.33	-	0.87	6.15	0.85	0.29	2.36	0.24
BRN	-	-	-	-	-	-	-	-	-	-
KHM	-	0.03	0.37	0.22	0.02	-	-	0.03	-	-
CHN	0.53	0.45	0.32	0.41	0.62	1.04	0.58	0.32	0.16	0.18
IDN	0.01	0.11	0.01	-	0.58	0.02	1.13	0.04	0.01	0.06
JPN	0.33	0.37	0.37	0.18	0.36	1.84	0.32	0.18	0.18	0.20
KOR	0.31	0.71	1.13	0.82	1.38	0.93	0.85	0.54	1.66	4.37
LAO	-	-	-	-	-	-	-	-	-	-
MYS	0.17	0.38	0.57	0.06	0.72	0.24	0.38	0.03	0.12	0.80
MMR	-	-	-	-	-	-	-	-	-	-
NZL	-	2.20	-	-	-	2.01	-	1.48	-	0.20
PHL	0.07	0.24	0.54	0.38	0.42	0.19	0.30	0.28	0.67	0.29
SGP	0.05	0.06	0.19	0.08	0.16	0.23	0.20	0.22	0.21	0.11
THA	0.20	0.61	1.51	0.33	1.16	0.72	0.32	0.11	0.18	0.89
VNM	0.44	0.59	1.90	0.55	3.86	5.54	1.46	5.46	3.31	0.87

Source*: Authors' computation using Orbis and WDI data.*

Note. ***-** *indicates that insufficient information was available to calculate the share.*

As seen in Tables B1 and B2, Orbis's annual coverage exhibits variability compared to the WDI FDI data, with substantial differences in the share of FDI flows. Additional variances in both databases' sources and collection methods may have further accentuated this difference (Bureau van Dijk, n.d.-a, International Monetary Fund, n.d.).[24] As such, the constraints of using the Orbis database are acknowledged.

[24] The Orbis database is sourced from various providers and sources, while the WDI FDI data is sourced from the IMF Balance of Payments (BoP), which is sourced from government entities. The full metadata and data coverage of the BoP for each economy is available on the IMF website.