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Structural Transformation and Economic Resilience: The Case of Malaysia

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Abstract: *Exports have been a critical source for the resilience of the Malaysian economy during the COVID-19 pandemic and post-pandemic period. Long-term structural change in intersectoral production networks could have reduced this resilience. Stronger domestic intersectoral linkages and declining participation in backward global value chain participation are likely to reduce the impact of positive export shocks on the country's economy. The services sector has become increasing important over time. Consumption in the services sector is clearly an important driver of growth. A positive export shock is enhanced by higher domestic intersectoral linkages in the services sector but not in manufacturing.*

Keywords: structural change, exports, macroeconomic fluctuations

JEL Classification: F14, E32, L16

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1.   Introduction

The Malaysian economy experienced a sharp contraction during the novel coronavirus disease (COVID-19) pandemic. The country's real gross domestic product (GDP) growth declined by 6.2% in 2020. The contraction was primarily brought about by the severe lockdown imposed by the Malaysian government as well as cross-border travel restrictions. Malaysia went through several phases of mobility restrictions starting in mid-March 2020. The country only began to enter the endemic recovery phase in early August 2021. The Malaysian economy subsequently experienced a robust recovery in 2021, achieving an 8.9% growth in real GDP (Figure 1).

Exports played a positive role in terms of shielding the economy from experiencing a deeper contraction in 2020 and in supporting economic recovery in 2021 and 2022. In other words, the country's export sector was resilient during the pandemic and recovery periods. It is possible that the resilience of Malaysia's export sector could be understood from the perspective of long-term structural changes in the economy and the global demand for manufactured goods. There has been a lack of research on this topic.

The goal of this paper is to analyse how structural changes in the Malaysian economy have affected the resilience of the country's economy. To do this, this paper will examine how the Malaysian economy has changed structurally from 2000 to 2020 in terms of sectoral GDP, trade structure, and global value chain (GVC) participation. It is hoped that the findings of this paper will shed some light on how structural changes have affected the resilience of the Malaysian economy in terms of domestic and external shocks.

The research literature that informs this study is drawn from research on intersectoral domestic linkages, GVC, and macroeconomic stability. This diverse body of literature is converging towards a research framework that links economic fluctuations to firm size distribution and production networks. Such a framework links long-term structural change in production networks to macroeconomic fluctuations and stability.

The outline of the rest of the paper is as follows. Section 2 will discuss the relevant literature and their key findings. Section 3 analyses the trends in structural trends in Malaysia from various perspectives. The state of inter-industry production network is examined in Section 4. An econometric analysis is carried out in Section 5. Section 6 concludes.

Figure 1: Malaysia – Real GDP Growth
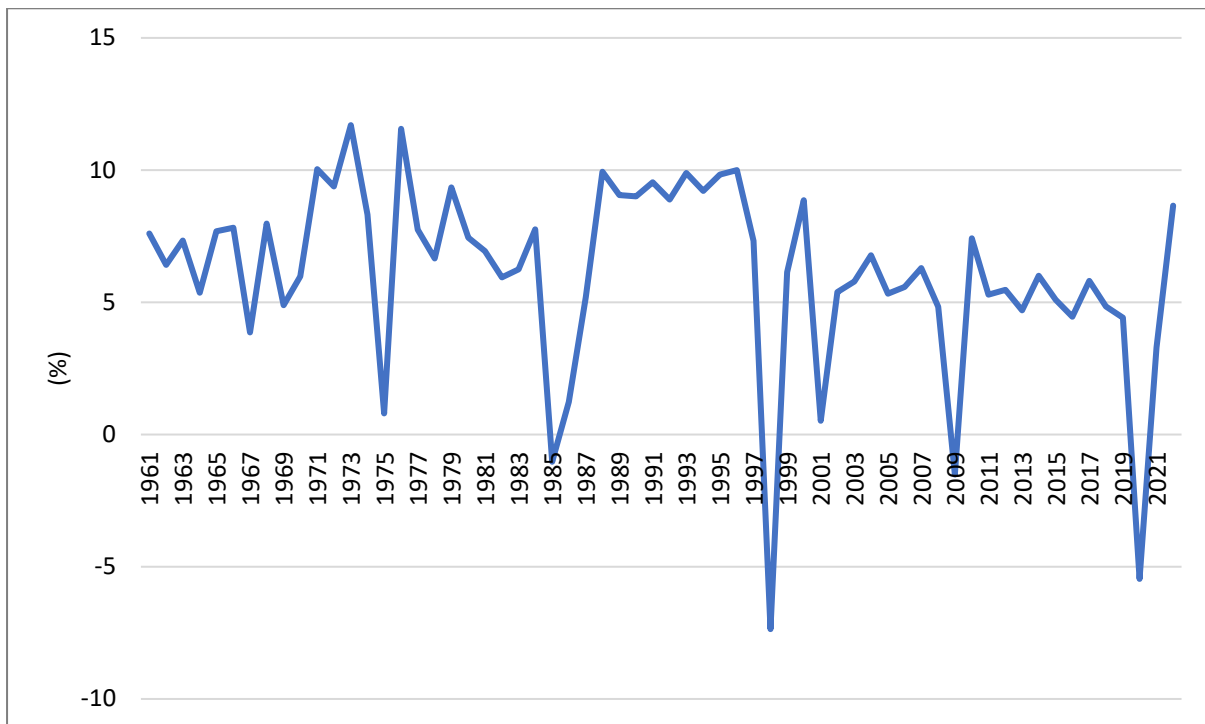
GDP = gross domestic product.
Source: World Bank Data. https://data.worldbank.org (accessed 10 May 2022).

2. Literature Review

The research literature relevant to this study is based on structural change and economy volatility. Key characteristics of structural change include sectoral composition of the economy and inter-sectoral linkages (as measured through input–output tables).

Carvalho (2008) provides an analysis of how intersectoral production linkages can amplify macroeconomic fluctuations. In the study, productivity fluctuations in hub-like connected sectors propagate through the economy. An economy's response to exogenous shocks depends on the production network structure of the economy.

Acemoglu et al. (2012) studied how the propagation of idiosyncratic shocks and aggregate fluctuations depend on the structure of interactions between different sectors. In particular, productivity shocks in a given sector can be cascade to the entire economy if the sector has higher-order interconnections with other sectors.

Moro (2015) provide evidence that an increase in share of services in GDP reduces total factor productivity growth and volatility. This is explained by the fact that the services sector has less share of intermediate goods in gross output, which leads to it having a smaller multiplier.

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Constantinescu and Barauskaite (2018) used the interconnected network approach to examine how shocks propagate in open economy. The authors find that the sectoral linkages result in a decay in aggregate economic volatility but at a rate lower than theoretical prediction. Such linkages appear to be important in closed as well as open economies.

Klimek, Poledna, and Thurner (2019) estimated resilience as a nonequilibrium property of networked production systems (sectoral linkages) using input–output data. The authors show that susceptibility-based growth predictions that consider sector- and country-specific recovery perform better than conventional econometric-based predictions.

ADB (2022, Chapter 4) uses input–output tables to estimate the impact of the COVID-19 pandemic on different industries in Asia and Pacific countries. The study finds that even though most sectors were adversely affected, some sectors gained during the pandemic. These include courier services and logistics businesses.

Overall, the existing literature suggests that the network and input–output approach to studying the propagation of economic shocks is a useful approach to understanding the relationship between structural change and business cycles.

3.   Structural Change in Malaysia

There are several dimensions to structural change. In the literature on development economics, structural change or structural transformation is often defined as the reallocation of economic activity across three broad sectors of the economy: primary (agriculture and mining), secondary (manufacturing and construction), and tertiary (services). A standard characterisation of structural change is to frame it in terms of changes in the relative importance of these sectors (Herrendorf, et al., 2014). In the early phase of development, an agriculture-based economy undergoes industrialisation that involves a shift in the relative importance of economic activities (in terms of output and employment) from agriculture to manufacturing (Syrquin, 1988). The services sector share of the economy increases during the industrialisation phase. At some point, the share of manufacturing peaks, after which the economy begins to deindustrialise when the manufacturing sector's share of economic activity begins to decline. The next phase of structural change, which has been labelled deindustrialisation, occurs when developed economies began experiencing a relative shift that entails a reduction in the manufacturing share of economic activity. This is often accompanied by an increase in the share of services in economic activity.

The Malaysian economy has clearly undergone the industrialisation phase since the country's independence in 1957. The share of manufacturing in GDP rose until it reached a

peak of around 31% in 1999 and thereafter stagnated around 30% to 31% between 2000 and 2004 (Figure 2). The manufacturing's share of GDP began to decline consistent thereafter until it reached 21% in 2019. The sector's share of GDP rose slightly to 22% in 2020 and 23% in 2021.

Figure 2: Sectoral Composition of GDP
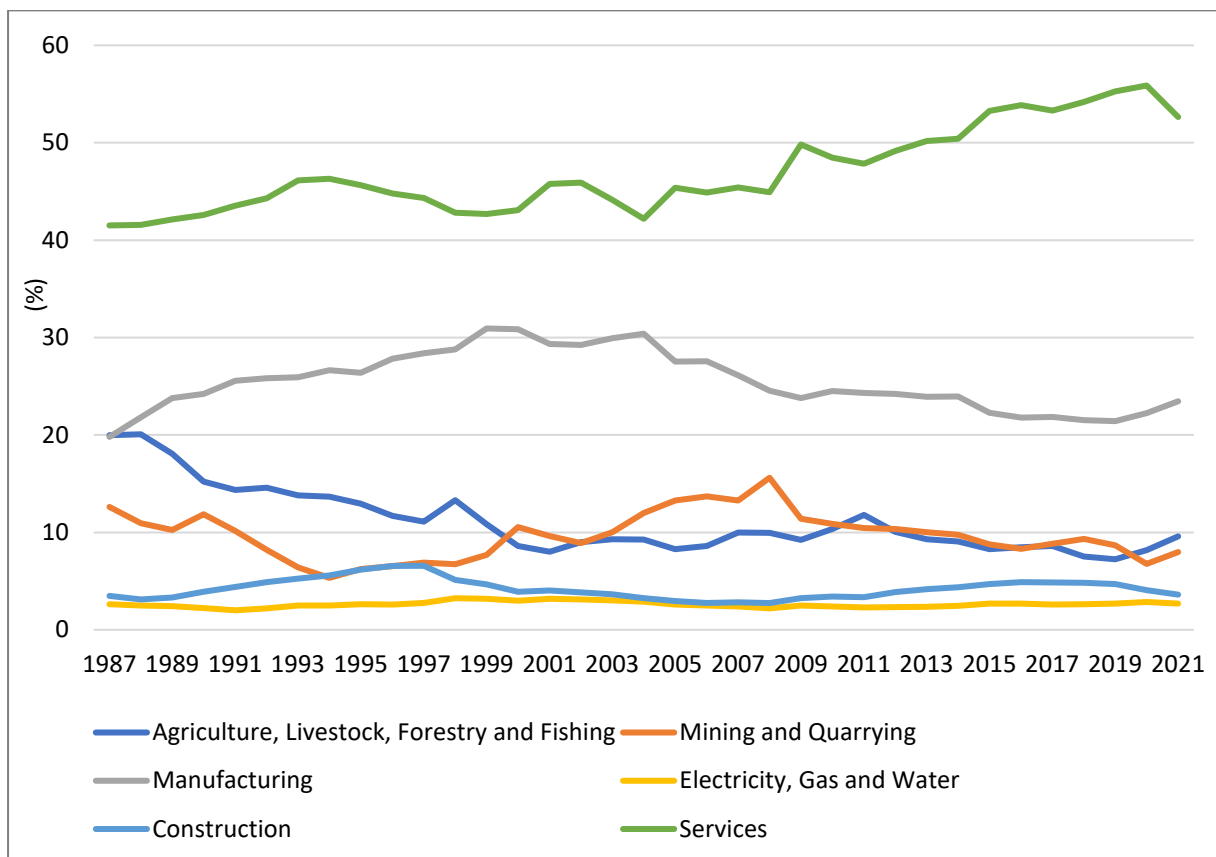
GDP = gross domestic product.
Source: Department of Statistics Malaysia.

Unlike the manufacturing sector, the services sector's share of GDP has risen over time from 41% in 1987 to 55% in 2020. As Malaysia is still a middle-income country, this phenomenon has been labelled premature deindustrialisation (Rasiah, 2011; Tan, 2014). The manufacturing sector's share of GDP increased slightly during the pandemic due to the sector performing better than other sectors, especially services.

The COVID-19 pandemic did have a severe impact on services, resulting in a decline in the sector's share of GDP in 2021. The services sector is fairly heterogenous. It comprises many different types of activities (subsectors). When the services sector is decomposed in a few groups of services subsectors, there are variations in the trajectories of these subsectors'

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share of the GDP. The largest services subsector is retail and wholesale trade, hotel and restaurants. After experiencing a decline between 1994 and 2004, these subsectors' share of GDP has risen since 2004. The financial sector's contribution to GDP peaked in 2002 and has been declining thereafter. Interestingly, the government services' share of GDP has been increasing since 2000.

Figure 3: Services Subsectors' Share of GDP
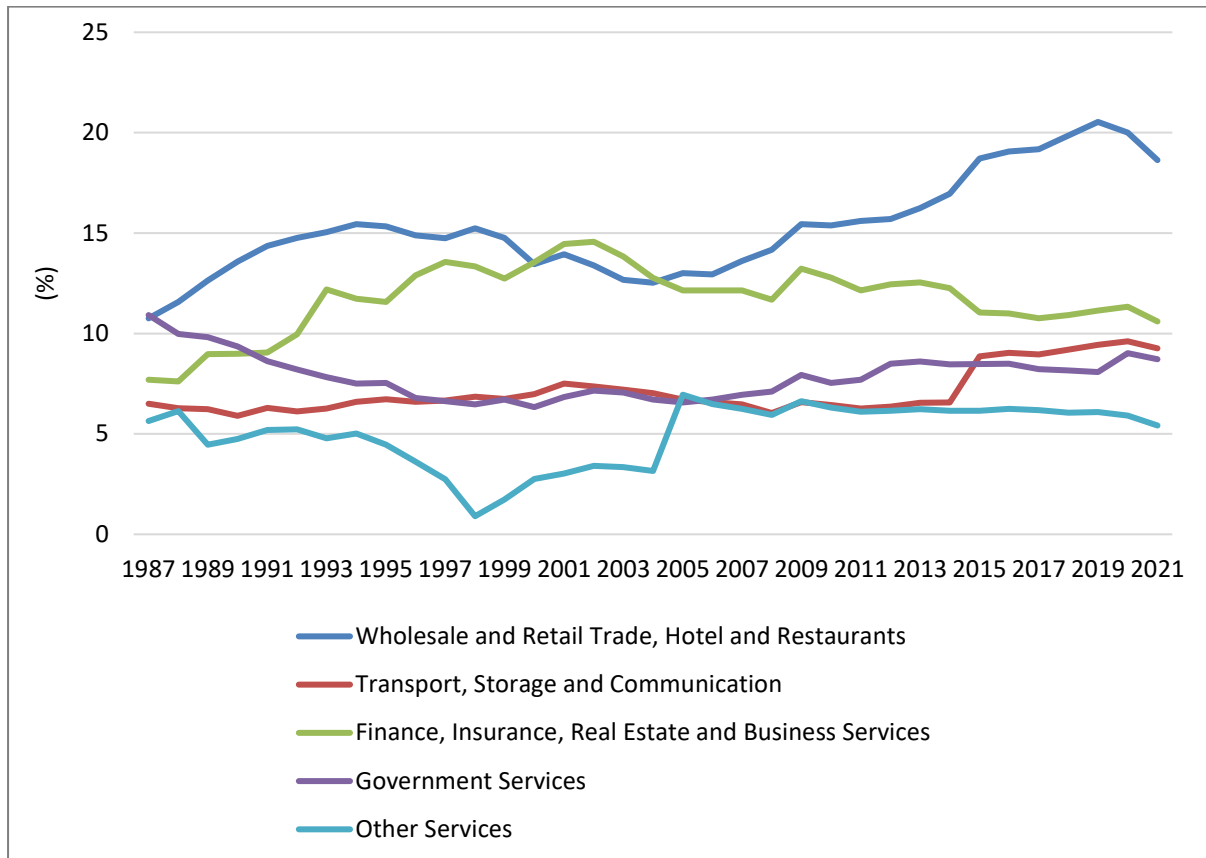
GDP = gross domestic product.
Source: Department of Statistics Malaysia.

From an expenditure perspective, private consumption remains the most important component, accounting for slightly more than 50% of the GDP (Figure 4). Net exports' share declined during the 2000–2013 period, stagnated during 2013–2017 before increasing during 2017–2021. The share of investment in GDP declined during the 2013–2021 period. This is an adverse development as a decline in investment is likely to reduce the country's potential growth rate over time.

Figure 4: Malaysia – Composition of GDP by Expenditure
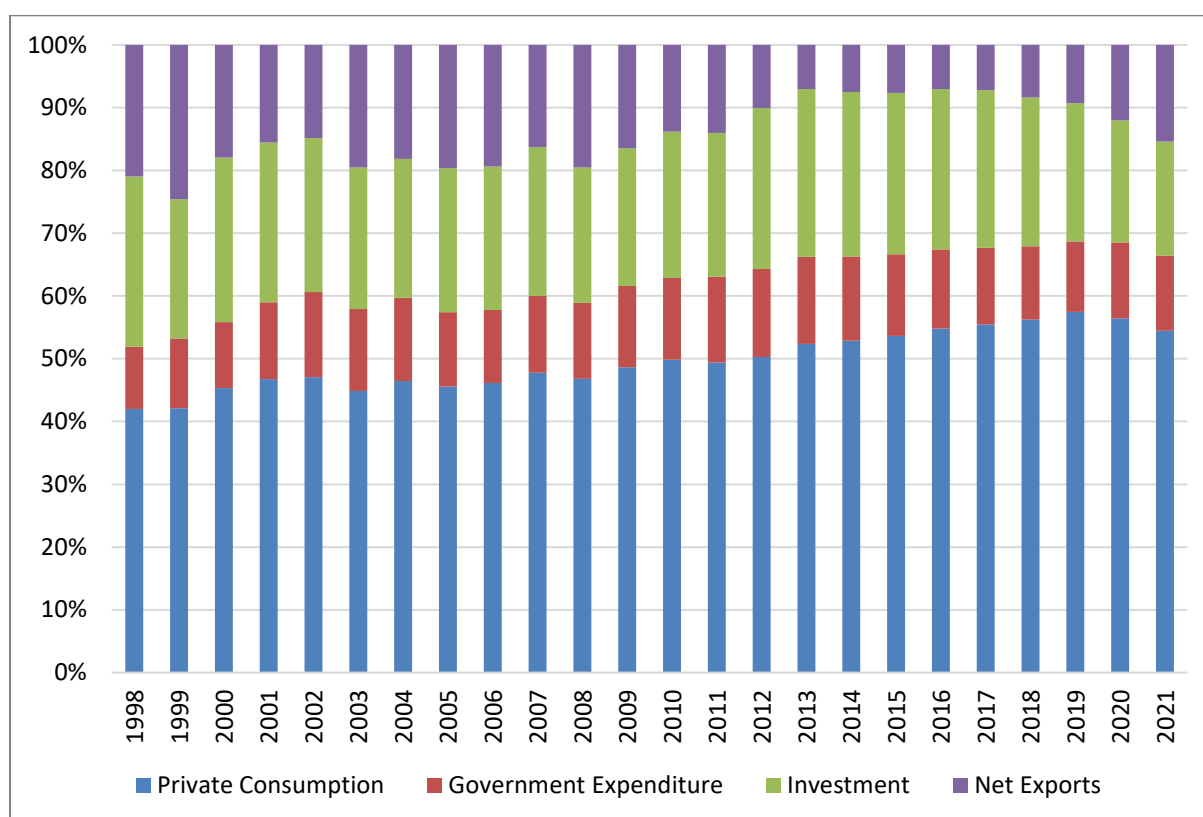
GDP = gross domestic product.
Source: Department of Statistics Malaysia.

Trade is an important driver of growth of the Malaysian economy. However, its role has declined over the years. This can be seen from the long-run trends in the imports and exports as a percentage of GDP (Figure 5). The export/GDP ratio peaked at around 120% in 2000 but subsequently declined to 62% in 2020. There was a slight increase in the export/GDP ratio to 69% in 2021 but this reversal is small in comparison to the long-term decline since 2000.

The composition of trade has also changed in the past 30 years (Figure 6). The manufacturing sector's share of the country's total exports continue to exceed 70% since 1993. However, the share of industries such as machinery and transport equipment has declined from a peak of 62% of total exports to around 20%–25% in recent years. The export structure of this industry has also changed, particularly in the decline of the exports from office machines and automatic data processing equipment (Figure 7).

The export of petroleum and natural gas (mineral fuels and lubricants) has increased over the years, as reflected by the increase in its share of total exports from 7.5% in 1998 to a peak of 22% in 2014. However, this industry's share of total exports declined from 22% in 2014 to 11% in 2020.

Figure 5: Imports and Exports as a Percentage of GDP
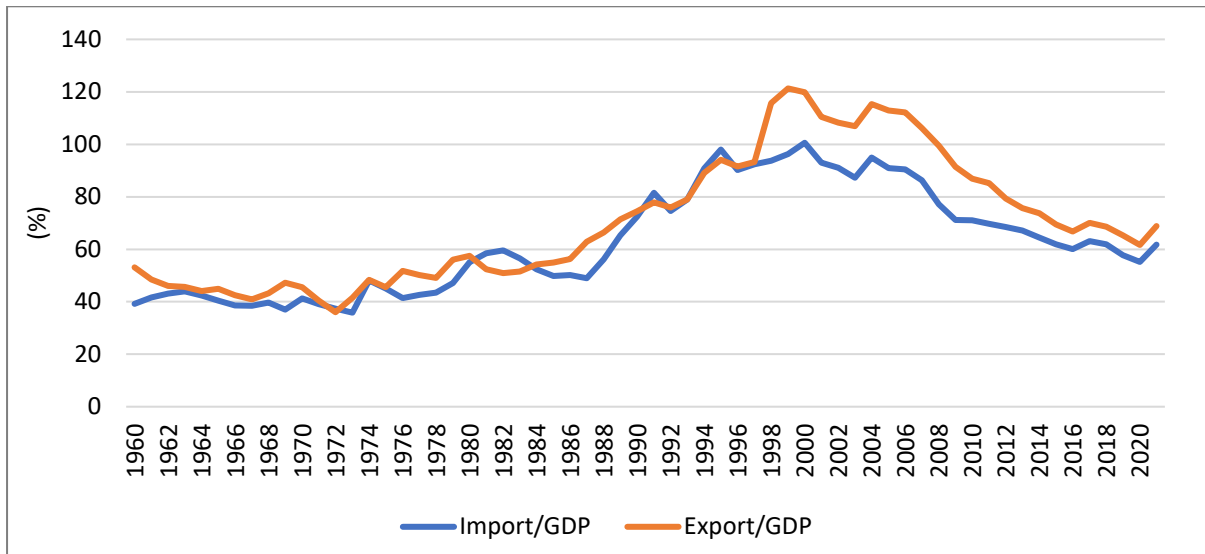
GDP = gross domestic product.
Source: World Bank Data. https://data.worldbank.org (accessed 10 May 2022).

Figure 6: Composition of Exports
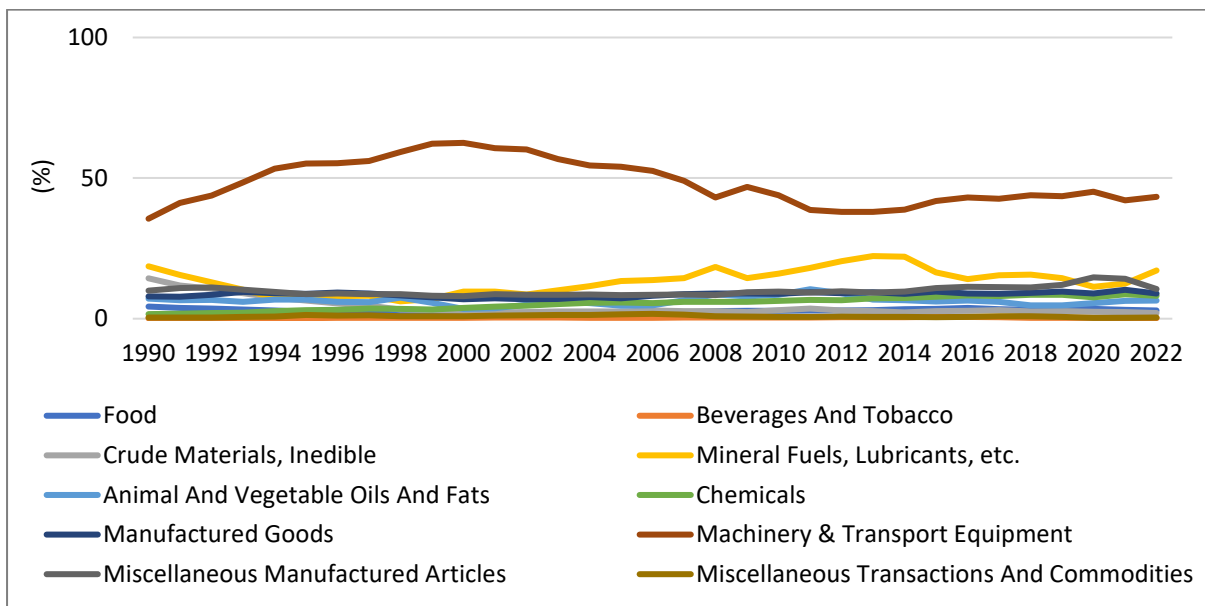
Source: Department of Statistics Malaysia.

Figure 7: Exports of Machinery and Transport Equipment
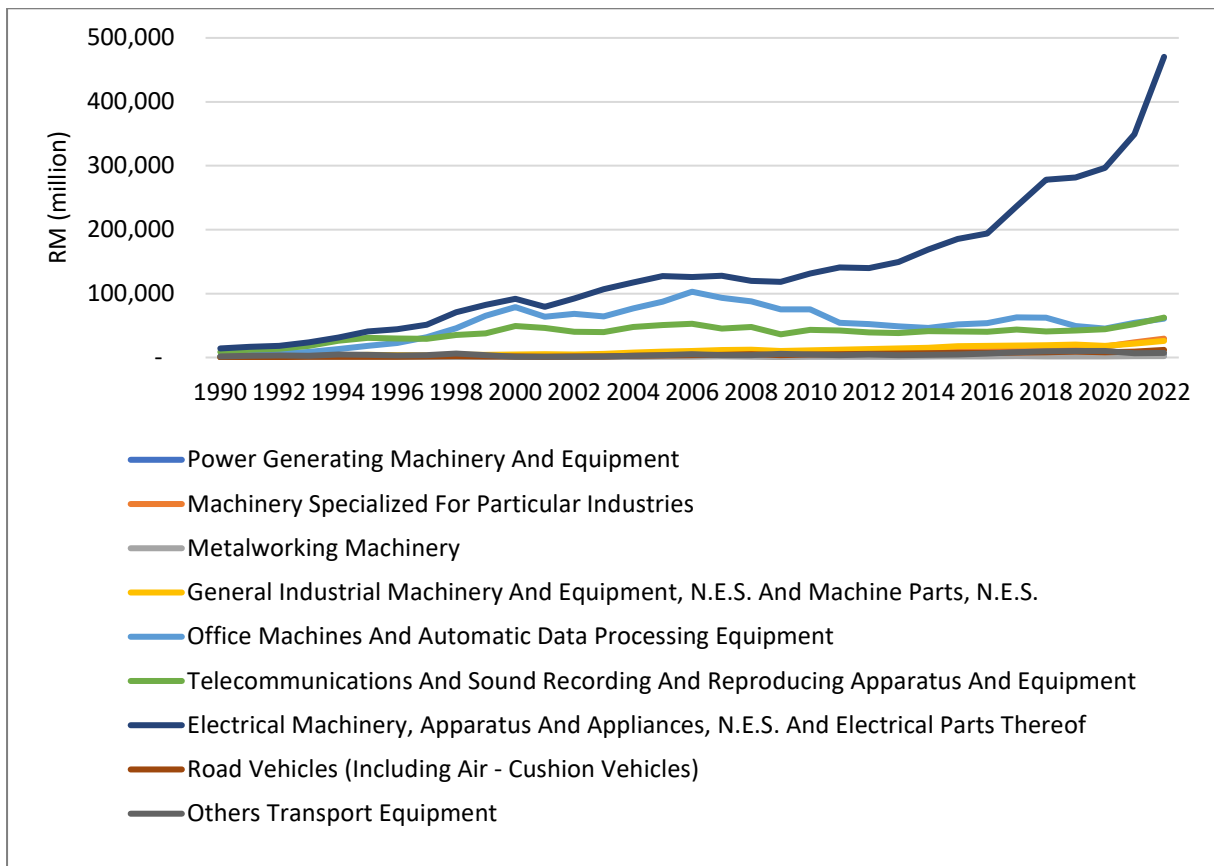
N.E.S. = not else specified.
Source: Department of Statistics Malaysia.

The above discussions do point to significant structural changes in the Malaysian economy over the past 30–50 years. Following the findings of Moro (2015), the volatility of the economy should decline when the services sector becomes increasingly important. This is a difficult hypothesis to test as external economic shocks can increase macroeconomic volatility. Malaysia has experienced five major shocks since 1965: (i) 1975 – OPEC oil crisis, (ii) 1985 – the Volcker shock, (iii) 1998 – the Asian financial crisis, (iv) 2009 – the global financial crisis, and (v) 2020 – the COVID-19 pandemic (Figure 8). The macroeconomic volatility as measured by a 5-year rolling window standard deviation of GDP growth is affected by these shocks. To examine this issue further, it might be useful to examine intersectoral production linkages through input–output data.

Figure 8: Growth Rate and Volatility (5-Year Lag Standard Deviation)
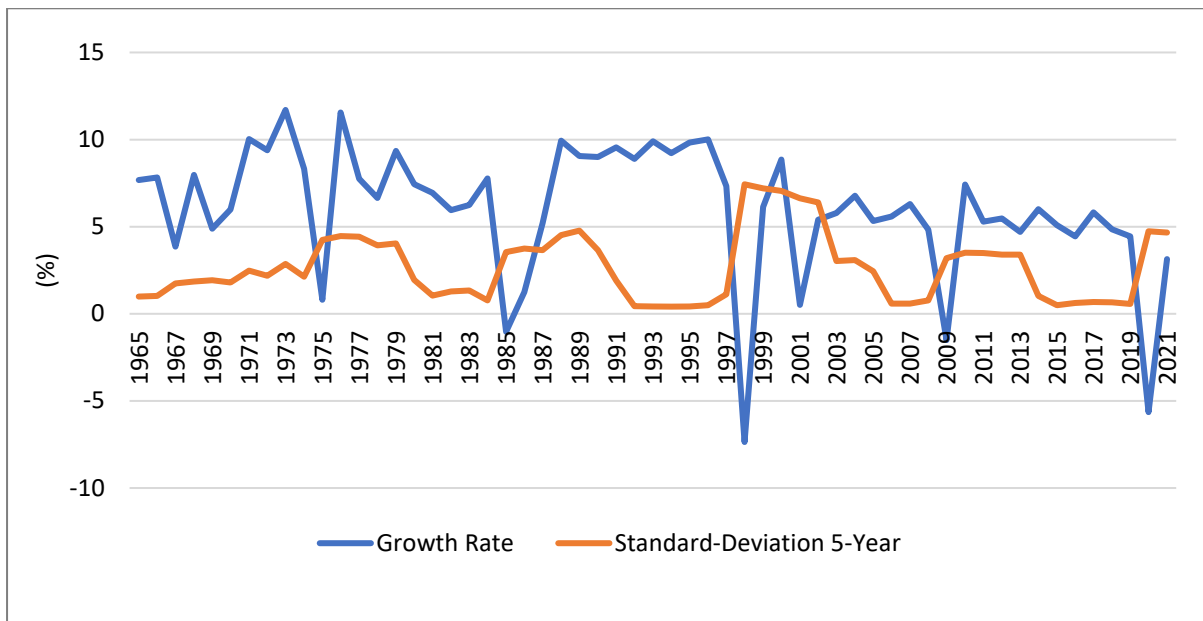
Source: Author.

4. Inter-Industry Production Network

Structural change is likely to bring about the transformation of inter-industry production networks. Some industries are likely to be more connected, in terms of purchase and sale, with other industries. This follows Moro's (2015) findings that a shift to a more services-oriented economy (with lower intersectoral linkages) reduces economic volatility.

Empirically, a number of studies have used the concept of 'in-degree' as a measure of inter-industry production dependence or networks. In-degree is measured in terms of the percentage share of industry i's share of total input of purchases of industry j. In this measurement, the number of industries meeting a pre-defined threshold is counted. Thus far, studies have used different threshold levels:

- Value 1 if exceed 1% threshold, otherwise zero (Carvalho, 2008)
- Value 1 if exceed 5% threshold, otherwise zero (Acemoglu, et al., 2012)

More generally, the intensity of inter-industry production network can be measured using a continuous measure rather than a binary one. This is visually depicted as a heatmap using the input–output data for year 2020 in Figure 9. In the diagram, cells with darker red signify greater intensity of inter-industry linkages. A bird's eye view of these linkages indicates that some industries have stronger links to other industries. For example, more than 60% of the intermediate inputs in the poultry industry comes from the animal feed industry.

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For the electrical and electronic (E&E) industries, the electronic components and boards industry is a major input (Figure 10). The electronic components and boards industry's share of total inputs in many of the E&E industries exceeds 40%. For computers, peripherals, office equipment, and machinery, this share is close to 70%.

Figure 9: Heatmap of Inter-Sectoral Production Network Input–Output Table (DOSM), 2020
(red indicating high-level of inter-industry interdependence)
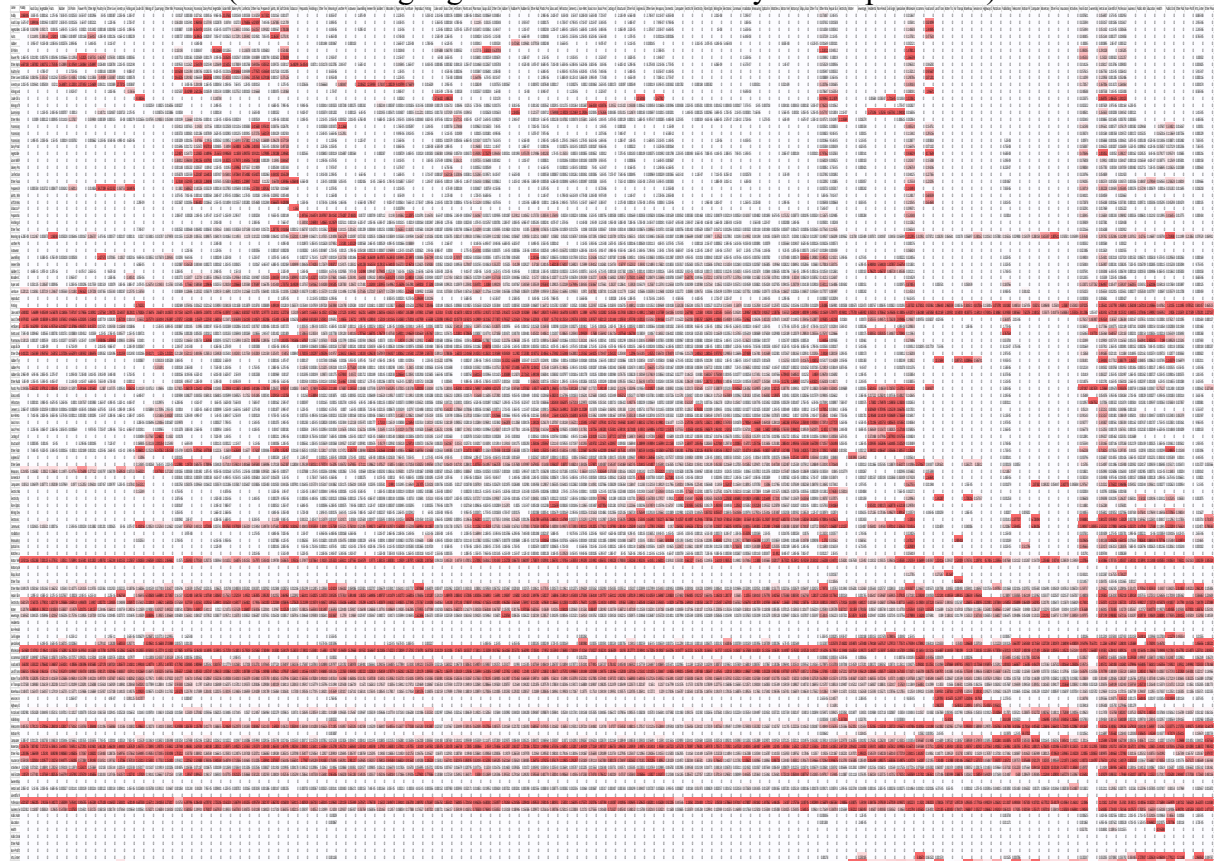
DOSM = Department of Statistics Malaysia.
Source: Author.

Figure 10: Share of Electronic Components and Boards in Total Inputs in Selected Electronic and Electrical Industries, 2020
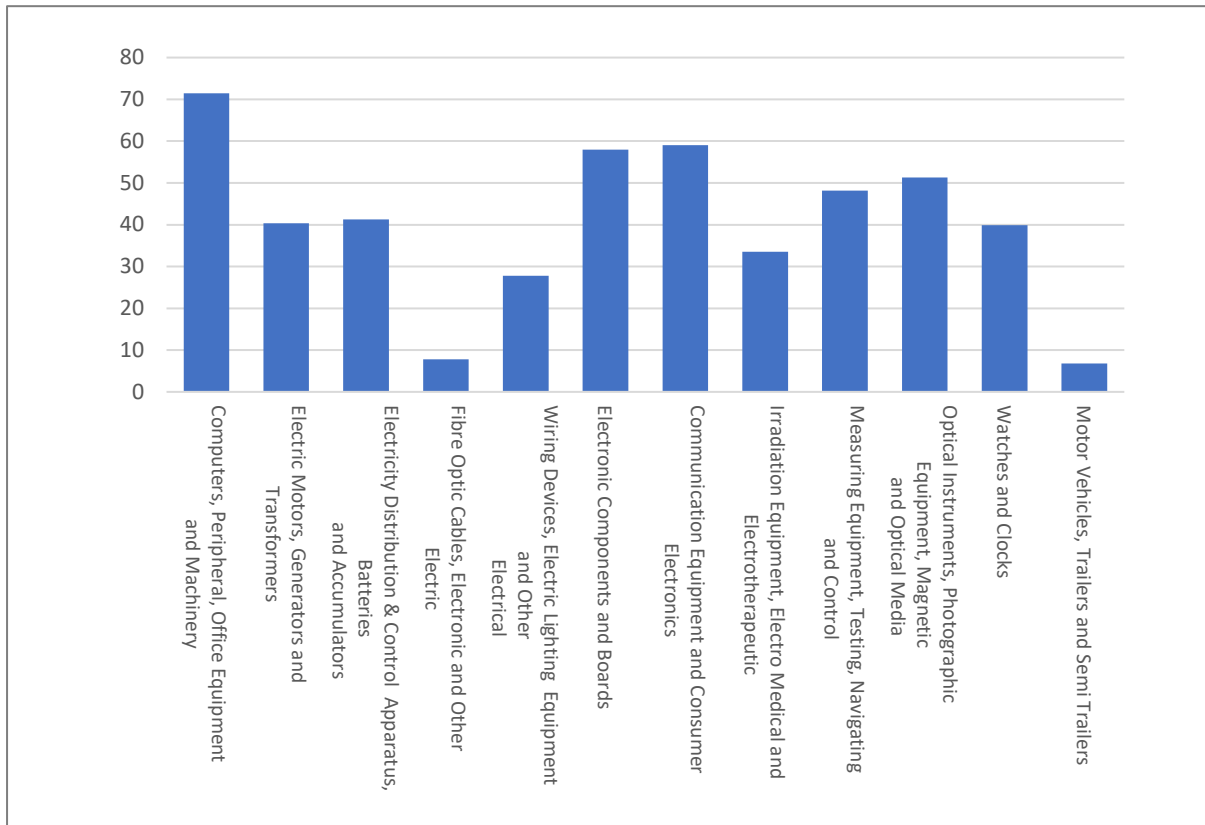
Source: Department of Statistics Malaysia.

Two important dimensions of production networks are domestic and foreign linkages. Being part of the global production network or global value chain (GVC) implies a significant proportion of the inputs are imported (GVC backward participation) or a significant proportion of its output is used as inputs in foreign countries' exports (GVC forward participation).

Overall, resource-based industries tend to have a higher proportion of their inputs sourced domestically (Table 1). Such industries include food and beverage, wood-related products, rubber and plastics. The E&E industries have relatively high imported inputs (equivalently high GVC backward participation) but historical data for the 2007–2020 period indicate that the dependence on imported inputs have declined over the years (Table 2). For example, the share of foreign inputs in the electrical and optical equipment industry has declined from 64% in 2017 to 40% in 2020.

Table 1: Domestic Sources' Share of Total Inputs (ratio) – Input–Output Data

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.28475	0.28862	0.29547	0.29675	0.29993	0.30326	0.32319	0.29522	0.31369	0.31614	0.31147	0.31912	0.3231	0.3282
Mining and quarrying	0.10144	0.10386	0.1086	0.10979	0.11167	0.11385	0.11598	0.11273	0.12096	0.12271	0.11955	0.12378	0.12618	0.12962
Food, beverages, and tobacco	0.75671	0.76115	0.76862	0.7688	0.77375	0.77794	0.77117	0.74803	0.79043	0.79339	0.78802	0.79495	0.79882	0.8037
Textiles and textile products	0.35635	0.36684	0.386	0.39117	0.39878	0.40719	0.41601	0.40587	0.43601	0.44278	0.4294	0.45543	0.46777	0.48119
Leather, leather products, and footwear	0.38063	0.38857	0.40214	0.40499	0.41093	0.4172	0.42352	0.41011	0.43762	0.44262	0.43302	0.45035	0.45896	0.4696
Wood and products of wood and cork	0.71857	0.71719	0.72479	0.72534	0.72905	0.7166	0.70753	0.70281	0.74206	0.74445	0.73776	0.76106	0.76936	0.77403
Pulp, paper, paper products, printing, and publishing	0.45941	0.46743	0.48194	0.48477	0.49111	0.50679	0.52045	0.48763	0.51935	0.52467	0.51408	0.53581	0.5461	0.55806
Coke, refined petroleum, and nuclear fuel	0.5313	0.5402	0.55606	0.55957	0.56662	0.57415	0.58155	0.56164	0.59818	0.60394	0.59303	0.6139	0.62337	0.63187
Chemicals and chemical products	0.44915	0.46122	0.48219	0.48752	0.49575	0.50579	0.51567	0.5015	0.53772	0.54543	0.53135	0.55505	0.56677	0.57978
Rubber and plastics	0.54709	0.55946	0.58142	0.587	0.59621	0.60663	0.61686	0.59828	0.63958	0.64742	0.63234	0.6608	0.67415	0.68772
Other nonmetallic minerals	0.59563	0.6035	0.617	0.61965	0.62602	0.6328	0.63962	0.61597	0.65436	0.65946	0.6502	0.66402	0.67169	0.68236
Basic metals and fabricated metal	0.3556	0.37205	0.40104	0.4096	0.42052	0.4343	0.44787	0.44112	0.47799	0.48834	0.46837	0.50787	0.52568	0.54163
Machinery, nec	0.26218	0.27647	0.30207	0.30996	0.31933	0.33144	0.34329	0.33987	0.36989	0.37897	0.36128	0.39536	0.41121	0.42705
Electrical and optical equipment	0.09795	0.12092	0.16153	0.17495	0.19535	0.21557	0.23493	0.24519	0.27881	0.29388	0.26501	0.31926	0.34476	0.37068
Transport equipment	0.35297	0.36936	0.39917	0.40909	0.41703	0.43171	0.45146	0.44234	0.47843	0.48588	0.4644	0.51794	0.5417	0.5651
Manufacturing, nec; recycling	0.2977	0.30595	0.32063	0.32456	0.3304	0.33326	0.32969	0.31142	0.35936	0.36463	0.35449	0.37395	0.383	0.39206
Electricity, gas, and water supply	0.2932	0.30231	0.31743	0.32141	0.32768	0.33511	0.34229	0.34014	0.35869	0.36436	0.35395	0.36726	0.37587	0.39131
Construction	0.48607	0.49351	0.50665	0.50943	0.51546	0.52172	0.52784	0.50913	0.54154	0.54626	0.53724	0.55466	0.5626	0.56989
Motor vehicles and motorcycles	0.28717	0.29248	0.30188	0.30469	0.30836	0.31253	0.31673	0.30604	0.32587	0.3286	0.32184	0.3367	0.34319	0.34926
Wholesale trade and commission trade	0.28804	0.29321	0.30245	0.30469	0.30893	0.31309	0.31739	0.30691	0.32692	0.33013	0.32376	0.33626	0.34243	0.35027
Retail trade	0.28774	0.29299	0.30257	0.30469	0.30865	0.31288	0.31735	0.3069	0.32699	0.33031	0.32404	0.33694	0.34308	0.35019
Hotels and restaurants	0.47643	0.4805	0.48751	0.48828	0.4923	0.49571	0.49901	0.47861	0.50646	0.50901	0.50412	0.51189	0.51605	0.52169
Inland transport	0.45485	0.46288	0.47534	0.47694	0.48323	0.48974	0.49567	0.4785	0.50959	0.51422	0.50586	0.51101	0.51661	0.53002
Water transport	0.46639	0.47201	0.48132	0.48335	0.48833	0.48422	0.48721	0.47913	0.50879	0.51268	0.50712	0.50904	0.51307	0.52518
Air transport	0.53261	0.54519	0.56312	0.5682	0.57755	0.58769	0.60261	0.57806	0.61854	0.62637	0.61519	0.61691	0.62389	0.64575
Other supporting and auxiliary transport activities	0.41203	0.4196	0.43306	0.43619	0.44205	0.45225	0.4547	0.43967	0.4687	0.47352	0.46429	0.4739	0.48188	0.5006
Post and telecommunications	0.51766	0.5221	0.53248	0.53447	0.53922	0.53198	0.53681	0.52665	0.5579	0.56129	0.55471	0.563	0.56953	0.58541
Financial intermediation	0.45501	0.45593	0.45852	0.45748	0.45948	0.46043	0.46134	0.43996	0.4628	0.46328	0.46147	0.46553	0.46763	0.4714
Real estate activities	0.33429	0.33514	0.33693	0.33629	0.33793	0.33868	0.33947	0.32393	0.34114	0.34171	0.34049	0.34174	0.34292	0.34611
Renting of M&Eq and other business activities	0.35446	0.35714	0.36332	0.36463	0.36738	0.36982	0.38316	0.35727	0.37789	0.37975	0.37595	0.38329	0.38728	0.3939
Public administration and defense; compulsory social security	0.32535	0.33044	0.33949	0.34144	0.34555	0.3578	0.35405	0.34159	0.36339	0.3666	0.36039	0.3664	0.37176	0.38502
Education	0.15089	0.15363	0.15856	0.15967	0.1618	0.16416	0.16641	0.16084	0.17135	0.17308	0.16971	0.1738	0.17679	0.18322
Health and social work	0.26013	0.26874	0.28414	0.28838	0.29431	0.30164	0.30875	0.30167	0.32456	0.33004	0.31952	0.33921	0.34861	0.35874
Other community, social, and personal services	0.37922	0.36828	0.39461	0.39377	0.40093	0.40539	0.41012	0.39513	0.41973	0.42299	0.41584	0.42613	0.43299	0.44727

ADB = Asian Development Bank, M&Eq = machinery and equipment,= NEC = not elsewhere classified.
Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

Table 2: Foreign Sources' Share of Total Inputs (ratio) – Input–Output Data

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.10761	0.10376	0.09695	0.09561	0.09235	0.08913	0.06927	0.09726	0.07888	0.07644	0.08112	0.07298	0.06887	0.06378
Mining and quarrying	0.07048	0.06789	0.06359	0.06244	0.06064	0.05853	0.05647	0.05979	0.05193	0.05038	0.05343	0.04778	0.04501	0.04164
Food, beverages, and tobacco	0.12449	0.12002	0.11208	0.11202	0.10678	0.10308	0.11011	0.13307	0.09126	0.08845	0.09386	0.08334	0.07851	0.07381
Textiles and textile products	0.30417	0.29292	0.27364	0.26826	0.26066	0.25105	0.24203	0.25229	0.22201	0.21507	0.22811	0.20606	0.19477	0.18115
Leather, leather products, and footwear	0.21227	0.20483	0.19144	0.188	0.18231	0.17585	0.16961	0.18319	0.15561	0.15085	0.15994	0.14517	0.13724	0.12647
Wood and products of wood and cork	0.11618	0.11115	0.10389	0.10395	0.09891	0.11044	0.11849	0.12353	0.08426	0.08162	0.08642	0.07924	0.07517	0.06971
Pulp, paper, paper products, printing, and publishing	0.23716	0.22842	0.2132	0.20941	0.20279	0.18653	0.17242	0.205	0.1726	0.16725	0.17736	0.16191	0.15325	0.14099
Coke, refined petroleum, and nuclear fuel	0.24985	0.24086	0.22506	0.22152	0.21444	0.20691	0.19954	0.21948	0.18308	0.17743	0.18827	0.16698	0.1574	0.14892
Chemicals and chemical products	0.32866	0.31707	0.29634	0.29072	0.28214	0.2723	0.26269	0.27688	0.24111	0.23374	0.24815	0.22037	0.20757	0.19477
Rubber and plastics	0.34631	0.33386	0.31196	0.30642	0.29729	0.28685	0.27663	0.29508	0.25369	0.24582	0.26085	0.233	0.21982	0.20622
Other nonmetallic minerals	0.22094	0.213	0.19885	0.19615	0.18937	0.18276	0.17633	0.20001	0.16179	0.15679	0.16647	0.14946	0.14096	0.13044
Basic metals and fabricated metal	0.45898	0.44251	0.41337	0.40469	0.39388	0.38001	0.36649	0.37313	0.33605	0.3256	0.34548	0.30739	0.28995	0.27393
Machinery, nec	0.4039	0.38914	0.36364	0.35604	0.34663	0.33439	0.32241	0.32588	0.29571	0.28648	0.30387	0.27228	0.25707	0.24112
Electrical and optical equipment	0.64203	0.61872	0.57799	0.56456	0.56995	0.5496	0.53028	0.52009	0.48648	0.47139	0.50019	0.447	0.42177	0.3958
Transport equipment	0.47771	0.45966	0.42906	0.42099	0.40653	0.39262	0.37697	0.38712	0.34836	0.33525	0.35503	0.33278	0.31724	0.2923
Manufacturing, nec; recycling	0.23213	0.22375	0.20904	0.20507	0.19914	0.19627	0.19978	0.25111	0.16988	0.16462	0.17466	0.15619	0.14739	0.13828
Electricity, gas, and water supply	0.24502	0.23648	0.22066	0.21624	0.21017	0.20282	0.19556	0.18861	0.17951	0.17399	0.18476	0.16834	0.1589	0.14362
Construction	0.2075	0.20005	0.18692	0.18413	0.17811	0.17185	0.16573	0.18444	0.15202	0.14731	0.15632	0.1389	0.13096	0.12367
Motor vehicles and motorcycles	0.14318	0.13813	0.1292	0.12742	0.12327	0.11888	0.11463	0.12521	0.10504	0.10162	0.10766	0.0976	0.09237	0.08607
Wholesale trade and commission trade	0.14362	0.13848	0.12945	0.12742	0.1235	0.11909	0.11487	0.12556	0.10538	0.1021	0.1083	0.09914	0.09384	0.08583
Retail trade	0.14347	0.13837	0.1295	0.12742	0.12338	0.11901	0.11485	0.12556	0.1054	0.10215	0.1084	0.09862	0.09329	0.08602
Hotels and restaurants	0.11275	0.10871	0.10155	0.10076	0.09676	0.09337	0.09003	0.11043	0.08259	0.08003	0.08493	0.07666	0.07236	0.06674
Inland transport	0.20237	0.19544	0.18246	0.17923	0.1736	0.16765	0.16166	0.17904	0.14845	0.14386	0.1528	0.13844	0.13042	0.11747
Water transport	0.14638	0.14124	0.13197	0.13057	0.12596	0.13055	0.12776	0.13676	0.10794	0.1047	0.1113	0.10294	0.09721	0.08542
Air transport	0.29621	0.28661	0.26736	0.26309	0.25557	0.24709	0.23192	0.25764	0.21941	0.21296	0.22667	0.20481	0.19255	0.17167
Other supporting and auxiliary transport activities	0.21213	0.20451	0.19109	0.18796	0.18208	0.17187	0.16942	0.18446	0.15541	0.15059	0.1598	0.15059	0.14271	0.12398
Post and telecommunications	0.14662	0.14114	0.13215	0.13093	0.12604	0.13326	0.12881	0.13902	0.10762	0.1043	0.11064	0.10723	0.10198	0.08585
Financial intermediation	0.03348	0.03226	0.03017	0.031	0.02872	0.02771	0.02672	0.04785	0.02447	0.0237	0.02513	0.02456	0.02337	0.01943
Real estate activities	0.02668	0.02571	0.02403	0.0246	0.02289	0.02208	0.0213	0.03679	0.01953	0.01892	0.02008	0.01961	0.01864	0.01541
Renting of M&Eq and other business activities	0.08309	0.08004	0.07497	0.07456	0.07154	0.06902	0.05592	0.08185	0.06107	0.05917	0.06276	0.05912	0.0561	0.0493
Public administration and defense; compulsory social security	0.14201	0.13692	0.12795	0.12603	0.12193	0.10969	0.11346	0.12592	0.10407	0.10084	0.107	0.1014	0.09615	0.08287
Education	0.07656	0.07381	0.069	0.06786	0.06574	0.06345	0.06118	0.06671	0.05609	0.05434	0.05766	0.0542	0.05138	0.04492
Health and social work	0.24082	0.23216	0.21703	0.21273	0.20676	0.19955	0.19244	0.19949	0.17647	0.171	0.18143	0.16284	0.15373	0.14354
Other community, social, and personal services	0.15436	0.14245	0.13908	0.13608	0.13244	0.12773	0.12323	0.13792	0.11289	0.10933	0.11589	0.11076	0.10526	0.09073

ADB = Asian Development Bank, M&Eq = machinery and equipment,= NEC = not elsewhere classified.

Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

One approach that links inter-industry production network and the macroeconomy involves the derivation of sectoral output multipliers. Conceptually, a sectoral output multiplier measures the extent to which the production in one sector (i) is induced by one unit change in final demand in another sector (j). A simple sectoral output multiplier can be derived by summing all the sectoral output multipliers across sectors in response to a change in demand in sector j. The evolution of simple sectoral output multiplier for Malaysia has been computed by ADB (2022) and is summarised in Table 3. Interestingly, the industries with the largest multipliers are the ones that use inputs that are mostly sourced domestically. For products which are produced via the GVC, multipliers that take into account backward and forward GVC participation can be computed:

- A proportion of imported inputs are used to produce outputs (backward linkages) with leakages through imports – the backward import multiplier (or backward leakage) is computed to measure the total amount of production that leaks to imports when there is a change in the demand for the product of a given sector.

- A proportion of domestically produced outputs is used as inputs abroad (forward participation) – the forward import multiplier (or forward leakage) is computed to measure leakages in terms of production taking place abroad from a change in the production of inputs produced domestically.

ADB's (2020) estimates of the backward import multiplier and forward import multiplier are summarised in Table 4 and Table 5. From Table 4, industries that are more connected globally have larger backward multipliers. This is because a larger amount of demand are leaked from the economy through imported inputs. Industries with stronger engagement with the world through the GVC also have higher forward import multiplier. This is because for any increase in the export of a locally produced intermediate output that are exported are associated with a large output produced abroad.

These backward and forward import multipliers affect how a domestic economy responds to recovery in external demand. In the case of Malaysia, both of these multipliers for GVC-oriented industries have been declining during the 2007–2020 period. This is consistent with the observation that fewer foreign inputs are used in the country – lower trade-based backward participation (Table 6). Furthermore, fewer inputs are produced domestically for export – lower trade-based forward participation (Table 7). It also means that the economy has undergone structural transformation in such a way that external events have less impact on the Malaysian economy, while domestic shocks have become more important.

Table 3: Simple Sectoral Output Multipliers

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.81558	0.82502	0.83338	0.83134	0.83635	0.83816	0.85749	0.82837	0.85364	0.85821	0.85226	0.85732	0.85771	0.86694
Mining and quarrying	0.8953	0.90402	0.90362	0.90638	0.90694	0.90864	0.91005	0.9065	0.91735	0.92042	0.91739	0.9212	0.92216	0.92706
Food, beverages, and tobacco	0.68814	0.70722	0.71371	0.71476	0.72805	0.73082	0.73204	0.69208	0.75426	0.76232	0.75114	0.7608	0.76442	0.7775
Textiles and textile products	0.57384	0.59864	0.61104	0.60778	0.61878	0.62714	0.6378	0.62318	0.66105	0.66876	0.65471	0.67163	0.68155	0.7004
Leather, leather products, and footwear	0.6732	0.69039	0.70346	0.70438	0.71213	0.7159	0.72382	0.70645	0.74335	0.74924	0.73867	0.74581	0.74752	0.76027
Wood and products of wood and cork	0.71386	0.7321	0.73905	0.73554	0.7486	0.73601	0.73882	0.72114	0.77495	0.78173	0.7753	0.77353	0.77429	0.79235
Pulp, paper, paper products, printing, and publishing	0.60983	0.6267	0.65034	0.65104	0.66147	0.67791	0.69399	0.65569	0.70034	0.70713	0.69677	0.70945	0.71232	0.73223
Coke, refined petroleum, and nuclear fuel	0.67477	0.70389	0.70569	0.69936	0.71116	0.71658	0.72657	0.70667	0.75443	0.76692	0.75474	0.76665	0.75815	0.7565
Chemicals and chemical products	0.51653	0.55118	0.55481	0.55568	0.55972	0.56532	0.57557	0.55688	0.60814	0.62181	0.60737	0.63064	0.63598	0.65559
Rubber and plastics	0.43984	0.4611	0.4917	0.5015	0.48429	0.48331	0.49545	0.48096	0.53763	0.54943	0.53485	0.5492	0.54256	0.55112
Other nonmetallic minerals	0.57619	0.64326	0.61087	0.62849	0.61879	0.62735	0.63406	0.61257	0.67382	0.6931	0.68138	0.68274	0.68159	0.70406
Basic metals and fabricated metal	0.37135	0.39466	0.40644	0.42672	0.42927	0.44262	0.44394	0.44038	0.48706	0.50403	0.48791	0.51658	0.53214	0.55898
Machinery, nec	0.47326	0.49405	0.503	0.52095	0.52393	0.53392	0.53584	0.53446	0.57047	0.58353	0.57095	0.59102	0.60163	0.62218
Electrical and optical equipment	0.31332	0.33782	0.33865	0.36737	0.35885	0.37256	0.36848	0.38026	0.40878	0.42082	0.40786	0.44733	0.48167	0.50608
Transport equipment	0.35066	0.37525	0.38171	0.41415	0.41769	0.42716	0.42418	0.42133	0.46066	0.4796	0.4653	0.45198	0.44943	0.47522
Manufacturing, nec; recycling	0.66402	0.68547	0.68696	0.69357	0.70037	0.70257	0.70003	0.6515	0.73379	0.7433	0.7342	0.74606	0.75214	0.76384
Electricity, gas, and water supply	0.66884	0.70243	0.70022	0.70369	0.70629	0.71224	0.72068	0.7253	0.74277	0.75356	0.74283	0.75326	0.75539	0.77234
Construction	0.59645	0.63036	0.61967	0.64234	0.64397	0.65197	0.65038	0.63589	0.68522	0.69803	0.68913	0.70035	0.70898	0.72561
Motor vehicles and motorcycles	0.74413	0.75626	0.77482	0.79303	0.78164	0.78524	0.78489	0.77664	0.79783	0.8054	0.79631	0.78065	0.76961	0.78152
Wholesale trade and commission trade	0.76835	0.78092	0.78618	0.79303	0.79712	0.80029	0.80419	0.79113	0.81891	0.8237	0.81741	0.8228	0.82321	0.83258
Retail trade	0.76812	0.78036	0.79156	0.79303	0.8009	0.80328	0.8064	0.79306	0.81998	0.82527	0.81727	0.81401	0.80921	0.81863
Hotels and restaurants	0.75732	0.77175	0.77805	0.7769	0.78733	0.79063	0.79633	0.76812	0.80976	0.81547	0.80713	0.81636	0.82038	0.83208
Inland transport	0.64648	0.66192	0.67645	0.68203	0.69297	0.6974	0.7042	0.68428	0.72667	0.73468	0.7235	0.7323	0.73259	0.74745
Water transport	0.69564	0.71012	0.72348	0.74248	0.74248	0.74005	0.74046	0.72865	0.76925	0.7769	0.76759	0.76861	0.76956	0.79028
Air transport	0.53356	0.55288	0.57804	0.58774	0.59222	0.60019	0.61628	0.58541	0.63519	0.64674	0.62928	0.64104	0.63731	0.66235
Other supporting and auxiliary transport activities	0.64461	0.65811	0.67384	0.68036	0.69404	0.70274	0.70559	0.68734	0.72589	0.73317	0.72237	0.72293	0.72467	0.7492
Post and telecommunications	0.73237	0.7556	0.75356	0.74715	0.7588	0.76943	0.77239	0.75526	0.79806	0.80219	0.79545	0.79341	0.79484	0.82009
Financial intermediation	0.89334	0.90686	0.91096	0.89867	0.91178	0.91323	0.91585	0.88593	0.92092	0.92209	0.91838	0.91485	0.91395	0.92378
Real estate activities	0.92	0.92713	0.92985	0.9258	0.93896	0.94012	0.94132	0.92124	0.94494	0.94599	0.94365	0.93696	0.9362	0.94284
Renting of M&Eq and other business activities	0.80857	0.82069	0.83245	0.84637	0.84299	0.84645	0.85927	0.83092	0.86031	0.86353	0.85882	0.85666	0.85337	0.86705
Public administration and defense; compulsory social security	0.76786	0.78089	0.78832	0.78996	0.79906	0.81097	0.80683	0.79273	0.82027	0.82488	0.81788	0.81588	0.81828	0.8373
Education	0.88362	0.88828	0.88692	0.89495	0.90247	0.90496	0.90561	0.9004	0.91253	0.91485	0.91219	0.91397	0.91352	0.92225
Health and social work	0.6614	0.6753	0.6855	0.68033	0.69366	0.69711	0.70398	0.69423	0.72448	0.73179	0.72273	0.73732	0.74138	0.7555
Other community, social, and personal services	0.74883	0.77733	0.76981	0.77977	0.78495	0.78964	0.79394	0.77529	0.80872	0.81359	0.80666	0.80842	0.81157	0.83273

M&Eq = machinery and equipment = NEC = not elsewhere classified.
Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

Table 4: Backward Import Multipliers

	2000	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.2485	0.18442	0.17498	0.16662	0.16866	0.16365	0.16184	0.14251	0.17163	0.14636	0.14179	0.14774	0.14268	0.14229	0.13306
Mining and quarrying	0.091	0.1047	0.09598	0.09638	0.09362	0.09306	0.09136	0.08995	0.0935	0.08265	0.07958	0.08261	0.0788	0.07784	0.07294
Food, beverages, and tobacco	0.42412	0.31186	0.29278	0.28629	0.28524	0.27195	0.26918	0.26796	0.30792	0.24574	0.23768	0.24886	0.2392	0.23558	0.2225
Textiles and textile products	0.42842	0.42616	0.40136	0.38896	0.39222	0.38122	0.37286	0.3622	0.37682	0.33895	0.33124	0.34529	0.32837	0.31845	0.2996
Leather, leather products, and footwear	0.4417	0.3268	0.30961	0.29654	0.29562	0.28787	0.2841	0.27618	0.29355	0.25665	0.25076	0.26133	0.25419	0.25248	0.23973
Wood and products of wood and cork	0.46205	0.28614	0.2679	0.26095	0.26446	0.2514	0.26399	0.26118	0.27886	0.22505	0.21827	0.2247	0.22647	0.22571	0.20765
Pulp, paper, paper products, printing, and publishing	0.45123	0.39017	0.3733	0.34966	0.34896	0.33853	0.32209	0.30601	0.34431	0.29966	0.29287	0.30323	0.29055	0.28768	0.26777
Coke, refined petroleum, and nuclear fuel	0.37168	0.32523	0.29611	0.29431	0.30064	0.28884	0.28342	0.27343	0.29333	0.24557	0.23308	0.24526	0.23335	0.24185	0.2435
Chemicals and chemical products	0.50775	0.48347	0.44882	0.44519	0.44432	0.44028	0.43468	0.42443	0.44312	0.39186	0.37819	0.39263	0.36936	0.36402	0.34441
Rubber and plastics	0.50908	0.56016	0.5389	0.5083	0.4985	0.51571	0.51669	0.50455	0.51904	0.46237	0.45057	0.46515	0.4508	0.45744	0.44888
Other nonmetallic minerals	0.74963	0.42381	0.35674	0.38913	0.37151	0.38121	0.37265	0.36594	0.38743	0.32618	0.3069	0.31862	0.31726	0.31841	0.29594
Basic metals and fabricated metal	0.63928	0.62865	0.60534	0.59356	0.57328	0.57073	0.55738	0.55606	0.55962	0.51294	0.49597	0.51209	0.48342	0.46786	0.44102
Machinery, nec	0.57013	0.52674	0.50595	0.497	0.47905	0.47607	0.46608	0.46416	0.46554	0.42953	0.41647	0.42905	0.40898	0.39837	0.37782
Electrical and optical equipment	0.62119	0.68668	0.66218	0.66135	0.63263	0.64115	0.62744	0.63152	0.61974	0.59122	0.57918	0.59214	0.55267	0.51833	0.49392
Transport equipment	0.80022	0.64934	0.62475	0.61829	0.58585	0.58231	0.57284	0.57582	0.57867	0.53934	0.5204	0.5347	0.54802	0.55057	0.52478
Manufacturing, nec; recycling	0.36812	0.33598	0.31453	0.31304	0.30643	0.29963	0.29743	0.29997	0.3485	0.26621	0.2567	0.2658	0.25394	0.24786	0.23616
Electricity, gas, and water supply	0.34646	0.33116	0.29757	0.29978	0.29631	0.29371	0.28776	0.27932	0.2747	0.25723	0.24644	0.25717	0.24674	0.24461	0.22766
Construction	0.45585	0.40355	0.36964	0.38033	0.35766	0.35603	0.34803	0.34962	0.36411	0.31478	0.30197	0.31087	0.29965	0.29102	0.27439
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	0.26839	0.25587	0.24374	0.22518	0.20697	0.21836	0.21476	0.21511	0.22336	0.20217	0.1946	0.20369	0.21935	0.23039	0.21848
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.27631	0.23165	0.21908	0.21382	0.20697	0.20288	0.19971	0.19581	0.20887	0.18109	0.1763	0.18259	0.1772	0.17679	0.16742
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.23732	0.23188	0.21964	0.20844	0.20697	0.1991	0.19672	0.1936	0.20694	0.18002	0.17473	0.18273	0.18599	0.19079	0.18137
Hotels and restaurants	0.30955	0.24268	0.22825	0.22195	0.2231	0.21267	0.20937	0.20367	0.23188	0.19024	0.18453	0.19287	0.18364	0.17962	0.16792
Inland transport	0.36599	0.35352	0.33808	0.32355	0.31797	0.30703	0.3026	0.2958	0.31572	0.27333	0.26532	0.2765	0.2677	0.26741	0.25255
Water transport	0.38487	0.30436	0.28988	0.27652	0.25752	0.25752	0.25995	0.25954	0.27135	0.23075	0.2231	0.23241	0.23139	0.23044	0.20972
Air transport	0.463	0.46644	0.44712	0.42196	0.41226	0.40778	0.39981	0.38372	0.41459	0.36481	0.35326	0.37072	0.35896	0.36269	0.33765
Other supporting and auxiliary transport activities; activities of travel agencies	0.36127	0.35539	0.34189	0.32616	0.31964	0.30596	0.29726	0.29441	0.31266	0.27411	0.26683	0.27763	0.27707	0.27533	0.2508
Post and telecommunications	0.3151	0.26763	0.2444	0.24644	0.25285	0.2412	0.23057	0.22761	0.24474	0.20194	0.19781	0.20455	0.20659	0.20516	0.17991
Financial intermediation	0.31441	0.10666	0.09314	0.08904	0.10133	0.08822	0.08677	0.08415	0.11407	0.07908	0.07791	0.08162	0.08515	0.08605	0.07622
Real estate activities	0.21809	0.08	0.07287	0.07015	0.0742	0.06104	0.05988	0.05868	0.07876	0.05506	0.05401	0.05635	0.06304	0.0638	0.05716
Renting of M&Eq and other business activities	0.31262	0.19143	0.17931	0.16755	0.15363	0.15701	0.15355	0.14073	0.16908	0.13969	0.13647	0.14118	0.14334	0.14663	0.13295
Public administration and defense; compulsory social security	0.22543	0.23214	0.21911	0.21168	0.21004	0.20094	0.18903	0.19317	0.20727	0.17973	0.17512	0.18212	0.18412	0.18172	0.1627
Education	0.09173	0.11638	0.11172	0.11308	0.10505	0.09753	0.09504	0.09439	0.0996	0.08747	0.08515	0.08781	0.08603	0.08648	0.07775
Health and social work	0.19627	0.3386	0.3247	0.3145	0.31967	0.30634	0.30289	0.29602	0.30577	0.27552	0.26821	0.27727	0.26268	0.25862	0.2445
Other community, social, and personal services	0.18229	0.25117	0.22267	0.23019	0.22023	0.21505	0.21036	0.20606	0.22471	0.19128	0.18641	0.19334	0.19158	0.18843	0.16727

M&Eq = machinery and equipment,= NEC = not elsewhere classified.

Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

Table 5: Forward Import Multipliers

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.3043	0.38845	0.3366	0.24458	0.26747	0.27133	0.23829	0.21669	0.23033	0.24405	0.24956	0.36228	0.32426	0.28718
Mining and quarrying	0.78603	0.73584	0.68065	0.70929	0.7649	0.77845	0.80909	0.76748	0.65791	0.52152	0.52656	0.62138	0.75537	0.80194
Food, beverages, and tobacco	0.27294	0.40309	0.34539	0.21282	0.25174	0.23634	0.20707	0.18593	0.1948	0.19105	0.19289	0.347	0.32705	0.24869
Textiles and textile products	0.20202	0.30838	0.20509	0.15282	0.1805	0.23304	0.1663	0.15925	0.1643	0.20296	0.21311	0.29257	0.30951	0.31528
Leather, leather products, and footwear	0.03413	0.13767	0.06516	0.03249	0.08111	0.09358	0.07672	0.04567	0.06841	0.05881	0.06915	0.16704	0.15022	0.17687
Wood and products of wood and cork	0.65219	0.95586	0.65066	0.44761	0.45922	0.49788	0.41384	0.36517	0.35799	0.339	0.33528	0.41122	0.34178	0.3379
Pulp, paper, paper products, printing, and publishing	0.4551	0.48761	0.36336	0.48798	0.4931	0.45712	0.40106	0.37203	0.43827	0.40259	0.48822	0.44206	0.37166	0.35651
Coke, refined petroleum, and nuclear fuel	0.39027	0.60645	0.38012	0.48122	0.55186	0.60659	0.67657	0.59762	0.50213	0.34066	0.35047	0.46706	0.55673	0.552
Chemicals and chemical products	0.73452	0.79293	0.71298	0.671	0.69826	0.6342	0.66586	0.66428	0.68158	0.45172	0.48013	0.60611	0.57172	0.58621
Rubber and plastics	0.64837	0.73428	0.74471	0.58615	0.5768	0.57443	0.53857	0.53844	0.56825	0.55411	0.56643	0.54447	0.39563	0.40849
Other nonmetallic minerals	0.27936	0.47423	0.27483	0.28872	0.24408	0.2462	0.21492	0.19445	0.20406	0.19507	0.18738	0.33487	0.35693	0.4793
Basic metals and fabricated metal	0.54932	0.66359	0.46238	0.38381	0.46746	0.43774	0.39041	0.36705	0.37325	0.36557	0.31927	0.45997	0.57854	0.60209
Machinery, nec	0.42745	0.597	0.43567	0.20246	0.35056	0.32268	0.31374	0.28647	0.33131	0.41171	0.42085	0.38954	0.32187	0.29504
Electrical and optical equipment	0.58159	0.71325	0.42066	0.62901	0.58321	0.59887	0.58366	0.51071	0.56879	0.61039	0.62552	0.68229	0.78637	0.73195
Transport equipment	0.25357	0.27194	0.23966	0.33519	0.16693	0.14897	0.13492	0.11014	0.12484	0.14486	0.15551	0.16031	0.13158	0.12608
Manufacturing, nec; recycling	0.25098	0.24502	0.28473	0.27945	0.23327	0.22193	0.221	0.19118	0.23655	0.25679	0.21598	0.2133	0.19259	0.19803
Electricity, gas, and water supply	0.36233	0.13392	0.14441	0.24929	0.21774	0.21067	0.19739	0.18132	0.18481	0.17599	0.18709	0.24303	0.26231	0.28733
Construction	0.0942	0.11096	0.10026	0.10093	0.10466	0.08806	0.1183	0.11412	0.11705	0.11785	0.11713	0.11884	0.07371	0.07349
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	0.40398	0.4795	0.40631	0.22783	0.36015	0.41827	0.34327	0.30365	0.349	0.31331	0.31381	0.33875	0.2867	0.30182
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.40539	0.39972	0.32996	0.26437	0.34069	0.31727	0.31116	0.28311	0.28353	0.27508	0.27782	0.31827	0.31996	0.31072
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.3251	0.32806	0.31361	0.46347	0.34006	0.28927	0.3033	0.25911	0.2473	0.24784	0.24909	0.26416	0.21232	0.22563
Hotels and restaurants	0.05604	0.04694	0.04389	0.05143	0.03957	0.0384	0.03759	0.03042	0.03417	0.03333	0.03361	0.04441	0.12021	0.13104
Inland transport	0.53129	0.43844	0.32821	0.30713	0.40012	0.3747	0.38023	0.35337	0.33941	0.32767	0.32228	0.35692	0.37181	0.34786
Water transport	0.33404	0.57804	0.24649	0.13662	0.25275	0.27764	0.24595	0.23294	0.23933	0.23247	0.24006	0.35288	0.44759	0.44942
Air transport	0.4443	0.48504	0.38383	0.38745	0.36206	0.33963	0.35167	0.33263	0.32437	0.31812	0.31357	0.3595	0.42536	0.53377
Other supporting and auxiliary transport activities; activities of travel agencies	0.42944	0.47779	0.35493	0.36175	0.36696	0.35466	0.34858	0.31877	0.3082	0.29093	0.28556	0.3306	0.3303	0.31759
Post and telecommunications	0.41484	0.33013	0.46753	0.19797	0.27572	0.25929	0.24616	0.21742	0.21086	0.20752	0.20524	0.19686	0.16348	0.14696
Financial intermediation	0.28177	0.26771	0.2647	0.23692	0.22712	0.22146	0.22286	0.20442	0.21061	0.20436	0.20232	0.26344	0.25716	0.2568
Real estate activities	0.09065	0.11201	0.09518	0.08969	0.21688	0.2083	0.20529	0.18314	0.19135	0.18784	0.19142	0.206	0.23318	0.22383
Renting of M&Eq and other business activities	0.52524	0.4838	0.28304	0.40293	0.26161	0.27376	0.26578	0.22841	0.2391	0.23565	0.24281	0.25602	0.5034	0.38323
Public administration and defense; compulsory social security	0.00139	0.02215	0.04332	0.03317	0.00077	0.0006	0.00072	0.0005	0.00076	0.00085	0.00083	0.00139	0.00145	0.00105
Education	0.00054	0.00011	8.2E-05	0.00048	0.00055	0.0005	0.00052	0.00051	0.00054	0.00381	0.003	0.00777	0.02605	0.01326
Health and social work	0.01546	0.00086	0.00094	0.01289	0.01209	0.01152	0.01213	0.01083	0.01146	0.01228	0.01304	0.03691	0.03015	0.03005
Other community, social, and personal services	0.22641	0.06081	0.0802	0.01286	0.09577	0.1306	0.15606	0.07613	0.08796	0.10596	0.08922	0.13217	0.12503	0.14311

M&Eq = machinery and equipment,= NEC = not elsewhere classified.
Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

Table 6: Trade-Based Backward Participation

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.18442	0.174985	0.16662	0.168662	0.163647	0.161841	0.142507	0.171628	0.146362	0.141785	0.14774	0.142677	0.142285	0.133062
Mining and quarrying	0.104697	0.095983	0.096376	0.093624	0.093057	0.091361	0.089954	0.093497	0.082652	0.079577	0.082614	0.078803	0.07784	0.072943
Food, beverages, and tobacco	0.311861	0.292782	0.286294	0.28524	0.271951	0.269185	0.267961	0.307917	0.245745	0.237683	0.248857	0.239199	0.235584	0.222497
Textiles and textile products	0.426165	0.401364	0.388956	0.392219	0.381223	0.372856	0.362204	0.376823	0.338951	0.331241	0.345292	0.328372	0.318447	0.299605
Leather, leather products, and footwear	0.326797	0.309608	0.296535	0.295618	0.287866	0.284104	0.276176	0.293553	0.256651	0.250755	0.26133	0.254192	0.252477	0.239729
Wood and products of wood and cork	0.286135	0.267902	0.260948	0.264463	0.2514	0.263987	0.261178	0.278861	0.225048	0.218267	0.224703	0.226466	0.225707	0.207647
Pulp, paper, paper products, printing, and publishing	0.390166	0.373303	0.349662	0.348957	0.33853	0.322094	0.306014	0.344311	0.299662	0.292873	0.30323	0.290552	0.287684	0.267769
Coke, refined petroleum, and nuclear fuel	0.325229	0.296111	0.294306	0.300641	0.288843	0.283423	0.27343	0.293328	0.245569	0.233082	0.245257	0.233354	0.241847	0.243497
Chemicals and chemical products	0.48347	0.448824	0.445188	0.444323	0.440279	0.434682	0.424429	0.443116	0.391861	0.378193	0.392627	0.369359	0.364024	0.344412
Rubber and plastics	0.560156	0.538899	0.508302	0.498496	0.515706	0.516691	0.504548	0.519043	0.462367	0.450569	0.465155	0.450798	0.457439	0.44888
Other nonmetallic minerals	0.423806	0.356745	0.389127	0.371512	0.381208	0.372648	0.365937	0.387432	0.326185	0.306897	0.318617	0.317256	0.318409	0.295941
Basic metals and fabricated metal	0.628649	0.605343	0.593557	0.573283	0.570731	0.557383	0.556059	0.559617	0.512945	0.495972	0.512092	0.483418	0.467864	0.441021
Machinery, nec	0.526742	0.505955	0.496997	0.479054	0.476071	0.46608	0.464163	0.465542	0.429528	0.416472	0.429049	0.40898	0.398366	0.377821
Electrical and optical equipment	0.68668	0.662177	0.661345	0.632626	0.641149	0.627437	0.631517	0.619738	0.591216	0.579177	0.592143	0.55267	0.518333	0.493915
Transport equipment	0.649335	0.624748	0.618291	0.585855	0.582307	0.572845	0.575822	0.578667	0.539344	0.520398	0.534703	0.548018	0.550575	0.52478
Manufacturing, nec; recycling	0.335978	0.314533	0.31304	0.306432	0.299629	0.297429	0.299966	0.348502	0.266212	0.256701	0.265796	0.253944	0.247863	0.236157
Electricity, gas, and water supply	0.331162	0.29757	0.299776	0.296315	0.29371	0.287764	0.279323	0.274703	0.25723	0.246445	0.257169	0.246741	0.244609	0.227664
Construction	0.403551	0.369637	0.380331	0.357658	0.356026	0.348031	0.349622	0.364107	0.314777	0.301967	0.310872	0.299648	0.291018	0.274387
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	0.255873	0.243744	0.225185	0.206973	0.218359	0.214762	0.21511	0.223361	0.202171	0.194604	0.203691	0.219348	0.230386	0.218477
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.231645	0.219079	0.213816	0.206973	0.202882	0.199705	0.195807	0.208871	0.181093	0.176304	0.182594	0.177203	0.176795	0.167416
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.231879	0.219642	0.208443	0.206973	0.199102	0.196716	0.193597	0.206935	0.180023	0.174731	0.182734	0.18599	0.19079	0.18137
Hotels and restaurants	0.242677	0.228248	0.221951	0.223104	0.212674	0.20937	0.203671	0.231882	0.190235	0.184532	0.192869	0.183639	0.179621	0.167924
Inland transport	0.353523	0.338078	0.323552	0.317971	0.307033	0.302599	0.295804	0.315717	0.273331	0.265315	0.276504	0.267699	0.267411	0.252549
Water transport	0.304357	0.289882	0.276518	0.257518	0.25752	0.25995	0.259541	0.271354	0.230745	0.223099	0.232407	0.23139	0.230439	0.209718
Air transport	0.466438	0.447123	0.421965	0.412258	0.407781	0.399809	0.383719	0.41459	0.364811	0.35326	0.370725	0.358958	0.362687	0.337655
Other supporting and auxiliary transport activities; activities of travel agencies	0.355391	0.341886	0.326157	0.31964	0.305963	0.297263	0.294408	0.312656	0.274109	0.266827	0.277627	0.277066	0.275334	0.250805
Post and telecommunications	0.267631	0.244403	0.246436	0.252845	0.241197	0.230569	0.227614	0.244742	0.201935	0.197815	0.204548	0.206586	0.205158	0.17991
Financial intermediation	0.106659	0.093136	0.089038	0.101335	0.088225	0.086769	0.084154	0.114074	0.079082	0.077911	0.081617	0.085145	0.086048	0.076224
Real estate activities	0.080014	0.072772		0.074136	0.061019					0.054008	0.056347	0.063036	0.063795	0.057159
Renting of M&Eq and other business activities	0.191428	0.179309	0.167552	0.153626	0.157009	0.153554	0.140726	0.169079	0.139691	0.136467	0.141175	0.143336	0.146631	0.132947
Public administration and defense; compulsory social security	0.232141	0.21911	0.211684	0.210038	0.20094	0.189033	0.193167	0.207269	0.179726	0.175116	0.182116	0.184119	0.181718	0.162697
Education	0.116384	0.111721	0.113086	0.105048	0.097534	0.095038	0.094393	0.099601	0.08747	0.085152	0.087815	0.086029	0.086476	0.07775
Health and social work	0.338606	0.324692	0.314497	0.319674	0.306339	0.302889	0.296027	0.305768	0.27552	0.268214	0.277266	0.262678	0.258618	0.2445
Other community, social, and personal services	0.251172	0.222675	0.230185	0.220233	0.215046	0.210359	0.206063	0.224714	0.191276	0.18641	0.19334	0.191583	0.188429	0.167272

M&Eq = machinery and equipment,= NEC = not elsewhere classified.

Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

Table 7: Trade-Based Forward Participation

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agriculture, hunting, forestry, and fishing	0.10976	0.11538	0.10337	0.09062	0.11869	0.16155	0.10945	0.10443	0.10874	0.19678	0.15041	0.16575	0.17011	0.16253
Mining and quarrying	0.53356	0.4153	0.51246	0.6164	0.5941	0.48411	0.57842	0.5536	0.4823	0.49323	0.47933	0.48707	0.3099	0.32723
Food, beverages, and tobacco	0.08675	0.11442	0.08956	0.06956	0.08743	0.10587	0.08384	0.06421	0.07403	0.10463	0.1136	0.16207	0.16701	0.17721
Textiles and textile products	0.06191	0.08787	0.06044	0.04715	0.07496	0.12655	0.07137	0.05968	0.06409	0.09613	0.09827	0.12481	0.1473	0.15763
Leather, leather products, and footwear	0.01222	0.05163	0.01224	0.01143	0.03243	0.0525	0.03201	0.01205	0.02326	0.01855	0.0243	0.09052	0.13499	0.13698
Wood and products of wood and cork	0.18249	0.12495	0.18059	0.15947	0.1978	0.24043	0.22888	0.22238	0.23591	0.21942	0.22492	0.23352	0.20245	0.19632
Pulp, paper, paper products, printing, and publishing	0.15747	0.16026	0.1192	0.21933	0.2291	0.21476	0.17579	0.13046	0.1852	0.20418	0.29909	0.27629	0.20356	0.20986
Coke, refined petroleum, and nuclear fuel	0.19728	0.29248	0.20933	0.26433	0.284	0.42832	0.26229	0.27912	0.32936	0.23112	0.23812	0.26979	0.3252	0.3142
Chemicals and chemical products	0.23665	0.23156	0.20965	0.24497	0.2857	0.29665	0.28727	0.249	0.27471	0.18518	0.19154	0.19548	0.19183	0.18733
Rubber and plastics	0.18113	0.1944	0.18213	0.17309	0.17685	0.20888	0.1775	0.1564	0.18164	0.20819	0.20771	0.22776	0.15714	0.15332
Other nonmetallic minerals	0.13578	0.15864	0.13036	0.11397	0.05888	0.07874	0.03779	0.02739	0.02115	0.01977	0.01865	0.11674	0.15287	0.11829
Basic metals and fabricated metal	0.12941	0.13478	0.11488	0.08658	0.12977	0.12467	0.12756	0.14152	0.12948	0.11529	0.08297	0.15364	0.1916	0.18699
Machinery, nec	0.09956	0.16613	0.09598	0.0405	0.0943	0.09157	0.08287	0.06951	0.09046	0.11501	0.11631	0.13986	0.09809	0.08582
Electrical and optical equipment	0.13029	0.16649	0.1022	0.15911	0.1557	0.14658	0.16245	0.10748	0.14116	0.16689	0.17631	0.20797	0.18318	0.18254
Transport equipment	0.08002	0.08697	0.04141	0.11314	0.04607	0.03732	0.02686	0.02996	0.02777	0.03896	0.04339	0.03893	0.08021	0.08244
Manufacturing, nec; recycling	0.07987	0.08591	0.09	0.10735	0.07339	0.06877	0.06806	0.06795	0.08223	0.11335	0.07767	0.03067	0.0363	0.0332
Electricity, gas, and water supply	0.15982	0.0143	0.11119	0.17043	0.12403	0.10325	0.12342	0.1343	0.14482	0.15137	0.16106	0.19834	0.17284	0.17171
Construction	0.08886	0.09792	0.09666	0.13385	0.15646	0.11169	0.14133	0.14523	0.15052	0.16085	0.16188	0.21934	0.11918	0.10451
Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	0.17338	0.19135	0.15715	0.50416	0.16594	0.27948	0.16578	0.15731	0.15424	0.16014	0.16616	0.22288	0.11183	0.08517
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.17405	0.20499	0.16553	0.15694	0.18047	0.17173	0.18189	0.17274	0.17978	0.18553	0.19882	0.23717	0.18469	0.19074
Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.23527	0.19609	0.26891	0.29029	0.34111	0.20934	0.34489	0.26562	0.30237	0.31898	0.3336	0.4542	0.20447	0.1384
Hotels and restaurants	0.06158	0.00059	0.001	0.06037	0.06421	0.05378	0.04924	0.04553	0.05329	0.02577	0.04226	0.15717	0.10474	0.15557
Inland transport	0.23458	0.15949	0.21423	0.21718	0.21079	0.17471	0.20446	0.19114	0.1876	0.21885	0.2222	0.19628	0.16947	0.16628
Water transport	0.15803	0.20323	0.08552	0.0526	0.10226	0.16389	0.10575	0.11529	0.12748	0.13779	0.15975	0.33331	0.27868	0.38561
Air transport	0.11195	0.12598	0.12445	0.13423	0.14286	0.13372	0.14789	0.13893	0.13772	0.16049	0.15628	0.16461	0.14058	0.12068
Other supporting and auxiliary transport activities; activities of travel agencies	0.13549	0.14828	0.16542	0.17398	0.17545	0.17241	0.17683	0.16076	0.16249	0.18203	0.18479	0.32511	0.33108	0.39888
Post and telecommunications	0.17064	0.182	0.13578	0.15589	0.14656	0.14492	0.14756	0.18159	0.16211	0.15793	0.17068	0.22506	0.19719	0.22734
Financial intermediation	0.21204	0.22155	0.21213	0.23055	0.21025	0.24419	0.24143	0.23234	0.24075	0.24852	0.25839	0.34168	0.21416	0.3013
Real estate activities	0.08658	1.1E-08		0	0.22156					0.25672	0.27268	0.32144	0.20637	0.31153
Renting of M&Eq and other business activities	0.25608	0.324	0.23075	0.2448	0.17556	0.26156	0.29281	0.29675	0.31275	0.30286	0.3248	0.29702	0.24709	0.33279
Public administration and defense; compulsory social security	0.03212	0.007	0.09671	0.0585	0.04397	0.03652	0.05132	0.03135	0.07114	0.06471	0.06082	0.15641	0.14127	0.17887
Education	0.01034	0.079	0.02292	4.8E-07	0.02096	0.05808	0.01396	0.00249	0.02005	0.08701	0.06478	0.15809	0.12772	0.11882
Health and social work	0.09182	0.04627	0.03016	1.6E-06	0.03769	0.03991	0.0409	0.00321	0.04152	0.03988	0.04875	0.04879	0.0337	0.04568
Other community, social, and personal services	0.1729	0.20096	0.14487	0.01654	0.04137	0.07939	0.12475	0.0248	0.06065	0.09441	0.06899	0.12527	0.11043	0.10259

M&Eq = machinery and equipment,= NEC = not elsewhere classified.

Source: https://data.adb.org/dataset/malaysia-input-output-economic-indicators (accessed 22 May 2022).

5. Production Networks, Trade, and Pandemic Recovery

The discussions in the previous sections suggest that Malaysia's economic performance during the pandemic and post-pandemic periods was supported by exports to some extent. However, the preceding section also pointed out the decline in backward and forward trade linkages. An econometric analysis might be useful to disentangle both these two effects (export and trade linkages). This is undertaken below.

5.1. Model

An econometric panel data analysis of how the economy is affected by structural change in the production network is undertaken using a national income decomposition model augmented by intersectoral production network.

The first model is used to decompose national income growth augmented with domestic intersectoral linkages. The model is specified as follows:

$$\ln Y_{it} = \alpha + \beta_1 C_t + \beta_2 I_{it} + \beta_3 G_{it} + \beta_4 X_{it} - \beta_5 M_{it} + \beta_6 X_{it}*BWD_{it} + \beta_7 X_{it}*FWD_{it} + \varepsilon_{i,t} \qquad (1)$$

where Y is GDP, C consumption, G government expenditure, X export, and M import. The variable BWD is the direct backward linkage, which is defined as the ratio of a sector's intermediate inputs to its total output. This variable measures directly the dependence of a sector on intersectoral supply of inputs. Similarly, the FWD variable is the direct forward linkage is defined as the ratio of a sector's intermediate sales to its total output. This variable measures directly the dependence of a sector on intersectoral demand for its output.

A modified version of the above model that incorporates trade linkages is used to test for the role of trade and the GVC. The model is as follows:

$$\ln Y_{it} = \alpha + \beta_1 C_t + \beta_2 I_{it} + \beta_3 G_{it} + \beta_4 X_{it} - \beta_5 M_{it} + \beta_6 X_{it}*TBWD_{it} + \beta_7 X_{it}*TFWD_{it} + \varepsilon_{i,t} \qquad (2)$$

where TBWD is the GVC backward participation is the sum of foreign value-added (FVA) and pure double-counted (PDC) of a sector's exports divided by the total exports of the sector. The variable TFWD is the sum of reexports (REX) and reflected (REF) exports (to the rest of the world) divided by the total exports of the sector.

The Hausman specification test is carried out to determine whether the fixed effect specification or the random effect specification is appropriate.

5.2. Data Sources

The real GDP data are obtained from the World Bank (https://data.worldbank.org/, accessed 11 May 2022). The export data are obtained from CEIC (https://insights.ceicdata.com, accessed 11 May 2022). The upstream (backward participation) and downstream (forward participation) data are obtained from the Asian Development Bank (https://data.adb.org/dataset/malaysia-input-output-economic-indicators, accessed 22 May 2022). Similarly, the trade backward and trade forward participation were computed by ADB (https://data.adb.org/dataset/malaysia-input-output-economic-indicators, accessed 22 May 2022). The data cover the period 2008 to 2020 and 34 sectors (defined by ADB).

5.3. Results

The results of the estimations are summarised in Table 8 (domestic linkages) and Table 9 (trade linkages). The estimations for the domestic intersectoral linkage model show that trade is a positive driver of growth. For estimations involving all sectors, the key and statistically significant and positive components of growth are consumption and investment. The dominance of the services sector (which exports relatively little) affects the overall contribution of the export sector (Table 8). However, when services are excluded, the export sector plays a key role in the GDP growth of agriculture (including mining) and manufacturing. The interaction variable for exports and backward linkage is statistically significant – indicating that an increase in domestic backward linkages (intermediates/output ratio) dampens the impact of exports on GDP growth. This implies that as the Malaysian economy has more domestic linkages (less reliance on imported inputs), it is less likely to benefit from external positive export shocks.

The opposite results are obtained for backward and forward trade linkages (Table 9). The consumption and investment variables are statistically significant and have the expected signs. Any increases in trade backward and forward linkages enhance the impact of an increase in exports on the GDP growth of the manufacturing sector. Thus, GVC participation enhances the effect of positive export shocks on the country's economic growth.

Comparisons of the results for the entire economy and those of the agriculture and manufacturing sector provide some insight for the role of the services sector. Consumption in the services sector is clearly an important driver of growth. A positive export shock is enhanced by higher domestic intersectoral linkages in services sector but not in manufacturing.

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Table 8: Growth Decomposition with Domestic Backward and Forward Linkages

	(A) All	(B) All	(C) Agriculture & Manufacturing	(D) Agriculture & Manufacturing
Variables	lnGDP	lnGDP	lnGDP	lnGDP
lnConsumption	0.116***	0.103***	0.0251	0.0172
	0.0225	0.0192	0.0222	0.0127
lnInvestment	0.0602***	0.0479***	0.152***	0.0341**
	0.0199	0.0181	0.0235	0.0149
lnGovernment	-0.0347***	-0.0214**	-0.0670***	-0.0133
	0.00948	0.00914	0.0154	0.00988
lnExport	-0.0141	-0.168***	0.306***	0.872***
	0.0161	0.0325	0.0545	0.0773
lnImport	-0.00762	-0.00831*	-0.0173***	-0.0115***
	0.0059	0.00501	0.00664	0.00384
Backward		-0.247		4.546***
		1.053		1.295
Forward		-0.769*		2.665***
		0.445		0.665
lnExport*Backward		0.397***		-0.360***
		0.106		0.132
lnExport*Forward		0.172***		-0.0987
		0.0585		0.0759
Constant	7.424***	7.244***	4.437***	-1.11
	0.172	0.332	-0.525	0.694
Observations	421	421	209	209
R-squared	0.244	0.466	0.353	0.798
Number of sectors	33	33	16	16
Note: Standard errors below coefficients.				
*** p<0.01, ** p<0.05, * p<0.1				

Source: Author.

Table 9: Growth Decomposition with Trade Backward and Forward Linkages

Variables	(A) All	(B) All	(C) Agriculture & Manufacturing	(D) Agriculture & Manufacturing
	lnGDP	lnGDP	lnGDP	lnGDP
lnConsumption	0.116***	0.0969***	0.0251	0.0445**
	0.0225	0.0195	0.0222	0.0203
lnInvestment	0.0602***	0.0428**	0.152***	0.0874***
	0.0199	0.0178	0.0235	0.0226
lnGovernment	-0.0347***	-0.00977	-0.0670***	-0.0241
	0.00948	0.00865	0.0154	0.015
lnExport	-0.0141	-0.185***	0.306***	0.0344
	0.0161	0.0335	0.0545	0.111
lnImport	-0.00762	-0.00989*	-0.0173***	-0.0194***
	0.0059	0.00507	0.00664	0.00571
Backward Trade		-7.876***		-8.518***
		1.087		2.174
Forward Trade		-3.951***		-3.572*
		0.87		1.951
lnExport*Backward Trade		0.499***		0.640**
		0.126		0.246
lnExport*Forward Trade		0.540***		0.418*
		0.106		0.215
Constant	7.424***	10.02***	4.437***	8.081***
	0.172	0.313	0.525	0.966
Observations	421	421	209	209
R-squared	0.244	0.456	0.353	0.535
Number of sectors	33	33	16	16
Note: Standard errors below coefficients.				
*** p<0.01, ** p<0.05, * p<0.1				

Source: Author.

6. Conclusions

Malaysia has an open economy and the country has historically been dependent on exports as a driver of growth. There are significant structural changes in the Malaysian economy that have impacted the resilience of the economy. The services sector has become increasingly important, whilst the manufacturing sector has become less important. These changes have important implications on the economic resilience of the country to shocks such as the COVID-19 pandemic. There is evidence that exports have been a key source of the country's economic resilience during the COVID-19 pandemic and post-pandemic periods. However, long-term structural change in intersectoral production networks could have reduced this resilience. Stronger domestic intersectoral linkages and declining participation in backward GVC participation are likely to reduce the impact of positive export shocks on the country's economic growth. The services sector has become increasing important over time. Consumption in the services sector is clearly an important driver of growth. A positive export shock is enhanced by higher domestic intersectoral linkages in services sector but not in manufacturing.

From a policy perspective, structural change can alter the resilience of an economy to domestic and external shocks. Short to medium-term macroeconomic stabilisation policies are affected by long-term structural changes. This phenomenon suggests that industrial policies that are aimed at altering the structure of an economy will need to consider how the resulting structural change will affect macroeconomic resilience and stability. This applies particularly to industrial policies that shape production networks – both domestic intersectoral linkages and external linkages in the form of GVC participation. Such policies will also need to take into account how market imperfections within production networks can affect economic resilience (Liu, 2019). The role of firm size distribution within production networks is another important aspect that merits greater policy attention (Carvalho and Grassi, 2019).

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