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Exporting processed food:

Sri Lanka's experience in the Asian context*

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Abstract

In recent decades, there has been a palpable shift in the commodity composition of world agri-food trade away from the traditional primary (unprocessed) products mostly exported from developing countries. However, this structural change in trade patterns and its policy implications have so far received scant attention in policy making in most agricultural-resource rich developing countries. Policy makers are still wedded to the conventional division of primary products and manufactured goods that lumps together processed food with primary (unprocessed) agri-food products. This paper aims to draw attention to this policy oversight by examining the experience of Sri Lankan in processed food exports against the backdrop of the experiences of the other countries is the Asian region. The analysis uses a new dataset that systematically delineate processed food from the traditional primary good products, The analytical narrative of inter-country pattern of export performance shows that, unlike primary commodity dependence, exporting processed food is positively associated with the state of economic advancement of countries. The results of the econometric analysis suggests that export success of a country is determined by a combination of growth of world demand, the domestic agricultural resource endowment and the conduciveness of the policy regime for global economic integration.

Key words: agri-food, processed food, trade policy, globalization, export performance

JEl Codes: F13, F63, N45, O13, Q17

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1. Introduction

A notable development in the world agri-food trade in recent decades has been the rapid expansion of products exported in processed form (processed food)[1] compared to the traditional unprocessed products. The relative importance of 'classical' export commodities traded mostly in raw form (coffee, tea, sugar, cocoa and so on) have sharply eroded as a result of rapid expansion of trade in products such as fruits and vegetables, poultry, fish and dairy products, which are exported in processed form.

Powerful forces on both demand and supply sides have underpinned this structural change in global trade patterns. On the demand side, food habits have also become increasingly 'internationalized' driven by factors such as international migration, communication revolution and international tourism. There has also been a 'nutritional transition' in food demand, a shift from starchy staples to more nutritious foods such as meat, vegetables and fruits, which are mostly traded in processed form[2] (Euromonitor International 2012, Gouel and Guimbard 2019, Masters et al. 2022). On the supply side, international tradability of processed food has increased notably thanks to advances in technology in food processing and improvement in refrigeration and global transportation facilities (Athukorala & Sen 1998). International tradability has further strengthened by 'Supermarketization' of food trade, and the associated expansions in contract farming in a variety of food products within the global agricultural value change (Martin 2019, Athukorala and Jayasuriya, 2003; Luckstead 2023).

The opportunity for expanding processed food deserves special attention in agricultural modernization in agricultural resource-rich countries for several reasons. First, diversification into processed food would help faster export orientation of agricultural production because income elasticity of demand for these products is larger compared to traditional primary products. The available income elasticity estimates convincingly suggest that the Engel Law, which postulates that the share of income spent on food declines as incomes rise, does not hold

[1] A widely used alternative term is 'high-value food'.

[2] The basic regularity of fall in the share of starch staples in the diet in favour of more nutritious food with higher income was first identified by Bennett (1954), and hence is dubbed 'Bennett Law'.

for processed food (Islam and Subramanian 1989, Suanin 2021[3], Baiardi et al 2014). Second, unlike in the case of processing of traditional primary product such as minerals and timber, final stages of food processing is highly labour-intensive (Roemer, 1979; Findlay, 1985). This implies that the expansion of the processed food sector can have a strong positive effect on employment generation and poverty alleviation in the typical labour-surplus developing economy (Weerahewa et al, 2009, Nidhiprabha & Chanchan 2005). Third, most processed food products have considerably high domestic input content (and hence high domestic value-added), compared to the conventional manufactured products such as garments, footwear and electronic assembly. Fourth, given the strong rural base of food production, the expansion of processed food industry is a powerful vehicle for linking the agricultural sectors with the manufacturing sector (Nidhiprabah 2004, Wilkinson 2012, Ehlert et al. 2014). Finally, there is evidence that processed food exports help agricultural modernisation productivity growth through knowledge spillover—learning through interaction with foreign buyers, exposure to foreign technology and improving quality standards in face of stringent export competition (Kohpaiboon 1999, Fleming and Abler 2013, Wilkinson et al. 2009).

There is, therefore, a compelling case for paying attention to processed food exports in export development strategy in agricultural resource rich countries. However, in practice, policy makers remained enslaved to the Engel Law, which justifies the continuing policy bias against agriculture. The policy bias is further justified by the available empirical evidence based on the standard trade data classification, which lump together processed food products with the traditional primary products and thus hides the specific growth-conducive effects of process food production and exports.

This purpose of this paper is to contribute to redressing this policy oversight by examining the experience of Sri Lankan in processed food exports against the backdrop of the experiences of the eleven other countries is the Asian region — China, South Korea, Taiwan, Indonesia, Malaysia, the Philippines, Thailand, Vietnam, Bangladesh, India and Pakistan. Featuring notable diversity in

[3] There is also evidence of high cross-price elasticity of processed vegetable, fruit as well as some flour and cereal imported from developing countries in developed-country markets, implying a high degree of substitutability of these products for domestic products.

the stages of development, the timing of policy reforms, and the pace and extent of global economic integration, the Asian countries provide an ideal laboratory for a comparative analysis of the subject at hand. The methodology involves a comparative analytical narrative of export romance, and a panel-data econometric analysis using a new dataset for the period 1990-2022. The dataset has been compiled by systematically separating processed food from total agri-food.

The rest of the paper is structured in four section. Section 2 provides a stage-setting overview of the emerging patterns of processed food exports in Sri Lanka following the economic liberalisation reforms initiated in 1977. Section 3 compares the Sri Lankan experiences in the context of the experiences of the countries in the Asian region. Section 4 undertakes an econometric analysis of the determinants of inter-country variations in export performance in Asia while paying attention to how the Sri Lankan experience compares with the average Asian experience. The final section summarises the findings, derives policy inferences and makes suggestions for further research. The methodology of compiling data from the UN trade data system is discussed in Appendix 1.

2. Processed food exports from Sri Lanka

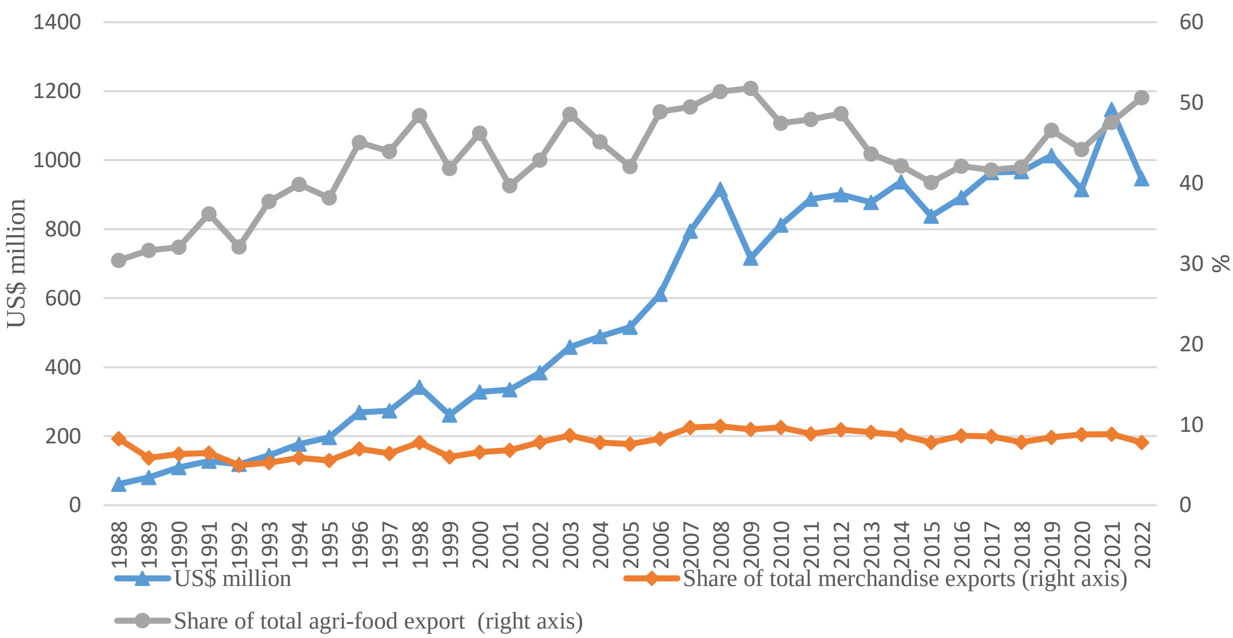
Sri Lanka inherited from the colonial era an export structure dominated by three planation crops —– tea, rubber and coconut products. During the first three decades of independence, the colonial export patterns hardly changed: the 'traditional trio' continued to continuing to account for over 90% of total exports. Following the 1977 policy reforms, and in particular consolidation of reforms in the early 1990s, the export structure has undergone a notable transformation resulting in a decline in the share of the traditional trio to less than a third by the of the late 1990s. The previous analyses of this pattern of export diversification has exclusively focus on the expansion of manufacturing exports, in particular garments.[4] An important development that has so far remain hidden in these analyses is the emergence of processed food as a new export line.

Processed food exports from Sri Lanka increased from an annual average level of US$ 135 million during 1990-95 to about US$900 million during 2005-09 (Figure 1). Since then, the

[4] See Athukorala (2019) and the works cited therein.

rate of growth has slowed. This was the time of significant ant-export bias in the economy resulted from some policy reversal from liberalisation reforms the infrastructure-propelled economic boom following the ending of the civil war in 2009 (Athukorala et al. 2017). However, processed food exports had reached the billion-dollar mark by the late 2010s. The share of processed food in total agri-food exports increased from about 30% in the early 1990 to about 50% in the mid-2000s. Since then, the export share has varied in the range of 43% to 50%.

Figure 1: Processed food exports from Sri Lanka, 1988 - 2022

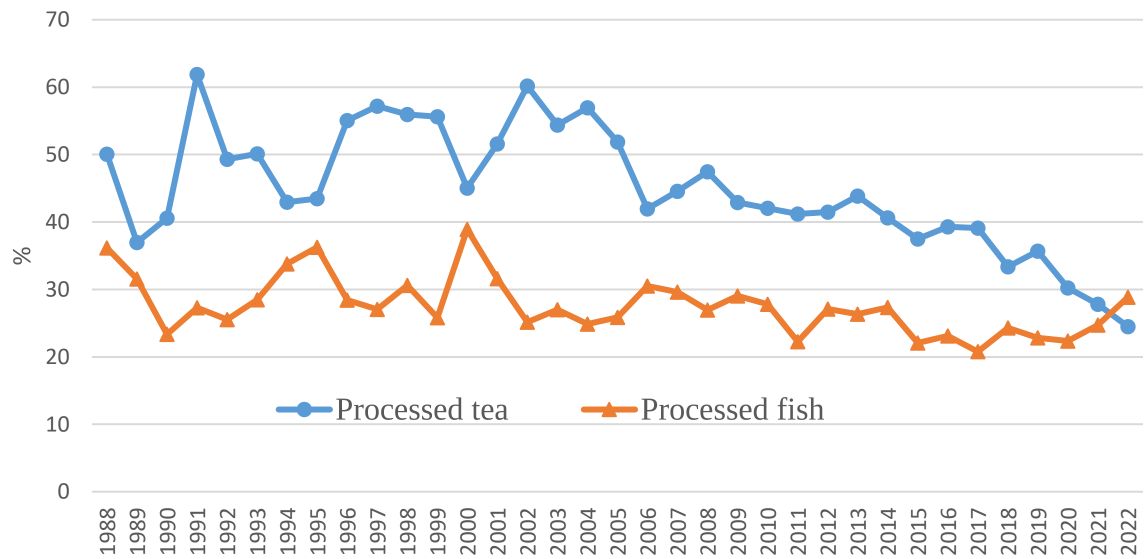


Source: Data compiled from the UN Comtrade database.

The share of processed food in total merchandise exports has varied in the narrow range of 6% to 10%, showing only a modest increasing trend. This is because of the faster growth of manufacturing exports, dominated by garments, compared to the other commodity categories. However, the relative importance of processed food compared to manufactured goods needs to be treated with caution because of the significantly higher import content of the latter products. If the data are appropriately adjusted for the import intensity, the share of processed food in total exports would have been much higher than revealed by the gross-trade figures. According to a simply calculation using the Sri Lankan input-output table for 2010[5], direct import content of manufacturing production (excluding processed food) in that year was 48% compared to a mere 12% of processed food.[6]

The composition of processed food exported from Sri Lanka are heavily concentrated in two products: processed tea (mostly instant tea) and fish products (Table 1). There has been some diversification into other products over the past two decade. However, so far, there are no clear signs of the country carving out a clear competitive edge in any other product category. The share of processed tea declined from about 40% in the early 1990s to about 30% by the late 2010$, but share of fish products has remained around 25% throughout (Figure 2).

Figure 2: Shares of processed tea and fsish inprocessed food exports from Sri Lanka, 1988-2022 (%)



Sauce: Compiled from UN Comtrade database.

[5] Available at the Website of the Department of Census and Statistics: http://www.statistics.gov.lk/NationalAccounts/Stat....

[6] It is important to note that the figure reported here relates to total domestic production of manufacturing. Import context of export production generally tends to be much higher because export producers have to use imported inputs to meet quality requirements dictated by foreign buyers.

Table 1: Sri Lanka: Commodity composition of processed food exports, 1988-2022 (period averages) (%)

SITC codes	Product name	1988-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-22
01	Meat and meat preparation	---	---	0.6	0.3	0.4	0.5	0.4	0.3
02	Dairy and egg products	0.2	0.2	1.0	0.6	0.7	0.6	0.8	0.4
03	Fish. crustaceans and preparations thereof	33.5	26.4	29.3	28.9	28.4	26.2	22.6	25.3
04	Cereals	0.3	0.6	0.4	0.8	7.4	10.6	4.4	3.6
05	Vegetables and fruits and preparations thereof	9.9	11.4	6.3	5.4	5.8	7.1	10.3	11.4
06	Confectionary	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.4
07	Coffee, tea, cocoa and spices	46.2	53.6	57.8	60.6	52.2	49.2	43.9	34.1
07413	of which processed tea[1]	43.5	49.0	53.4	53.6	45.7	41.8	36.9	27.5
09	Miscellaneous prepared edible products	0.6	1.7	2.2	2.3	4.1	3.2	7.8	16.9
11	Beverages	0.2	0.3	0.5	0.5	0.5	1.6	4.1	3.4
41	Animal oils and fats	0.2	0.2	0.1	---	0.1	---	---	---
42	Fixed vegetable facts and oil	9.0	5.4	1.4	0.5	0.3	0.9	5.3	4.3
	Processed food	100	100	100	100	100	100	100	100
	US$ million	71	135	269	399	711	883	935	1003
	Memo items								
	Processed food % of total merchandise exports	7.1	5.8	6.6	7.5	9.0	9.1	8.2	8.5
	Processed food % of total agri-food exports	33.4	38.2	46.2	46.1	51.1	48.7	44.6	51.3

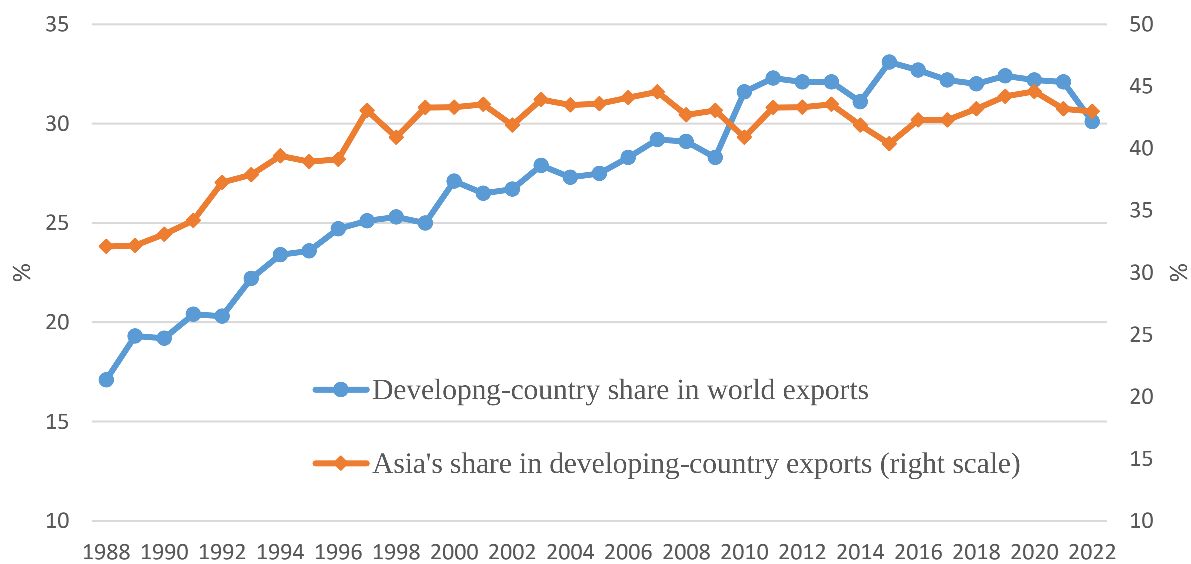
Note: --- Zero or less than 0.05%   (1) predominantly instant tea

Sauce: Compiled from UN Comtrade database.

3. Sri Lankan experience is the Asian context

The share of processed food in total world agri-food trade increased from 27% in the early 1970 over 60% by the end of 2010s. This notable compositional change has been underpinned by repaid market penetration of processed food from developing countries[7]. The developing-country share in total world processed food exports increased from about 17% in 1990-94 to 32% during 2015-19 (Figure 3). The twelve Asian countries covered in this study have been significant gainers of this shift in the source-country origin of processed food exports from developed to developing countries. Their share in developing-country exports increased from 36% during 1990-94 to over 42% by 2015-19.[8]

Figure 3: Processed food exports: developing-country share in world exports and Asia's share in developing-country exports (%)



Sauce: Compiled from UN Comtrade database.

Table 2 presents data on country shares and annual compound growth rates of processed food exports from Asian countries during 1990-2019. Sri Lanka, together with Bangladesh and

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[7] Based on the United Nation country classification: https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf

[8] Data for 2000-22 are excluded from the discussion to allow for the supply-side disruptions cause by the Covid-19 pandemic.

Pakistan, are at the bottom of the county ranking in terms of the export shares within the region. The slowing of Sri Lanka's export expansion in the recent decade is further supported by its comparative performance in the regional context: Sri Lanka's average annual growth rate in 2010-19 was 3.6% compared to the regional average of 5.1% and it was the lowest among the twelve countries after Bangladesh.

Table 2: Processed food exports from Asia: Country shares and growth rates, 1990-19

	Country shares (%)			Annual compound growth rate (%)		
	1990-99	2000-09	2010-19	1990-99	2000-99	2010-19
Bangladesh	1.1	1.0	0.6	8.0	5.0	1.9
China	27.7	37.9	36.3	14.2	9.8	4.5
India	6.5	8.0	9.6	12.5	9.9	5.9
Indonesia	8.5	8.1	9.4	9.7	7.3	7.6
Pakistan	0.9	0.8	1.0	7.9	8.4	4.1
Malaysia	5.6	6.4	7.6	8.7	12.2	7.2
Korea	8.3	4.6	4.4	2.6	1.6	7.2
Philippines	4.1	3.3	2.7	4.4	5.7	3.9
Sri Lanka	0.8	1.1	0.9	14.0	11.6	3.7
Taiwan	10.6	3.8	3.5	-3.2	3.1	8.5
Thailand	23.5	19.0	16.4	6.8	6.8	3.2
Vietnam	2.4	6.2	7.6	22.8	17.5	6.4
Asia	100.0	100.0	100.0	7.7	8.4	5.1
US$ billion	262	494	1021			

Sauce: Compiled from UN Comtrade database

The overall pattern of export shares and growth rates among countries generally support the view that, unlike primary commodity dependence, exporting processed food is not a structural feature of lower status in the development ladder. Taiwan and Korea, the two high-income countries in the region, have continued to record significant growth in process food exports. At the same time, as noted, Bangladesh, Pakistan and Sri Lanka are at the bottom of the performance ranking. Generally, export success in processed food seems to be positively associated with the pace and the degree of global economic integration of countries.

The data reported in Table 3 indicate that the diversification of agri-food exports into processed food among countries takes place side by side with the decline in the share of agriculture in the national economy as conventionally measured in the national income accounts. In other words, generally, exporting processed food seems to come with a decline in the share of agriculture in national output in the process of economic advancement. The upshot is that export orientation in agriculture associated with the structural shift towards processed food in world trade is, in fact, a sign of economic advancement, rather than economic backwardness.

Table 3: Agricultural share in GDP and processed food share in agro-food exports in Asia, 1990- 2019

	Agriculture in GDP (%)			Processed food in agri-food exports (%)		
	1990-99	2000- 99	2010-19	1990-99	2000-99	2010-19
Bangladesh	23.5	17.1	12.9	65.0	76.5	78.1
China	17.4	10.5	7.4	65.0	76.5	78.1
India	22.9	16.3	15.0	40.9	42.3	41.0
Indonesia	16.4	13.2	12.0	40.9	42.3	41.0
Pakistan	21.3	20.5	20.7	40.9	29.7	26.1
Malaysia	11.6	8.2	7.9	31.0	31.5	35.8
Korea	4.8	2.4	1.8	92.4	84.9	76.2
Philippines	15.9	12.3	10.2	45.5	46.4	41.5
Sri Lanka	21.2	12.1	7.1	39.5	48.0	44.1
Taiwan	6.5	3.6	2.5	85.7	95.9	94.5
Thailand	8.8	8.4	8.7	70.4	67.3	59.6
Vietnam	26.4	18.7	12.8	41.6	52.3	45.2
Asia	14.6	10.1	8.1	57.0	56.8	52.1

Sauce: Compiled from UN Comtrade database.

Data on the commodity composition of processed food exports from Asia are summarised in Table 4. In the late 1980s, fish products accounted for over a half of exports from Asia. This figure has continuously declined over the years as the commodity mix diversified into other categories, in particular vegetables and fruits, and meat products. Data for individual counties (not reported here because of the space constraint) show that this commodity diversification patterns are much more prominent in China, Thailand, Taiwan, Korea, suggesting that export success is processed food is associated with the diversification of commodity composition in line with emerging global demand patterns. A composition of the composition of processed food exports from Sri Lanka (Table 1) with the overall Asian patterns, clearly indicate that that Sri Lanka has so far failed to reap gains from emerging export opportunities.

Table 4: Commodity composition of processed food exports from Asian countries (%), 1988-22.

		1988-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-22
1	Meat and meat preparation	5.0	5.6	8.3	7.7	7.1	7.7	8.3	8.2
2	Dairy and egg products	0.3	0.9	0.9	1.4	1.8	1.4	1.5	1.4
3	Fish. crustaceans and preparations thereof	56.5	52.8	49.8	48.8	43.2	38.9	30.8	27.8
4	Cereals	1.5	1.8	2.4	2.9	3.7	4.3	5.4	5.7
5	Vegetables and fruits and preparations thereof	27.8	25.9	21.2	20.7	22.7	22.0	22.5	22.1
6	Confectionary	2.6	2.8	2.9	2.6	3.0	3.4	3.9	4.5
7	Coffee, tea, cocoa and spices	1.9	2.5	3.8	3.8	4.5	5.1	6.2	5.6
9	Miscellaneous edible products and preparations	1.6	3.3	4.6	6.3	7.7	9.2	11.3	14.7
11	Beverages	0.9	1.7	2.6	2.9	2.6	3.2	4.9	4.2
41	Animal oils and fats	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2
42	Fixed vegetable facts and oil	1.9	2.6	3.5	2.6	3.6	4.5	4.8	5.6
	Processed food	100	100	100	100	100	100	100	100
	US$ million	10811	18994	27915	35284	59501	94226	100903	105803
	Memo items								
	Processed food % of total merchandise exports	8.0	5.8	4.2	3.2	2.6	2.7	2.3	2.2
	Processed food % of total agri food exports	58	58	56	59	55	51	53	52.6

Source: Data compiled from UN Comtrade database.

4. Determinants of processed food exports

In this section, we undertake an econometric analysis to understand underlying drivers of process food exports, paying attention to how the Sri Lankan experience compares with the average experience of the Asian countries. The hypothesis of the analysis, derived from the analytical narrative of the inter-country export patterns in the previous sections, is that export success depends on a combination of global demand, domestic agricultural resource endowment and the conduciveness of domestic policy regime for global economic integration. Ideally, we need to model export demand and supply separately while allowing for the likely two-way interaction between export supply and demand. However, given the nature of data viability, our strategy is to estimate a 'reduced form' export equation that combines supply and demand factors. The specification of the export equation is tailored to the constraints of the dataset.

We use in the analysis world real gross national income (denoted *WY*) to captures the demand for processed food in the context of internationalisation of demand for processed food. Domestic agricultural resource endowment (*ARES*) is represented by two alternative variables: land under agricultural production (*AGLND*) as measured by the World Food and Agriculture Organisation (FAO), and real agricultural output as measured in national income accounts (*AGSHR*). The role of the domestic policy regime in falsification global economic integration of the domestic agri-food production is captured by two alternative 'openness' variables: the economic globalization index (*KOFGI*) constructed by the KOF Globalization Institute and trade to GNI ratio (*TGNI*). Of these two indicators, *KFGI* is considered a better indicator of economic openness as it systematically capture several dimensions of global economic integration (Potrafke 2015). The *TGNI* captures several factors unrelated to related to trade policy, in particular the country size (Gräbner et al., 2021). The real effective exchange rate (*REER*), which measures the development of the price level adjusted value of a country's currency against a basket of the country's trading partners, is included to capture the impact of international competitiveness of tradable goods production on export performance. The real per capital income, denoted by *PY*, is used to capture the potential positive influence of domestic demand expansion on export growth. The underlying hypothesis is that the production for the domestic market must be lucrative enough to enable firms to achieve economies of scale and thus to reduce costs enough to break into foreign markets. The level of development measured by *PY* is also positively associated with better trade-related infrastructure that facilitate export trade. Population (*POP*) is used as a proxy for the country size. A stylised fact observed relating to trade orientation of nations is that forces working toward greater specialisation through foreign trade would be weaker in a larger country. However, *POP* may also be capturing the favourable impact of domestic market size (operating through scale economies at the formative stage of output expansion) on export expansion. Finally, an intercept dummy variable is included to capture supply-side disruption associated with the COVID-19 pandemic during 2000-02.

Based on this variable choice, the export equation in a panel data setting takes the following form:

$$PFEX_{it} = \beta_0 + \beta_1 WY_{it} + \beta_2 ARES_{it} + \beta_3 PY_{it} + \beta_4 OPEN_{it}, + \beta_5 REER_{it} + \beta_6 POP_{it} + \beta_7 CVD_{it} + \gamma_i + \eta_t + \epsilon_{i,t}$$

Where *PFEX* is processed food exports γ_i and η_t are country- and time-specific effects, respectively, and i = 1,2,... N is countries, t is time unit in years. The explanatory variables are given below with the expected s regression coefficients in brackets:

WY (+)	World income measured of world real gross national income.
ARES (+)	Agricultural resource endowment measured alternatively by agricultural land (*AGLND*) and real total agricultural output (*AGPRD*).
PY (+)	Real per capital income.
OPEN (+)	Outward orientation (openness) of the domestic policy regime measured alternatively by the KOF globalization index (*KOFGI*) and trade to GNI ratio (*TGNI*).
REER (-)	Real effective exchange rate.
POP (+)	Mid-year population.
CVD (-1)	Intercept dummy variable capture supply-side disruption caused by the COVID-19 pandemic, which takes value 1 for 2020, 2021 and 2022 and zero other years.

The above model is meant to capture the ‘average’ relationship between the explanatory variables and export performance among the sample countries. To examine whether Sri Lanka’s experience deviates from this average patters, we used the standard dummy variable method, that is estimate the model using an intercept dummy and slope dummies for Sri Lanka.

The model is estimated using an annual panel dataset for the Asia countries over the period 1990-2022. The data series for *PFEX* is compiled from the UN Comtrade database. The method of trade data compilation is discussion in the Appendix. The original data series in current US dollar is converted into constant (2015) dollar to allow for intercountry variations in exchange rates of the countries vis a vis the US$. Data on *WY*, *PY*, *TGNI*, *AGLND* and *AGPRD* are from the World Bank, World Development Indicators Data base. Data on *KOFGI* is from the database of KOF Swiss Economics Institute: http:www.kof.ethz.ch.globalisation/. The methodology of *KOFGI* is discussed in Gygli et al (2029). Data for REER are from https://www.bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database. The method of *REER* construction is detailed in Darvas (2021). In econometric estimation, variable *PFEX, WY*, *AGLND*, *AGPRG*, *PY* and *POP* are measured in natural logarithms and *KOFGI*, *TGNI*, and *REER* are used in decimal form.

In experimental runs, we alternatively used all three standard panel-data estimators: pooled OLS, random-effects estimator (RE), and fixed effect estimator. Pool OLS has the advantage of a gain in efficiency given its finite-sample properties. However, the Breusch–Pagan Lagrange multiplier test favoured the use of RE over the pooled OLS because of the presence of within group auto-correlation. In a comparison between RE and FE estimators, Hausmann test confirmed that RE estimates are subject to unobserved heterogeneity bias. Therefore, our choice is FE estimator, even though the results are broadly similar in terms of RE and FE estimators (Dougherty 2022).

Our preferred results, selected based on both consistency with the analytical priors and the statistical properties, are reported in Table 5. To facilitate interpretation of the results, summary statics and the bivariate correlation coefficients of the variables are reported in Tables 6 and 7, respectively. Equation 1 in Table 5 is the model that represent the overall (average) relationships for the eleven countries covered in the analysis. Equation 2 and 3 are the estimates with dummy interaction terms for Sri Lanka (denoted *SLK*) to text whether the Sri Lankan experience compared with the average retinal picture.[9] The alternative estimates

[9] The FE estimator with country-specific fixed effects automatically allows for the SLK intercept dummy.

with *AGPRD* as an alternative for *AGLND*, and *TGNI* and an alternative for *KOFGI* are reported in Appendix Table 1. The variable *POP* is dropped from all regressions because it's high correlation with *AGLND* and *PY* (Table 7). Estimates with year-specific fixed effects are not reported because they were strikingly similar to the reported country-specific fixed effect results (suggesting that there are no time-specific influence impacting on the observed relations).

To comment first on Equation 1, the coefficient on *YW* is significant at the 1% level of statistical significance or better with the expected (positively) sign. It suggest that, on average, one percentage point increase in world income is associated with 3.5 percentage points increase in processed food exports from Asian countries. Thus, the Engel Law does not seem to hold for world demand for processed food exports. Interestingly this result is remarkably robust to the alternative estimates of the model reported in the Appendix (Table A-2). There is also strong statistical evidence of the relevance of the agricultural resource endowment for success in processed food exports: the coefficient on *AGLAND* is highly significant with a positive coefficient of 2.86. Likewise, the coefficient of *KOFGI* is signifiable at the one-percent level with a coefficient of 3.2, suggesting that economic openness is a key factor that conditions a country's potential to leverage production potential to reap gain from the expanding world demand for processed food.

The coefficients of the other three variables (*PY*, *REER* and *CVD*) carry the expected signs, but are not statistically significant. The results for *WY*, *AGLAND* and *KOFGI* are remarkably insensitive to the deletion of these variables from the equation.

Table 5: Determinants of process food exports: Regression resulst[1]

Explanatory variable	Dependent variable: Ln *PFEX*		
	(1)	(2)	(3)
Ln WY	2.53*** (0.46)	2.49*** (0.46)	2.49*** (0.46)
ARES: *Ln AGLND*	2.86*** (0.62)	3.33*** (0.853)	3.31*** (0.85)
OPEN: *KOFGI*	3.22*** (0.93)	2.87*** (0.876)	2.99*** (0.86)
Ln PY	0.14 (0.29)	0.26 (0.31)	0.25 (0.30)
REER	-0.21 (0.42)	-0.37 (0.37)	-0.35 (0.36)
CVD	-0.03 (0.08)	-0.3 (0.09)	0.02 (0.08)
Ln WY× SLK		2.81*** (0.46)	1.35*** (0.23)
Ln AGLND× SLK		-3.24*** (0.85)	-3.05*** (0.91)
Ln KFGI× SLK		0.10 (0.09)	1.46 (0.90)
Ln PY × SLK		-1.54*** (0.30)	
Ln REER ×SLK		+2.26*** (0.36)	
CVD × LK		0.29** (0.09)	
Constant	-85.88*** (10.67)	-99.92*** (12.92)	
Country-specific fixed effects	Yes	Yes	Yes
Hausman test	179.10***	-	-
Sargan-Hansen test[3] ×	-	399.25**	410.25
Observations	341	341	341
R-squared	0.90	0.90	0.90
Number of countries	11	11	11

Notes

(1) Heteroscedasticity corrected standard errors are given in brackets with statistical significance denoted as *** p<0.01, ** p<0.05, * p<0.1.

(2) Hausmann chi-square test for selecting between fixed effect (FE) and random effect (RE) for panel data estimation. The null hypothesis that 'difference in coefficients not systematic' not accepted in all cases at one percent level suggesting that FE is the preferred estimator.

(3) This is an alternative to Hausman test when many independent variables and interaction terms are involved

Table 6: Summary statistics

Variable	Mean	Std. Dev.	Min	Max
LnPFEX	7.717	1.519	3.659	10.556
REER	1.062	0.184	0.514	1.750
LnWY	17.862	.285	17.399	18.312
LnAGLND	15.849	1.822	13	18.91
LnAGPRD	10.606	1.267	8.154	14.016
LnPY	8.046	1.07	6.2	10.42
TGDP	0.742	0.446	0.16	2.20
KOFGI	0.484	0.142	0.147	0.767
LnPOP	18.51	1.325	17	21

Table 7: Bivariate correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) lnpfx	1.000							
(2 REER	0.150	1.000						
(3) LnWY	0.563	0.429	1.000					
(4) LnAGLND	0.344	0.119	0.008	1.000				
(5) LnAGPRD	0.496	-0.095	0.363	-0.456	1.000			
(6) LnPY	0.619	0.117	0.189	0.864	-0.060	1.000		
(7) TGDP	0.273	-0.039	0.082	-0.529	0.458	-0.337	1.000	
(8) KOFGI	0.460	-0.137	0.280	-0.475	0.647	-0.216	0.813	1.000
(9) lnpop	0.305	0.095	0.014	0.923	-0.367	0.900	-0.603	-0.559

Turning to Equation 2, *WY* with interaction for Sri Lanka (LnWY×*SLK*) is highly significant with a coefficient of 2.8. The results suggest that world demand is much more important (as twice as that for the average impost for the Asian countries). Presumably, this result is dictated by the fact that, as noted, during th period under study Sri Lanka's export bundle was dominated by two products (processed tea and fish products) the domestic production of which was specifically catered for world demand. The interaction terms for *AGLND* is highly significant with the negative sign and its coefficient is strikingly similar in magnitude to that of *AGLND*. The upshot is that, under the *existing commodity mix* dominated by processed tea and seafood, agricultural land endowment does not have a statically significant effect on processed food exports from Sri Lanka compared to the average Asian experience. Agricultural land is virtually not relevant for processed tea, which absorb only a fraction of the large primary tea production in the country; marine resource are not captured in *AGLND.* The coefficient of *KOFGI*× *SLK* is not statistically significant. This suggests that Sri Lanka is not an exceptional case as far as the pivotal importance of global economic integration of the economy in achieving success in processed food exports.

The interaction terms for the other three variables are not statistically significant. The alternative estimate of the model (Equation 3) indicates that the above inferences are remarkably robust to the deletion of these three interaction terms.

5. Concluding remarks

The purpose of this paper has been to document and examine the emerging opportunities for the expansion of processed agro-foods for Sri Lanka and other agricultural resource rich developing countries. The analytical narrative of the inter-country pattern of export performance in Asia shows that, unlike primary commodity dependence, specialisation in processed food is positively associated with the state of economic advancement. The econometric analysis provides strong empirical evince that export success in process food of a given country in determined by a combination of world demand, agricultural resource endowment, and domestic policy that is conducive for global economic integration. There is strong evidence that the Engel Law, which has justified the policy bias in favour of manufacturing production and against agriculture, does not hold for global demand for processed food.

Liberalisation reforms initiated in the late 1970s has set the stage for Sri Lanka to enter global processed food markets. However, the outcome has far been lacklustre compared to the overall Asian experience. Export composition has so far been concentrated in two products, process tea and fish products, which are not directly related to the agricultural resource endowment of the country. When examined the Sri Lanka export patterns in the context of the overall Asian experience, it is clearly evident that Sri Lanka has so far failed to enter the dynamic world markets for processed vegetables, fruits and preparations.

This paper is an exploratory study that focussed on patterns and determinants of process food exports at the country level. The purpose has been to redress the policy oversight of the emerging opportunities for diversifying agri-food production into export-oriented processed food production and policy options in broader terms. Policy reforms for greater integration of the country set the broader context for reaping against from emerging export opportunities. However, intercountry differences in export performance would eventually depends on country-specific factors such as land tenure patterns, agricultural extension services, ability to meet international food-safety standards, and the trade related logistics, including domestic procurement systems that links agri producers with export processing firms. Further micro-level research is required on these prerequisites within individual countries to guide designing the national export development policy.

Appendix 1: Data compilation

Data are compiled from the UN Comtrade database using the Standard International Trade Calcification (SITC), Revision 3.

Agri-food products are identified as products classified under SITC Sections 0: food and live animals (excluding Section 00: live animals); Section 1: Beverages and tobacco (excluding Subsection 121: beverages and manufactured tobacco); Section 4: Animal and vegetable oil (excluding Division 43: inedible vegetable and animal waxes), and Division 22: Oil seeds and oleaginous fruits.

Within agri-food, processed food is defined as 'any food other than a raw agricultural commodity and includes any raw agricultural commodity that has been subject to processing, such as canning, cooking, freezing, dehydration, or milling' (Thee United States Federal Food, Drug and Cosmetic Act, as of March 2018 (Chapter 9, Section 341) (https://www.fda.gov/regulatory-information/federal-food-drug-and-cosmetic-act-fdc-act/fdc-act-chapter-iv-food).

The SITC system — the common source of data for the study of international trade patterns — does not permit the direct identification of industrial products based on agricultural (and other natural) resources. To deal with this classification problem, we cross-referenced the SITC commodity listing at the 5-digit level to that of the international Standard Industry Classification (ISIC) at the 4-digit level, using the UN commodity concordance between SITC and ISIC classification. The list of processed foods thus identified are listed in Table A-1.

Table A-1: Processed food, SITC Rev 3

SITC	
01	Meat and meat preparations
02	Dairy products and birds' eggs
03	Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof
046	Meal and flour of wheat and flour of meslin
047	Other cereal meals and flours
048	Cereal preparations and preparations of flour or starch of fruits or vegetables
054	Vegetables, fresh, chilled, frozen or simply preserved (including dried leguminous vegetables
056	Vegetables, roots and tubers, prepared or preserved, n.e.s.
058	Fruit, preserved, and fruit preparations (excluding fruit juices)
059	Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter
0612	Other beet or cane sugar and chemically pure sucrose, in solid form
0615	Molasses resulting from the extraction or refining of sugar
0616	Natural honey
0619	Other sugars (including chemically pure lactose, maltose, glucose and fructose in solid form); sugar syrups not containing added flavouring or colouring matter; artificial honey (whether or not mixed with natural honey); caramel
062	Sugar confectionery
0713	Extracts, essences and concentrates of coffee and preparations with a basis of these products or with a basis of coffee; coffee substitutes and extracts, essences and concentrates thereof
0722	Cocoa powder not containing added sugar/other sweetening matter
0723	Cocoa paste, whether or not defatted
0724	Cocoa butter, fat/oil
073	Chocolate and other food preparations containing cocoa, n.e.s.
07413	Black tea (fermented) & partly fermented tea, in immediate packings of a content not > 3 kg, whether/not flavoured

0743	Maté; extracts, essences and concentrates of tea or maté, and preparations with a basis of tea, maté, or their extracts, essences or concentrates
09	Miscellaneous edible products and preparations
11	Beverages
4111	Fats and oils and their fractions, of fish or marine mammals, whether or not refined, but not chemically modified
4112	Lard; other pig fat & poultry fat, rendered, whether/not pressed/solvent-extracted
41131	Pig fat free of lean meat & poultry fat (not rendered), fresh, chilled, frozen, salted, in brine, dried/smoked
41133	Lard stearin, lard oil, oleo-stearin, oleo-oil & tallow oil
41139	Animal oils & fats & their fractions, n.e.s., whether/not refined, but not chemically modified.
42119	Soya bean oil, refined, & its fractions
42129	Cotton seed oil, refined, & its fractions
42139	Groundnut oil, refined, & its fractions
4214	Olive oil and other oil obtained from olives
42159	Sunflower seed/safflower oil, refined, & fractions thereof
42169	Maize (corn) oil, refined, & its fractions
42179	Rape, colza/mustard oil, refined, & fractions thereof
4218	Sesame oil & its fractions
42219	Linseed oil, refined, & its fractions
42229	Palm oil, refined, & its fractions
42239	Coconut (copra) oil, refined, & its fractions
42249	Palm kernel/babassu oil, refined, & fractions thereof
4225	Castor oil & its fractions
4229	Other fixed vegetable fats, crude, refined/fractionated, other than “soft”

Appendix 2: Alternative regressions

Table A-2: Determinants of process food exports: Alternative regression results[1]

Explanatory Variable	Dependent variable: *Ln PFEX*		
	(1)	(3)	(3)
Ln WY	2.374**	2.606***	2.094**
	(0.861)	(0.510)	(0.739)
RES – *Ln AGLND*		1.935**	
		(0.830)	
RES – *Ln AGPRD*	0.840		1.439*
	(0.810)		(0.781)
Ln PY	-0.138	0.217	-0.237
	(0.506)	(0.328)	(0.508)
OPEN: *KOFGI*	2.01		
	(1.21)		
OPEN: *TGNI*		0.301	0.361
		(0.384)	(0.377)
REER	0.131	0.152	0.0802
	(0.563)	(0.729)	(0.497)
CVD	-0.126	-0.177**	-0.217**
	(0.0785)	(0.0791)	(0.0920)
Constant	-43.67***	-71.61***	-43.38***
	(9.235)	(14.57)	(8.898)
Country fixed effects	Yes	Yes	Yes
Hausmann text, chi2(6)	12.37*	43.56***	11.48***
Observations	341	396	396
R-squared	0.858	0.830	0.826
Number of code	11	12	12

Notes:

(1) Heteroscedasticity corrected standard errors are given in brackets with statistical significance denoted as *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

(2) Haussmann chi-square test for selecting between fixed effect (FE) and random effect (RE) for panel data estimation. The null hypothesis that ‘difference in coefficients not systematic’ not accepted in all cases at one percent level suggesting that FE is the preferred estimator.

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