

Increasing inequality in agri-food value chains: global trends from 1995-2020

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ABSTRACT

Agri-food systems are increasingly globalised. In the last three decades, as national food systems have become more interdependent, the distribution of productive activities and economic value between different actors and countries has changed. Prior research on domestic agri-food value chains has shown that the farm share of food-system income has declined consistently, while post-farmgate sectors capture the majority of income. Market concentration in post-farmgate sectors is high in industrialised economies and is driving food-system transformations in developing economies. Here, we extend this analysis to assess the global distributional consequences of food-system transformations for the first time. We use multi-regional input-output data to disaggregate food expenditures between different countries and sectors across agri-food value chains, from 1995 to 2020. We arrive at several main findings: 1) agricultural production for food and industrial inputs has increasingly shifted to the global South, 2) global food-system income is increasingly captured by post-farm activities in the global North, and 3) a substantial share of food-system income is captured in low-tax jurisdictions with low agricultural production. These findings demonstrate that the contemporary agri-food system and agricultural trade are skewing the distribution of economic returns away from agricultural producers in the global South.

1. Introduction

Like other economic sectors, the agri-food sector is increasingly globalised and complex. Trade in the sector has nearly tripled in real terms from 680 billion USD in 1995 to 1.9 trillion USD in 2022. (Banerjee, 2011; FAO, 2020, 2024). A third of the total agricultural and food output crosses national borders at least once during the production process, through global value chains (Bellemare et al., 2022). Concentration of value in food manufacturing and retail has increased, and foreign investments are leading to food-system transformations in developing nations. Farmers and producers increasingly use industrial agricultural inputs, supermarkets are increasing their market share of food retail, and processed foods constitute a larger share of the consumption basket, among other changes (Ambikapathi et al., 2022; Reardon and Timmer, 2012). Scholarship on the sector has sought to analyse these changes through frameworks that describe and assess food

systems and global agri-food value chains (GAVCs) (Lawrence, 2019; Patel, 2012). We use food-system transformations to refer to changes in the material organization of global agricultural production, as opposed to other common uses of the term that refer to changing the food system to be more sustainable and equitable.

The global value chain framework captures the effects of linkages between different sectors of the economy that make up a value chain. In the global food system, post-farmgate sectors have become larger and more powerful as crops are processed, transformed and travel long distances to final consumers. These linkages have deepened as multinational firms manage production and non-production economic activities across sectors and even across countries, as part of a single business operation, or through 'arms-length' contracts with firms and agricultural producers across the world (Clapp, 2022; Reardon and Timmer, 2014).

Some of the current economic literature suggests that the growth in

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agri-food production and trade has created opportunities for economic development for developing countries through access to global markets and technology transfers (Gereffi and Lee, 2012), whereas others suggest that value chains intensify competition between countries to reduce costs, and increase inequality by facilitating unequal exchange and creating an international division of labour. We can test these claims empirically by assessing distributional dynamics in the global food system (Hickel et al., 2022; Yeung and Coe, 2015).

Recent research has demonstrated that in advanced economies the farm share of the food-system income has been declining (Canning et al., 2016). For many global South nations, the farm share of food expenditures ‘made away from home’ (i.e., in restaurants etc.) has fallen for many economies or remained stagnant at low levels for others (Yi et al., 2021). Several rich case studies of specific globally traded crops or agri-foods point out the existence of huge markups over farm prices, that accrue to non-farm actors and in the post-farmgate sectors (Elsby, 2020; Kumar, 2019, 2022; Purcell, 2018). This raises questions about the extent to which these distributional dynamics occur more generally in global South countries, and at the global scale.

In this paper we provide the first comprehensive assessment of distributional dynamics in the global agri-food system, by sector and region, for the years 1995–2020. We focus specifically on the distribution between and within the global North and global South. To do so, we break down the distribution of the global value-added in the agricultural and food sector by the region in which they are earned. We further break down these earnings by the economic sector in which they are recorded. Incomes related to the global agri-food value chain earned in non-farm sectors in the global North may have been earned due to agricultural production in the global South or vice-versa. This allows us to describe where agricultural production occurs, what sectors it goes to, and ultimately where food-system value is captured.

We find evidence for value capture in GAVCs by economic sectors that make up forward linkages for agriculture like food manufacturing, research and development, and financial services among others. We also find that global North economies, and especially a few tax haven economies such as Singapore, disproportionately capture value in these sectors even as their share of global agricultural production falls. This implies that the development potential of GAVCs for poorer economies is not realised, as food-system incomes are not distributed in accordance with agricultural production.

Our study uses multi-regional input-output (MRIO) data to contribute to this literature by focusing on the global level. We disaggregate all global food system incomes by sector and region to identify relative gains by using the OECD’s Inter Country Input Output (ICIO) database for reliability, coverage and comparability with other studies (OECD, 2023). Our analysis focuses on the “agriculture, hunting, and forestry” sector, and the “manufacturing of food products, beverages and tobacco” sector. In this analysis, we ignore the “fishing and aquaculture” sector in order to focus on the crop cultivation and livestock segments. We also ignore the “accommodation and food services” sector, as we cannot isolate food production within this sector.

We distinguish national economies between global North and global South, using the IMF’s classification of “advanced” economies and “emerging and developing” economies (IMF, n.d.). The global North (“advanced”) includes the USA, Canada, Australia, New Zealand, Japan, Korea, Israel and the wealthy economies of Europe. The global South includes the rest of Asia, Africa and Latin America.

Note that, due to the aggregate nature of the ICIO, the sector ‘agriculture, hunting, forestry’ includes incomes earned from small farms and large industrial operations including concentrated animal feed lots together. It is not possible to separate incomes earned from small scale agriculture from agribusiness profits. This should be borne in mind when interpreting results on ‘farm share’, which can refer to farms of any size. At the same time, at the level of MRIO analysis it is not possible to treat crop cultivation and animal husbandry separately. Taken together, the farm share might be better referred to as ‘farm- and agribusiness-share’.

2. Methods

We use input-output (IO) methods to disaggregate production and absorption of value between different national economies and sectors. This follows the methodology adopted in studies of trade in global value chains as well as distribution of value through international trade (Hickel et al., 2022; OECD, 2022; Timmer et al., 2015). Input-output tables maintain data on trade between different economies, as well as the absorption of outputs of different industry-country pairs by other industry-countries. This is a powerful tool to understand movements in the global economic structure and value distribution between sectors and countries.

2.1. Choice of OECD ICIO

Of the various input-output databases maintained by the OECD and UNCTAD (EORA) among others (Lenzen et al., 2013; OECD, 2023; Timmer et al., 2015), we have selected the OECD’s Inter Country Input-Output (ICIO) tables. It maintains data for 76 countries and a residual term for the “rest of the world”. Since data is more accurately and widely available for the advanced countries of the global North, the “rest of the world” category comprises countries whose national statistical offices do not maintain the requisite information to be included in the construction of the OECD’s ICIO table. For these 77 country categories, data is maintained by the OECD for 26 years between 1995 and 2020, and for 45 different sectors of production, maintained as aggregate figures to make them comparable between different countries. A list of the countries and sectors for which the OECD aggregates data from official national sources and estimates aggregates for comparability is publicly available (OECD, 2023).

For our analysis, we find the OECD’s ICIO database most suitable for two reasons. First, the OECD collects data from official national sources as reported by the national governments of these countries. These countries cover a variety of countries across the global North and global South, especially countries with the largest agricultural production. Country resolution for the African continent is low, but better than those of some other IO databases. Since many African nations are overwhelmingly dependent on agriculture for employment, exports and national income, this is an important consideration for analysis of global agricultural value generation and distribution. Future studies and data collection is required to overcome the limitations of any empirical analysis based on these datasets.

Second, the OECD’s ICIO has been used widely for studies of global value chains, and especially for recent studies on agricultural value chains (Yi et al., 2021). The FAO’s statistical division also maintains the food value chain database based on the OECD’s ICIO. Despite differences in approach between this study and others, the use of the same database enables comparability and allows for their empirical results to be understood in continuity.

For our analysis, it is also important to note that the OECD’s ICIO is based on the 2008 System of National Accounts (SNA), which incorporates some activities as productive economic activities that generate value-added, that were previously excluded from the 1993 and earlier versions of the SNA.

2.2. Classification of economic sectors into linkages

Table 1 (in appendix) provides our classification of the sectors as given in the ICIO into the different linkages relative to the agricultural sector in the GAVCs. In addition, it provides details on our classification of sectors of the ICIO into the industry categories used in our analysis.

This classification is based on the common understanding of the different economic sectors as they relate to the agricultural sector. Backward linkages comprise sectors that provide inputs into agriculture such as fertilisers and basic services like electricity and water. Forward linkages comprise (1) those sectors which use agricultural output as raw

material or feed, and (2) those which provide logistical support to the whole value chain including transport, retail and wholesale trade, and financial services.

2.3. Calculation of food value chain earnings

The OECD provides the Leontief inverse matrix for the underlying final demand and transactions matrix (Z matrix) of trade and absorption between country-sector pairs. To break down the value generated along the chain, we extend the method to incorporate the ‘post farmgate’ value chain or forward linkages (Canning et al., 2016; Yi et al., 2021). To make sure we do not overstate earnings made from the food value chain, we multiply the sales of each country-industry pair connected to food expenditures, with their respective value-added shares of gross output. This then removes the role of sectors comprising backward linkages as well, from determining the weight of the agricultural sector.

We use the following calculation to arrive at each country (i)-industry (j) pair’s ‘earnings’ or recorded value additions from food sales globally:

$$Earnings_{i,j} = (L * FD_{food})_{i,j} * \left(\frac{VA}{X} \right)_{i,j}$$

where FD_{food} is a vector of global final demand of the ‘agriculture, hunting and forestry’ sector (from here on, we refer to this as the agricultural sector) and the ‘manufacture of food products, beverages and tobacco’ sectors, L is the Leontief inverse matrix, VA is the value added vector (including taxes less subsidies), and X is gross output vector.

To calculate the farm share of the global food dollar, we calculate the value that accrues to the agricultural sector for each country made from the final demand expenditures on agriculture (which we assume are food expenditures) and the final demand expenditures on the manufacture of food products, beverages and tobacco products.

To relativise these ‘earnings’, we divide them by net agricultural production. To calculate the net agricultural production of each country, we deduct from the gross agricultural output of each country, the intra-industry input, i.e., the input of the agriculture sector. We choose net agricultural production because we want to avoid overestimating the contribution of different countries to global agricultural production which can happen when their agricultural sectors are based on large imports of agricultural inputs into gross agricultural production. This is particularly important to avoid overstating the production of those economies which rely on large feed inputs for industrial meat and dairy production.

As we know, value recorded can differ from actual value generated by direct means (Cobham and Jansky, 2017) such as transfer pricing and

indirect means such as price suppression by monopoly power in the market (Yeros and Jha, 2020). These means allow for value capture by gaining sectors. Thus, we interpret changes over time, in the share of incomes in different sectors relative to agricultural production, as indicators of value captured.

3. Results

3.1. Changing agricultural production share

We begin by assessing changes in the distribution of global agricultural production in the world economy between the global North and global South. We find that in the 26 years between 1995 and 2020, total global agricultural production has shifted overwhelmingly to the global South in value terms (Fig. 1). Of total agricultural production, the global South produced 50 % of output in 1995 and by 2020 was producing 80 %, while the Northern countries produce only 20 %.

Globally, the farming share of food system income remains around 35 % of total income generated in the food system, defined as the total ‘value-added’ of different sectors that pertains to final consumption expenditures on the ‘agriculture, hunting and forestry’ and ‘manufacture of food, beverages, and tobacco’ industries in the OECD’s ICIO. Henceforth, we refer to this value-added from the two sectors’ final sales as food-system incomes.

Even as agricultural production itself rises disproportionately in the global South, other food-system sectors grow disproportionately in the global North. We measured the ratio of non-farm incomes in the food system to farm incomes in the food system. This ratio gives a measurement of the relative weight of farming and non-farming sectors in the food system. We find that the global North countries earned 3.5 times as much from the non-farm sectors of the global food system as their farm incomes in 1995, and increased this ratio to 4.5 in 2020. At the same time, the global South, stagnated such that its non-farm to farm incomes ratio marginally increased from 1.12 to 1.22 during this period.

Within the global food system, this signifies stagnating diversification in the global South such that there is increasing specialisation of activities territorially in the food system. The global South specialises in agriculture and marginally improves its opportunities to earn from the rest of the food value chain. At the same time, the global North industries continue to capture value from the global agri-food system even while their relative contribution to the underlying agricultural and forestry production declines, as these processes are shifted to the global South.

In addition, we find that the increase in gross production is driven by increases in feed, manufacturing and industrial use, as well as for intra-agricultural services and inputs (Fig. 2). Food manufacturing, which

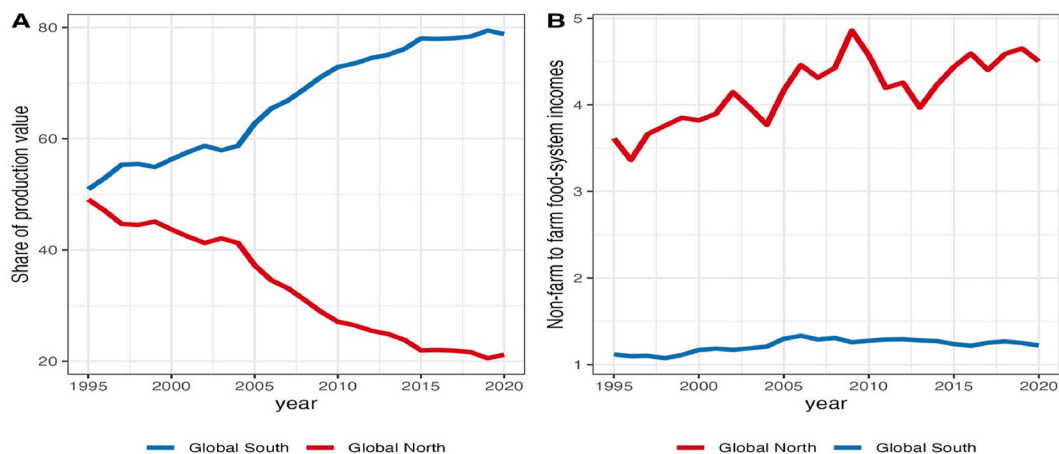


Fig. 1. (a) North and South share of global agriculture and forestry production value, where production is gross agricultural output minus intra-industry inputs. (b) Non-farm incomes from the global food system as a ratio of farm incomes.

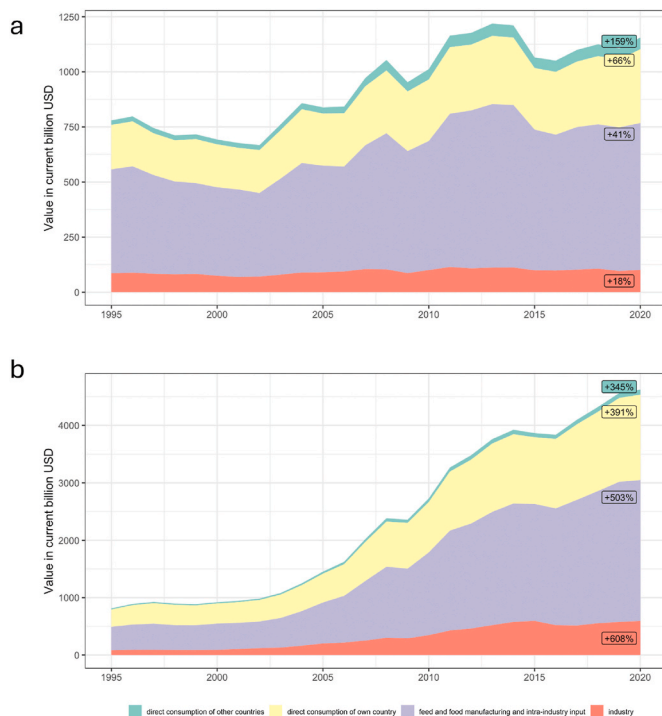


Fig. 2. (a) Absorption of agricultural output from global North countries. (b) Absorption of agricultural output from global South countries. Numbers on the right show percentage change in 2020 relative to 1995.

includes the production of ultra-processed foods, grain processing, and the preparation of feed material for large-scale animal and meat industry, has grown its use of agricultural inputs by over 4 times in this time period, absorbing approximately \$1.5 trillion of agricultural produce in 2020. Other industrial uses have also pulled agricultural output from the global South considerably. Export for final consumption in other countries has kept pace with growth in own final consumption. Diversification and export-dependence in the absorption of agricultural output suggests that agricultural value chains are essential to other value chains in the global economy, and that the growth and direction of growth in agriculture is bound up with market incentives in other industries.

Furthermore, we find, as shown in Fig. 3, that the global North's reliance for consumption on agricultural and forestry production from the global South has grown in recent years compared to its reliance on its own agricultural and forestry production. This shows a marked increase in the global North's import dependence on primary commodity imports. By 2020, the North consumed Southern agricultural and forestry commodities valued at \$391 billion directly or embodied in other commodities (28 % of its total reliance on agricultural and forestry

production. At the same time, the South imported \$124 billion of agriculture and forestry production from the North directly or embodied in other commodities (2 % of its final demand based on agricultural commodities).

Market incentives in GAVCs drive cropland distribution. For instance, these incentives are the contemporary means by which the 'food-feed-fuel' competition is decided, such that 40% of global cropland is now dedicated to feed production (Dixon et al. n.d.; Kastner et al., 2012; Ray et al., 2022). In 2023, the Food and Agriculture Organization recorded that "food preparations (not elsewhere classified)" were the highest exported food and agricultural commodity by value, with global trade reaching approximately 96 billion US dollars.

Food preparations (not elsewhere classified) are loosely classified by the FAO as "homogenized composite food preparations; soups and broths; ketchup and other sauces; mixed condiments and seasonings; vinegar and substitutes; yeast and baking powders; stuffed pasta, whether or not cooked; couscous; and protein concentrates." This value exceeded the export value of any cultivated crop including maize, soya beans and wheat, which are the highest traded commodities by volume (FAOSTAT, n.d.). Meanwhile, a majority of some cultivated crops is dedicated to use as feed for meat production. For instance, maize accounts for 36.6% of all feed material globally, and almost 60% of its global production is used for feed (FAOSTAT).

Further, we find that agricultural incomes remain a small part of food system incomes. The dominance of other sectors that constitute the pre-farmgate sectors (fertilisers, research and development, support services etc.) and post-farmgate sectors (food manufacturing, processing, transport, retail and wholesale trade) in food-system incomes were always significant in the global North, but this is increasingly also true in the global South. China presents a particularly striking example, where the post- and pre-farmgate sectors have expanded rapidly (Fig. 4).

What the agricultural sector retains as income relative to its net production (gross production net of own input) has also fallen or remained stable everywhere, but remains higher in the global South. Most of the growth in food system incomes in the North has occurred in the non-agricultural sector, as it reduces its share of global agricultural production.

3.2. Food systems earnings do not correlate with agricultural incomes internationally

We find that even as agricultural production expands globally, growth in food-system incomes does not occur with growth in agricultural production. We define food-system income for each country as a ratio of their agricultural output, as the value-capture ratio. This ratio measures the ability of countries to earn from the global food system as their agricultural production changes. Existing literature suggests that the global South can grow incomes from post-farmgate sectors on account of increasing agricultural production.

Taking this approach, we find that some countries record very high ratios, much higher than the global and regional averages. This is

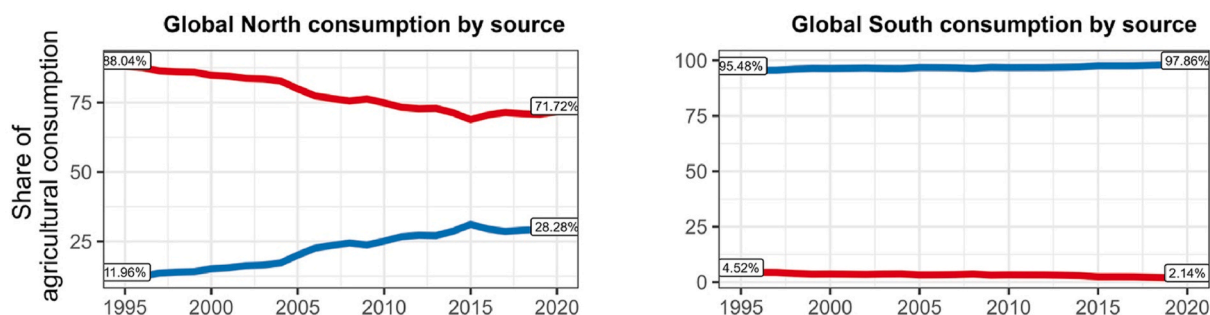


Fig. 3. Percentage of final demand of agricultural commodities in direct or embodied forms from agricultural and forestry production from the global North and the global South.

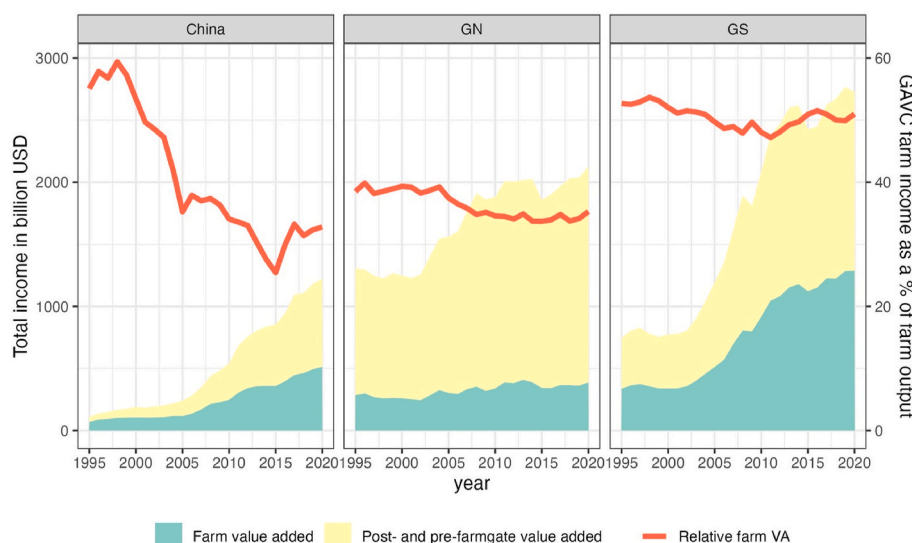


Fig. 4. (left axis) Value added in billion USD. (right axis) Relative farm value-added: farm value-added of groups of countries calculated as a ratio of net agricultural production.

particularly striking in the case of financial hubs like Singapore, Hong Kong, Luxembourg, Iceland, Ireland, and Norway, which have the highest value-capture ratios in the set, all capturing from the food system at least 3 times the value of their net agricultural production (Table 1). Singapore captures almost 69 times more value from the global agri-food value chain than it produces from agriculture, which has increased from 36 times in 1995; the ratio for Hong Kong has increased from 18 to 27. Most of these countries also happen to be tax havens, according to the list by Tørsløv et al. (2018).

With available data, we assessed 8 of the 11 countries identified in Tørsløv et al. (2018) as tax havens, as described in the methods section (T. Tørsløv et al., 2023). These are: Malta, Singapore, Hong Kong, Ireland, Belgium, Luxembourg, Netherlands and Switzerland. On average, tax haven economies have value-capture ratios almost 3 times higher than the rest of the world. Fig. 5a plots the ratios for these tax havens, together with the six countries with the highest value-capture ratios in our set for comparison. We chose 6 countries with the highest value capture in 2020 since these countries record value-capture ratios higher than 3. The fluctuations in the growth of this ratio for highly globalised and financialised economies further suggests that these value additions might in fact be due to profit shifting of value generated elsewhere, rather than changes in real productive activities (Grondona and Burgos, 2022; Smith, 2012).

These findings demonstrate the thesis that value-added statistics often include processes of ‘value capture’, by which value produced in one region and sector is captured in another, through ‘arms-length’ relationships within value chains (Smith, 2012). Value captured by tax havens is particularly noticeable in many cases, making countries like Singapore and Hong Kong appear to be the most “productive” in

economic terms, even though very little physical production occurs there. Our analysis shows that Singapore and Hong Kong, and to a lesser extent, Luxembourg, Iceland, Norway and Ireland are able to capture more food-system income than other economies, relative to their agricultural production. This is consistent with how these countries operate within other value chains (Grondona and Burgos, 2022).

These economies are on the Financial Secrecy Index list of secretive locations that are used for offshoring wealth and profits, and we identify these as significant actors in the global food system (Cobham and Janský, 2019). Despite low farming activity, and low food-system production of any kind, these economies are able to record high value-added from the global sales of food. Low-tax economies have also been often identified on black lists of several countries in the global South, by which countries may impose sanctions on tax haven jurisdictions (Akhtar and Grondona, 2019).

Value capture along these lines occurs when corporations move profits from one place and sector to another, especially in the case of multinational firms. 40% of multinational profits are estimated to be shifted to low-tax jurisdictions; for the global food system, main commodity traders and agribusinesses like Cargill, Bunge and Louis Dreyfus have their trading offices in Singapore (Grondona and Burgos, 2022; Quentin and Campling, 2018; UNCTAD, 2020).

However, even aside from the low-tax jurisdictions, some global North countries like Iceland and Norway are recorded as high earners in the global agri-food value system. In addition, we find that global North countries as a group record higher food-system income as a ratio of agricultural production than global South countries (Fig. 5b). The North’s value-capture ratio increased steadily from 1995 to 2008, declined during the financial crisis, and has since recovered. By contrast, the global South shows a gradual and persistent decline. This analysis reveals that agriculture-dependent economies, which are taking on a higher burden of food production for the world, are not benefitting proportionally from the globalisation of food systems and the expansion of value chains.

3.3. Post farmgate sectors are the source of inequality

If such value capture is indeed locked off in a few economic sectors, the value recorded in trade and input-output statistics must be understood to derive at least partly from capture and profit-shifting. Fig. 6 shows that this value-added is concentrated in sectors that comprise forward linkages including food manufacturing, finance, real estate and

Table 1

Top 10 economies with respect to value-capture ratios in 2020.

Country	Value-capture ratio
Singapore	69.01
Hong Kong, China	21.25
Luxembourg	5.35
Iceland	4.82
Norway	3.46
Ireland	3.29
Malta	2.90
Germany	2.80
Brunei Darussalam	2.78
Japan	2.71

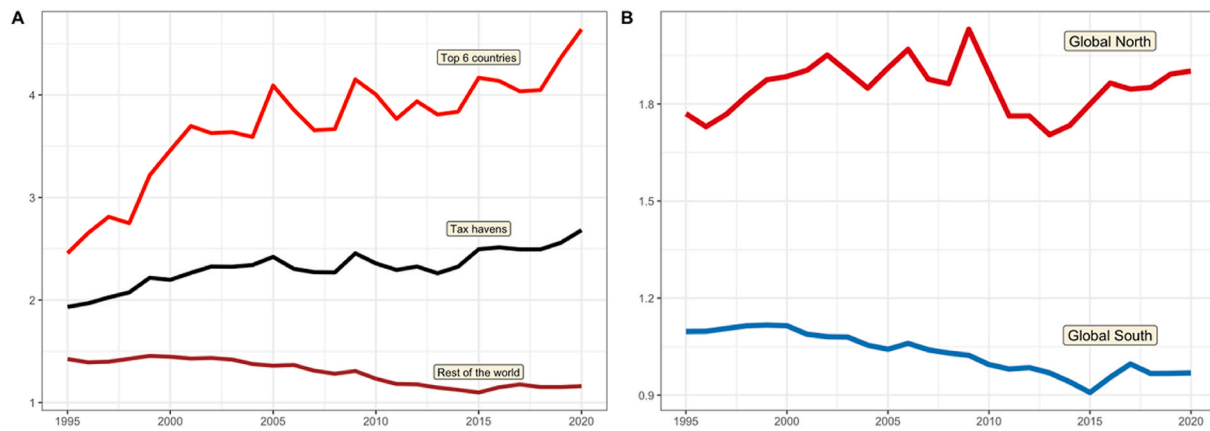


Fig. 5. Value-capture ratios (value recorded from global agricultural value chains as a proportion of net agricultural production), for (a) the six countries with the highest ratios (Singapore, Hong Kong, Luxembourg, Iceland, Ireland, and Norway), the top eight tax havens and financialised economies (Malta, Singapore, Hong Kong, Ireland, Belgium, Luxembourg, Netherlands and Switzerland), and the rest of the world, and (b) for the global North and the global South, where the high-ratio and tax-haven countries from the prior panel are removed from analysis. The Global South line includes China.

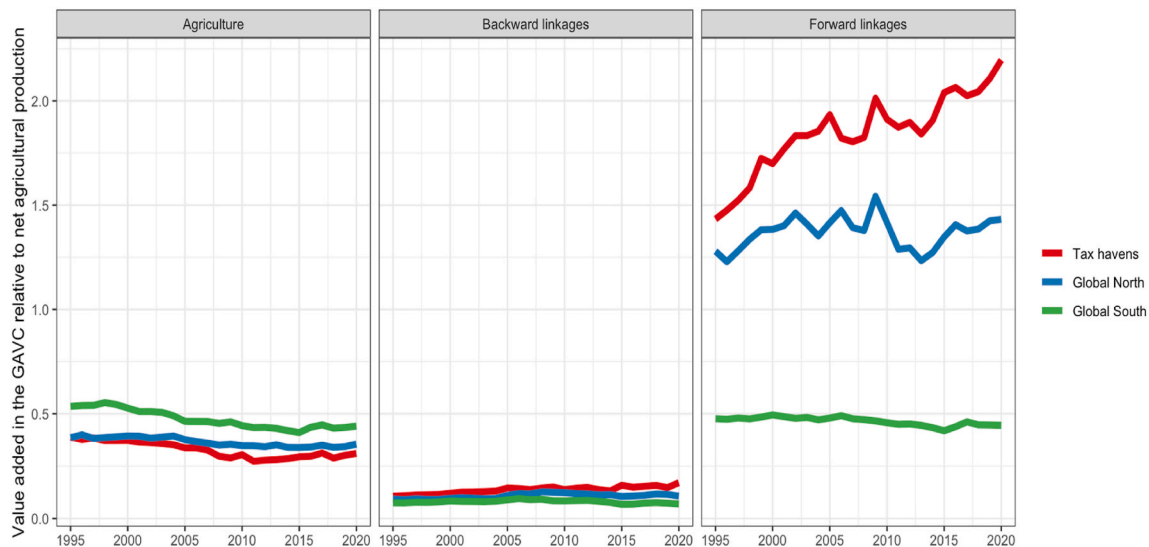


Fig. 6. Value earned or captured from global agricultural value chains as a proportion of net agricultural production. Tax havens being Malta, Singapore, Hong Kong, Ireland, Belgium, Luxembourg, Netherlands and Switzerland.

professional activities. Forward linkages are those that connect agricultural commodities to consumers. In these activities, the tax havens and advanced economies stand out as capturing large and increasing quantities of value. Global North economies as a whole record relative earnings higher than China and the rest of the global South. The tax havens and the global North economies also capture more value than the South in backward linkages (such as petroleum and chemical products), albeit by smaller margins. This provides further evidence of value capture at the sectoral level.

Forward linkages are defined as those sectors that use agricultural input in the production of food or follow farmgate activities. For instance, agricultural sectors earn or capture between 40 and 50 percent of the value (net of all intermediate consumption from other sectors) of agricultural output.

It is critical to note here that with the exception of the food manufacturing sector, these forward linkages are classified as “non-productive” or “non-fabrication” activities. These sectors produce value without undertaking material production and are seen as those dependent on productive sectors for the generation of profits (Assa, 2016; Assa and Kvangraven, 2021; Ghosh, 2022). Some of these activities - particularly, financial services and research and development - were not

included as productive activities by the System of National Accounts before 2008. Finance, insurance and real estate are often classified as ‘FIRE’ sectors, and are treated together as such in our analysis.

3.4. Concentration in the food systems

Our analysis further suggests that, while the global South produces the majority of the world’s agriculture, the global North dominates all forward linkages. The distribution of sectoral earnings a clear indicator of the growing inequality in the distribution of food system earnings. Fig. 7 shows how the global North has concentrated power over the different major sectors in the agri-food value chains.

To contextualise these findings, it is important to note that in recent years, a few multinational corporations in the food manufacturing and trading sectors have expanded their profits massively by leveraging temporary supply bottlenecks and periods of volatility to maintain increased prices (Salerno, 2017; Weber and Wasner, 2023). In the United States alone, corporate profits in the food manufacturing industry rose from 21.9 to 80.7 billion US dollars between 1998 and 2023. From their overall business (including food related), the transport and trade sectors recorded 758.4 billion US dollars in profits only in the

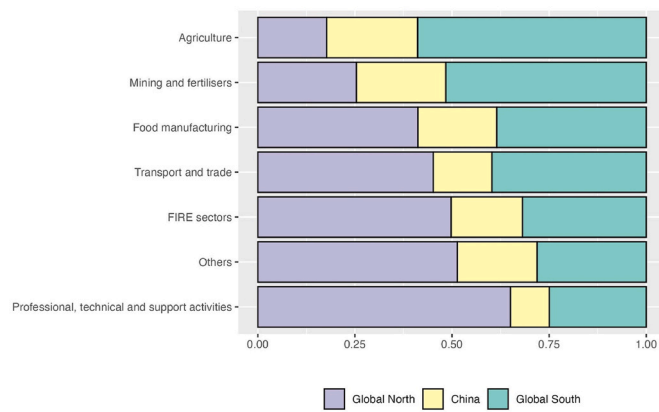


Fig. 7. The composition of value-added in global food systems by country groups and sectors.

United States (United States Bureau of Economic Analysis, 2024).

Overall, we find evidence for value capture by sectors recording high corporate profits in global agri-food value systems. Value captured by these sectors is concentrated in the countries of the global North. This casts serious doubts on the potential of global markets to deliver real development for Southern economies. Agricultural incomes are stagnating, even as production expands, and the non-farm sectors are developing at a faster pace only in the global North where agricultural raw material is increasingly processed and marketed (Clapp, 2022). Here, value-added concentrates in non-production sectors.

Countries of the global South - that have been historically deindustrialised during centuries of colonisation - have been taking on a high burden of the world's agricultural production needs in recent years (Patnaik, 2015). As agricultural production increases, so does the entire value chain dependent on it. Other industries that are dependent on agricultural inputs are able to grow on the basis of the expansion of agricultural feed and raw material itself. Food manufacturing too is also able to diversify towards large-scale meat production and processed commodities in supermarkets (Bellemare et al., 2022; Lawrence, 2019; Reardon and Minten, 2020). But, as expanding agricultural production enables growth of value production and material throughput in the global economy, it does not generate proportional economic opportunities for producing nations and actors. According to the FAO, countries of the global South continue to maintain a small proportion of non-agricultural employment in food value chains (17.67 % in Asia, and 10 % in Africa), even though a significant chunk of their population depends on agriculture for their livelihoods (FAO, 2023). In Africa, for instance, 48.1 % of total employment is in agriculture, compared to only 5.3 % in non-agriculture segments of the food value chain.

The existence of value capture at the global level suggests that GAVCs have become a means of propagating unequal exchange between national economies, such that trade along value chains occurs on unequal terms (Ajl, 2023; Jha and Yeros, 2022). Growth of value-added and coordinated by 'lead' transnational corporations are increasing inequality within the value chain and between world regions. Regulating the global economy and trade flows in the GAVC should aim at measuring and reducing value capture. Such value capture facilitates growth without fair distribution (Gibson et al., 2025). These results indicate that free trade in agriculture cannot on its own offer the means of development and structural transformation to industrialisation for global South countries.

Under global capitalism, our analysis shows that growth of food manufacturing, the insertion of the FIRE sectors in food production and distribution, and production for geographically distant markets, have increased the incomes of the manufacturing sectors of advanced countries, the finance sector, as well as the trade and transport sectors, which are gaining in the economic distribution of the global value chain, and

therefore their bargaining power within the chain. Financialised value chains have been noted to create market incentives that push unhealthy and unsustainable diets on the world population (Wood et al., 2023).

Global South countries face substantial obstacles to benefitting from global agri-food value chains. At the same time, globally, farmers and agricultural workers face squeezes on their incomes, due to value-capture from service, FIRE and other sectors of the economy. The rural and agricultural workers are the major losers. Evidence indicates that smallholder farmers in developing countries are food insecure, and at least in some cases more food insecure than the national averages of such countries (Mwangi et al., 2020; Sibhatu and Qaim, 2017). This suggests that inter-sectoral inequality translates to food insecurity within the global food system. Increasing inequality in the global food system away from farmers, serves to prolong the crisis of food security and poverty among farmers, and can potentially make it worse.

3.5. Conclusion

Our study provides empirical evidence at the global level for increasing inter-sectoral and inter-regional inequality. It shows that the global North, and the manufacturing and FIRE sectors more broadly, have increased their value capture through global value chains, while basic production of agricultural goods has shifted to the global South. This mirrors the broader process by which capital seeks to shift highly-competitive low-profit activities to the periphery of the world-system, while concentrating high-profit activities in the core (Wallerstein, 1995).

Our study is constrained by the availability and level of aggregation of global data. First, IO analysis assumes homogeneity in production. IO tables assume that the output of any country-industry pair is homogeneous, and the input mix used to produce any part of that output must be the same. It has been shown that this assumption does not hold true especially comparing output produced for exports and for domestic use. In fact, even for production carried out for exports, the input mix can vary significantly depending on where the exports are destined for (De Gortari, 2019). Our analysis can therefore only show the average picture.

Additionally, from IO analysis, we can tell where value-added is recorded as having been generated, but not adequately to which actor that value-added accrues. Within the value-added recorded in any country-industry, actors that capture that value-added may be outside of the territories of national economies. IO tables cannot explicitly capture such phenomena as profit-shifting and transfer mispricing that significantly impact the value-added that might be recorded for any sector and in any economy. We are also unable to capture the extent to which the value-added recorded (and especially therein, profits) in any country-sector accrue to multinational companies or large domestic firms as opposed to smaller firms. For this, we still must rely on other sources of data. Despite these challenges, the IO analysis we carry out provides critical information on the distribution of value-added as recorded in various countries. Future research and data collection should aim at overcoming these challenges.

Our analysis highlights the need for regulatory policies in global value chains. At the national level, trade must be regulated, domestic capacity for non-farm operations should be developed, and agricultural production and distribution must be managed in the interest of national food security instead of profit maximisation. This requires industrial policy and planning. At the international level, all countries must cooperate to reduce value capture and reduce inequality (Wise and Murphy, 2012). Improving incomes in basic agricultural production, regulating corporate profits and profit-shifting in specific sectors, as well as regulating the conditions of agricultural trade, could guide GAVCs in the direction espoused by the UN's Sustainable Development Goals (Yi et al., 2021).

CRediT authorship contribution statement

Meghna Goyal: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jason Hickel:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Praveen Jha:** Writing – review & editing, Supervision, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

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Technical Appendix.

Table 1
Classification of OECD ICIO sectors

Linkages	Aggregate industry	ICIO sector	Industry code
Agriculture Backward linkages	Agriculture	Agriculture, hunting, forestry	A01_02
		Mining and quarrying, energy producing products	B05_06
	Mining and fertilisers	Mining and quarrying, non-energy producing products	B07_08
		Mining support service activities	B09
		Coke and refined petroleum products	C19
Forward linkages	Basic services	Chemical and chemical products	C20
		Electricity, gas, steam and air conditioning supply	D
	Food manufacturing	Water supply; sewerage, waste management and remediation activities	E
		Food products, beverages and tobacco	C10T12
		Construction	F
	FIRE sectors	Financial and insurance activities	K
		Real estate activities	L
		Professional, scientific and technical activities	M
	Professional, technical and support activities	Administrative and support services	N
		Wholesale and retail trade; repair of motor vehicles	G
	Transport and trade	Land transport and transport via pipelines	H49
		Water transport	H50
	Others	Air transport	H51
		Warehousing and support activities for transportation	H52
		Postal and courier activities	H53
		Accommodation and food service activities	I
		Publishing, audiovisual and broadcasting activities	J58T60
		Telecommunications	J61
		IT and other information services	J62_63
		Public administration and defence; compulsory social security	O
		Education	P
		Human health and social work activities	Q
		Arts, entertainment and recreation	R
		Other service activities	S
		Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	T
		Textiles, textile products, leather and footwear	C13T15
		Wood and products of wood and cork	C16
		Paper products and printing	C17_18
		Pharmaceuticals, medicinal chemical and botanical products	C21
		Rubber and plastics products	C22
		Other non-metallic mineral products	C23
		Basic metals	C24
		Fabricated metal products	C25
		Computer, electronic and optical equipment	C26
		Electrical equipment	C27
		Machinery and equipment, nec	C28
		Motor vehicles, trailers and semi-trailers	C29
		Other transport equipment	C30
		Manufacturing nec; repair and installation of machinery and equipment	C31T33

Notes on methodology

It is important to note for our methodology, especially with regard to its comparability to other GVC studies, that data is available in current USD dollars and ‘basic prices’ as opposed to purchaser prices. Importantly, basic prices remove trade and transport margins (OECD, 2022). When purchaser prices are used, retail and wholesale trade margins are estimated to be higher than in our analysis indicating that our analysis underestimates the relative share of the retail and wholesale industries in value-additions in the food value chain. Other studies suggest that over 46–48 % of the total value generated in the food value chain accrues to wholesale and retail trade (FAO, 2022).

The IO databases are relatively new and provide data for only recent years, making comparability over the long-term (e.g., prior to 1995) impossible. Although this limits our analysis to the period between 1995 and 2020, we find it to suit our purposes of evaluating contemporary global value chains. The logistical revolution and fast-paced globalisation of production occurred precisely during this time period.

To get sales of each country-industry pair connected to food expenditures, we make the following assumptions, that we consider reasonable: 1. All final demand sales of the agriculture, hunting and forestry industry for each country is assumed to be sales for food uses. This is necessary because the industry cannot be further disaggregated using IO methods to specify food-only sales. 2. All final demand sales of the manufacture of food products, beverages and tobacco for each country is also assumed to be sales for food uses. 3. We ignore the fishing and aquaculture sector as our focus is on crop cultivation. 4. We also ignore the accommodation and food services sector, for which establishing how much of services should be accounted for by food or hospitality services, would require its own set of assumptions that we do not undertake here, but has been undertaken for some countries by Yi et al. (2021).

Data availability

Data will be made available on request.

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