

Structural Change and Development Through Agricultural Exports: Performance and Policies

Christopher Cramer

SARChI Industrial Development Working Paper Series

WP 2023-08

July 2023



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DSI/NRF SOUTH AFRICAN RESEARCH CHAIR IN INDUSTRIAL DEVELOPMENT

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ISBN 978-0-6398363-8-6

July 2023

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Funding acknowledgement

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Recommended citation

Cramer, C. (2023). Structural Change and Development Through Agricultural Exports: Performance and Policies. SARChI Industrial Development Working Paper Series WP 2023-08. SARChI Industrial Development, University of Johannesburg.

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Abstract

Debates on the role of agriculture in economic development and structural change often rest on over-aggregation, on old and tired assumptions, and on misleadingly rigid notions of distinctions between ‘sectors’. To show the limits of such an approach, this paper focuses on high-value agricultural exports (HVAX): generally knowledge-intense, complex activities intricately twined with a range of other activities, and effectively ‘industrial’. If HVAX can make a significant contribution to easing the balance-of-payments constraint on growth and development, and if they can generate new wage employment opportunities at the same time, then they may be an important focus for policy design. International evidence suggests some striking rates of expansion of a range of high-value export crops, especially in Latin America. Variations in performance highlight the relative underperformance elsewhere (e.g. some South African exports) and suggests scope for policy reform. Closer attention shows that government policies have been central to the patterns of variation in performance across LMICs, although these policies have ranged from the more ‘horizontal’ (e.g. in Peru) to the more ‘vertical’, as in, at times, Brazil and Chile. Reviewing the research literature and drawing on fieldwork in Ethiopia and South Africa, it was possible to highlight the range of constraints that governments and private sector actors face and that need to be addressed if HVAX are to fulfil their potential role in new paths of structural transformation.

Keywords: Structural change, high-value agricultural exports, industrial policy, comparative performance in developing countries

JEL codes: O13, O19, O25, Q17, Q18

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Acknowledgements

Support for this research was received under the project ‘Community of Practice in Industrialisation and Innovation’ (grant number 110691), hosted by the DSI/NRF South African Research Chair in Industrial Development (grant number 98627), University of Johannesburg.

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1. Introduction

What role do agricultural exports play in a 21st-century development strategy? Should low- and middle-income country (LMIC) governments prioritise policies in support of expanding high-value agricultural exports? Or should they be wary of this, perhaps because of fears of disadvantageous terms of trade or food security threats?

Debates on the significance of agriculture in the process of economic development and structural change continue without resolution. Various views persist, ranging from the idea, at one end of the spectrum, that agriculture is the engine of development, to the notion, at the other, that agriculture is a ‘fifth wheel’ (Andersson and Till 2018). Academic attention to this question has fluctuated over the decades (Andersson and Till 2018), as has official development assistance (ODA), which, after rising to a peak in the mid-1980s, fell to a trough around 2003 before picking up somewhat more recently (although, as a share of all ODA aid to agriculture, it has remained stuck at a very low level). Policy officials in low- and middle-income countries (LMICs) therefore pick up very mixed and changing signals and may be forgiven for finding it difficult to know what level of priority to give to agriculture in general, or to specific forms and parts of agriculture: small farmers or large – the once almost sacrosanct faith in the inverse relationship between farm size and productivity is no longer questioned only by a minority of economists, and there is now widespread scepticism (Muyanga and Jayne 2019; Rada and Fuglie 2019); domestic food crops or export crops; etc. Climate change and war have intensified food supply and food security concerns, helping to refresh some of these debates, but at times in a short-term, less than strategic way.

Yet agriculture is over-aggregated, and treating it as an undifferentiated ‘sector’ is not much use to policy officials. In this paper I focus on the potential contribution to economic development objectives of high-value agricultural exports: generally, knowledge-intense, complex activities intricately intertwined with a range of other activities, and effectively ‘industrial’. If it is the case, as argued below, that high-value agricultural exports (HVAX) can make significant contributions to easing the balance-of-payments constraint on sustained growth, that they reflect and constitute structural transformation, and that they are powerful agents of employment creation, then it is useful to understand variations in their performance across low- and middle-income countries (LMICs) and, on the basis of such variation, to understand what role government policies have played in the relative success or failure of different countries.

International evidence suggests some striking rates of expansion of a range of high-value export crops – avocados, berries, citrus, etc. (as opposed to ‘commodity’ crops like cereals) – and especially among a number of Latin American countries, in the past twenty years or so. But to what extent and how does public policy matter, and if so which policies, in accelerating HVAX in LMICs? This export growth has been led by private-sector firms, but looking more closely at a range of case studies shows that governments and public-sector agencies have

played a fundamental role in enabling and driving this growth, alongside collective action among private firms. Government interventions have ranged from the more ‘horizontal’ – as in Peru – to the more ‘vertical’ – as in, at times, Brazil and Chile. I draw on international data (FAO, ITC) to illustrate some of the experiences of HVAX expansion and its variation across countries. I review the research literature on particular countries and export crops – including Brazil, Chile, Peru and South Africa – to explore the policies that have been linked to export performance. And I draw on insights from primary field research, especially in Ethiopia and South Africa.¹

In the sections that follow, I first outline the argument about why it matters to understand variations in the performance of high-value agricultural exports, and what role government policy has played in the rapid rates of growth of revenue from such exports. Then I illustrate the potential and variation in export revenues, pointing to some particularly striking (and contrasting) experiences. That variation leads to a review and discussion of the kinds of public-sector role and policies, both where there has been extraordinarily rapid expansion in high-value agricultural export revenue and where there has been relative under-performance. The latter leads to a summary of some of the main constraints on exporters, before a conclusion is drawn that highlights key policy issues.

2. ‘Fresh is the Thing that Matters’: High-value Agricultural Exports, Structural Transformation, Growth and Employment

It has often been thought by policy officials in LMICs that there is little need to design policies for the promotion of agricultural exports. After all, as it has been argued by development economists and political figures, ‘unprocessed’ agricultural exports in particular are typical primary commodities, low in knowledge-intensity, whose terms of trade, vis-à-vis manufactured imports, are structurally unfavourable. In Latin America in recent years, for example, “there has been a predominantly negative view” of natural resource-related production, which is seen as a set of enclave activities that hinder the development of innovation capabilities (Figueiredo 2014:5). Instead, this view has it, policy emphasis should be on accelerating industrialisation through the promotion of manufactured goods (and especially manufactured exports). In addition, food security concerns have often been cited as grounds for prioritising food production for domestic consumption in pursuit of ‘food sovereignty’.

Yet the evidence suggests strongly that high-value agricultural exports can play a significant role in structural transformation and sustained economic growth, while also addressing pressing concerns, including rural female poverty, and that global supply and demand changes relating to fresh produce have enabled “new pathways to growth-enhancing

¹ I would also like to thank Taylor Rockhill, for research assistance in producing this paper.

structural change” (Paus et al. 2023). Fears that high-value agricultural exports (HVAX) are at best weak instruments of structural transformation are misplaced. First, they can relax the balance-of-payments constraint on growth. Sustained economic growth is limited by the capacity to satisfy the thirst for imports that comes with fast growth. The financing of imports depends on access to foreign exchange. While aid inflows may be forthcoming, they are not always predictable, and they typically come with inconvenient strings attached. Commercial debt can tangle an economy in high and bunched debt service obligations. The best way to finance the rapidly expanding import demand is by increasing export revenue (Cramer et al. 2020). And, as Thirlwall (2011) has shown, it matters what a country exports. The most effective exports are those for which there is a high income elasticity of demand internationally: where demand responds positively to increases in income. And, almost by definition, high-value agricultural exports are those for which there is a high income elasticity of demand (Barrett et al. 2022; Shimizu 2022).

Furthermore, that high income elasticity of demand means that the terms of trade are not falling in a systematic trend. In fact, the whole idea of a secular decline in the net barter terms of trade for primary commodities relative to manufactures has stoked a damaging diversion in many LMIC country policy circles, and among many development economists. There is no consensus in the large number of research studies on this that there actually is convincing evidence of an overall systematic, secular, downward trend for primary commodities relative to manufactures. Perhaps most importantly, what is clear is that primary commodity prices do not move together. Relative price trends and income elasticities of demand for different primary commodities, indeed for different foods, vary hugely and do not move in harmony. While income elasticities of demand for grains may be below one, they are typically for foods with higher fat and protein content; and the scope for product differentiation through branding, cultivated tastes, associations with health benefits, etc. to push up higher income demand for avocados, specialty arabica coffees, macadamia nuts, blueberries, etc., has grown, as has demand in large and growing markets like, above all, China, but also Indonesia, Brazil, Mexico, and elsewhere (Cramer et al. 2020:117).

Second, the evidence suggests that, as well as contributing to sustained economic growth (not least by relaxing the balance-of-payments constraint that is a structural feature of LMIC economies), expanding high-value agricultural export production also promotes, in fact *constitutes*, structural change. Much development economics and policy advice, working with standard and very old ideas of the classification of economic activities into three broad sectors, is based on outdated notions of ‘agriculture’ involving relatively low-productivity activities with relatively few linkages and spillovers to other activities. But the global economy has changed. It has become clearer that there are plenty of linkages (forward, backward, fiscal, foreign exchange) connecting agricultural production with other activities. And, while there for a very long time have been technical innovations that have raised agricultural productivity, mitigated perishability (Freidberg 2009), and enhanced the climatic resilience of

crops, the intensity of change has led to the phenomenon of the ‘industrialisation of freshness’: the way in which the production of many fresh agricultural goods (including, and perhaps especially, for export) is so complex, ‘roundabout’, knowledge intensive and capital intensive that it is to all intents and purposes industrial (Cramer et al. 2022). Chisoro-Dube et al. (2019), for instance, show how constant technical upgrading across inputs, production, packaging, storage, marketing and distribution is critical for market access and competitiveness. One example is in innovations in the genetics of eucalyptus trees for pulp production in Brazil, where, as one study put it, there was a realisation that the ‘pulp factory’ was actually the tree itself (Grattapaglia and Kirst 2008). More broadly, the industrialisation of freshness and the parallel process of ‘servicification’ (the increasing share of final value of goods derived from service activities like logistics, R&D and marketing) constitute a dismantling of the neat structural divisions between ‘sectors’.

Yet when development economists highlight the gains from manufacturing – for example in work inspired by the classic contributions of Kaldor’s Growth Laws – they still typically have in mind a specific notion of the ‘industrial’ that involves large urban factory production: from the 19th-century textile factories of the industrial revolution, through Fordist motor factories, to the enormous Chinese establishments of the 21st century and the factories conjured up in Freeman’s (2018) history, *Behemoth*. And when economists argue for the leading developmental role of ‘complex’ exports, such as the IMF’s Cherif et al. (2018), drawing on Hidalgo and Hausmann’s (2009) analysis of economic complexity, their large-N statistics have to invoke international trade statistics that cling to outmoded classification systems, assuming complexity from predetermined categories.

This has important implications for policy officials. For it is no longer appropriate to ‘read off’ the scope for deriving the gains associated with industrialisation from more obvious manufacturing activities. The collapse or partial rubbing out of distinctions between sectors means that there may be activities classed traditionally as ‘agriculture’ that are higher productivity than, are associated with more domestic linkages than, and have just as much scope for learning-by-doing if not more than ‘manufacturing’. To the extent that this is the case, policymakers may need to recalibrate their priorities for policy formulation, based on different and more granular criteria. In the most advanced forms of industrial freshness, farming by the square metre is evolving into farming by the cubic metre. One of the founders of the US firm Plenty, which is one of the pioneers of creating indoors, vertical, ‘controlled-environment’ farms, suggested that the firm is ‘manufacturing ideal growing land’. Others are working on bio-chemical innovations that benefit from symbiosis between nitrate-producing

microbes and food plants to enable a reduction or even elimination of chemical input requirements.² Farming can be distinctly ‘complex’.³

For example, servicification and the industrialisation of freshness combine to blur sectoral distinctions, and indeed to blur the distinctions between firms, in Chilean sweet cherry export production. One study found a ‘very high incidence of services’ in the global cherry industry, with more than 70 different service activities spread across orchard establishment, production, packing, distribution and marketing, as well as transversal services like finance, utilities, legal and human resources. Some of these are provided in-house, some partly in-house and partly contracted out, and some are fully outsourced. There is also an ecosystem of research and development linking, among others, the fruit exporters’ association ASOEX with universities and with INIA (el Instituto de Investigaciones Agropecuarias). Production is ‘agricultural’ but involves many forms of industrial complexity, including R&D, cold storage, packaging technologies, sorting and grading, testing, precision tracing, fertiliser and irrigation inputs, etc. “I began to do cherries because it was difficult,” said Hernán Garcés in an interview with *The Economist* magazine. Garcés Fruit is now the world’s largest cherry producer and its output increased 25-fold in 15 years. The company uses immense fans to warm the trees in winter and helicopters to air-dry the fruit after downpours. In an important linkage, Chile now manufactures the bags that regulate the air in cherry packaging, which it formerly had imported from the USA.⁴ And in Peru, where Paus et al. (2023) argue that linkages to other sectors are limited, demand “for specialised packing material has been the one major link with manufacturing. It has led to product diversification and innovation, to increased exports of packaging products, and enticed foreign companies to invest in Peru” (Paus et al. 2023:9).

Third, high-value agricultural exports typically require high labour inputs and therefore have considerable potential for generating substantial labour demand. Given that these goods are produced in rural areas and that they are often dependent predominantly on female labour, they may have particular potential for contributing to rural poverty reduction through the absorption of rural women into high-productivity employment. When the agricultural census was carried out in Chile in 2007, 450 000 people were employed annually in cherry production, about one third of them as permanent employees. Since then, Chilean cherry exports have continued to expand, becoming in recent years far and away the largest cherry exporter in the world. Chilean producers notably have introduced childcare facilities to facilitate women’s employment, especially in cherry packing. In Peru, labour costs amount to

² Nate Storey of Plenty, quoted in Foroohar (2022); Molly Jahn’s work at the University of Wisconsin-Madison, supported by DARPA, is introduced in the same piece.

³ Even in staple production and non-export agriculture there has been a ‘quiet revolution’ in the sophistication of agricultural value chains (AVCs) in low- and middle-income countries in recent decades; Barrett et al. (2022:1320) suggest that the ‘evidence on AVCs has been hiding in plain sight for years’, but that economists have thus far paid little attention to the economic phenomena involved.

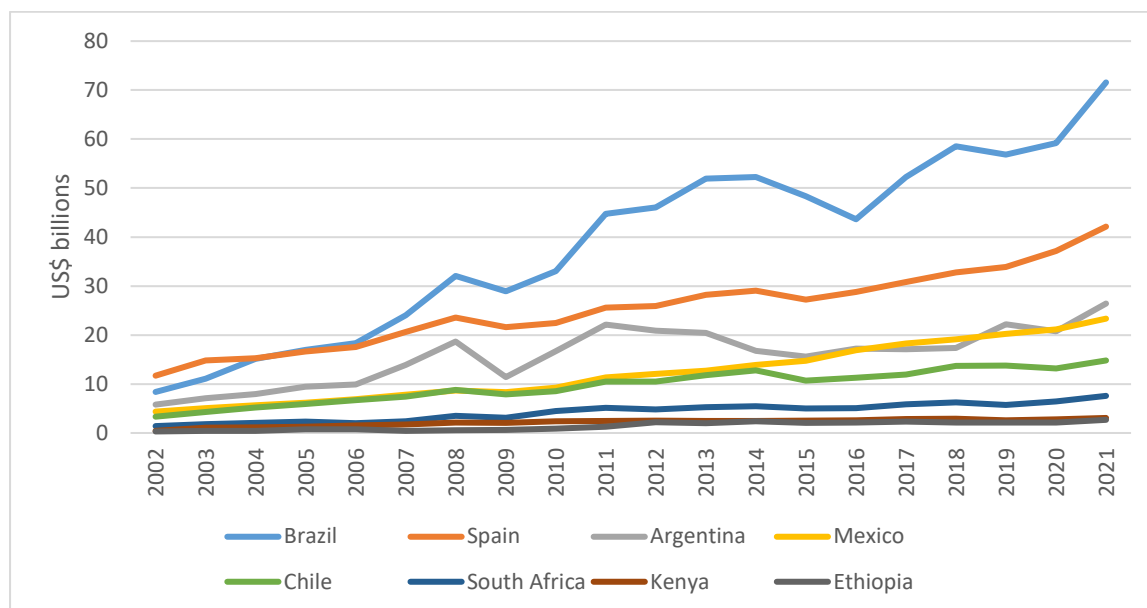
⁴ Adam Smith in Chile: The parable of the cherry orchard, *The Economist*, January 19 2021.

about 40% of the cost per kg of producing asparagus and avocados, 70% of blueberry costs, and almost 80% of grape production costs (Paus et al. 2023:11). Between 2004 and 2014, “the number of workers in modern agriculture who gained access to medical insurance and a pension system [in Peru] increased 5-6 times. Female employment in the industry increased by six times in the same period” (Shimizu 2022:15). In recent years in Brazil, agriculture has been a net generator of employment and was the only sector of the economy with increasing labour productivity (Arias et al. 2017). Brazilian agribusiness employs some 34.6 million people (almost a fifth of the population) (Arias et al. 2017).

Altogether, the promotion of a rapid expansion of high-value agricultural exports may have a ‘triple whammy’ effect: the returns to effective policy design may be unusually high. Therefore, it is valuable to have some idea of variations globally in the levels and rates of change in these exports and to highlight some of the policies that have supported the more impressive performances. It is also instructive to know the most important types of constraint that undermine prospects for a rapid increase in HVAX earnings. The following sections illustrate some relevant performance trends, discuss some of the policy context in HVAX successes, and outline some of the key constraints that policy officials in LIMICs need to address if they are to spark a process of catching up in the industrialisation freshness and to reap some of the benefits outlined above.

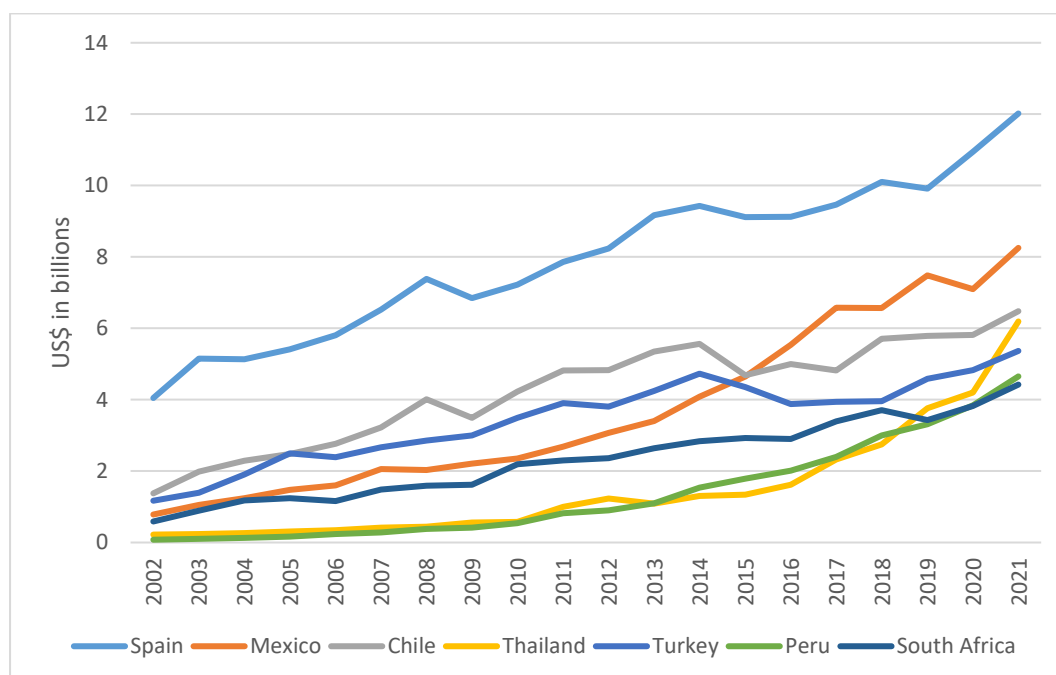
3. Performance

Over the past 20 years or so there has been a marked, in some cases dramatic, increase in earnings from high-value agricultural exports (HVAX). As noted above, there is no consensus on a clear definition of such export goods, but they are typically those goods with a high value-to-volume ratio, and for which there is strong demand (and income elasticity of demand) internationally. To give an example, while bulk commodity coffee may not be a high-value agricultural export, specialty arabica coffees (those achieving very high-quality scores, with scope for product differentiation in terms of origin or variety characteristics), may be classed as HVAX. Similarly, HVAX include many ‘unprocessed’, or in the case of nuts, peeled ‘fresh’ goods: avocados, cut flowers, cherries, etc. Given that processing is usually taken to mean significant transformation (milling, juicing, drying or concentrating), there is yet another grey area given that many ‘fresh’ and apparently unprocessed agricultural goods undergo various forms of processing themselves (trimmed vegetables, cut roses, cracked or peeled nuts). Indeed, the features of the industrialisation of freshness in some ways are difficult to distinguish from ‘processing’. To give one example, a ‘ripe and ready to eat’ avocado on a supermarket shelf in the UK may originate in South Africa and arrive unpeeled and packaged, but it has been through manipulations that include exposure to ripening gases after shipping and on arrival at industrial facilities in the UK. Given the pace and direction of change in the global economy, these are all things that require further analysis and categorical refinement. For now, we have to rely on a rough-and-ready, intuitive approach.

Figure 1: Growth in agricultural exports (2002 to 2021)

Source: FAOSTAT

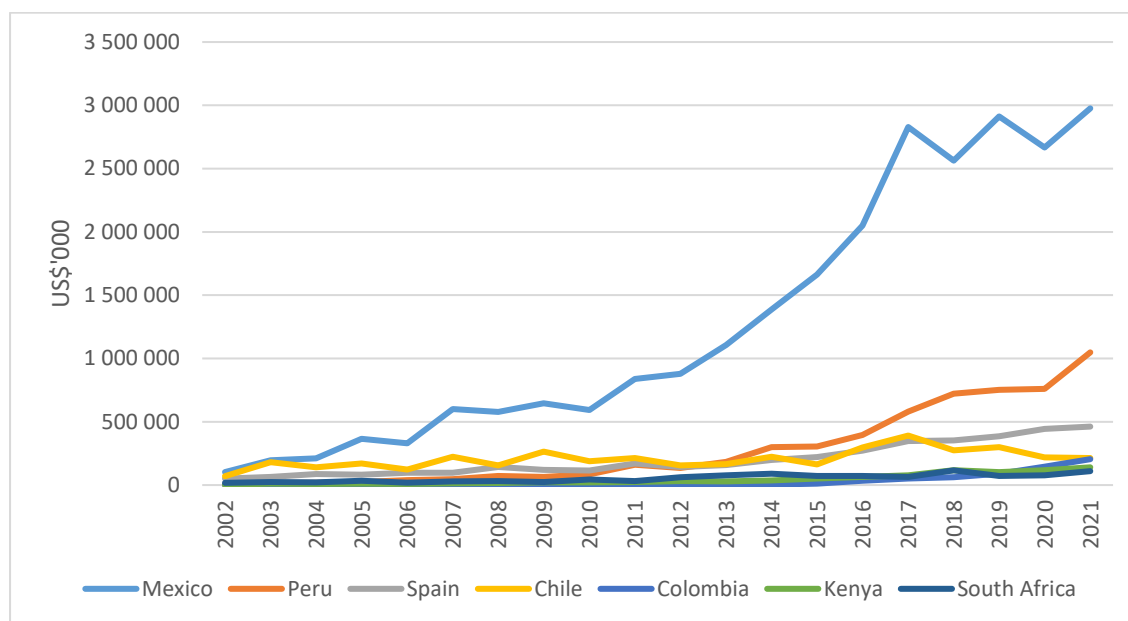
Figure 1 shows the expansion in overall agricultural exports for a selection of LMIC countries plus Spain, showing remarkable growth in Brazil, with earnings in Spain and Argentina also doubling in 20 years. These data include all agricultural output, and for some countries including processed or bulk commodity output. Figure 2 focuses on fruit and nut exports – unprocessed – and, while Spain’s performance stands out, the data also show strong growth in countries including Mexico and Chile.

Figure 2: Fruit and nut exports

Source: FAOSTAT

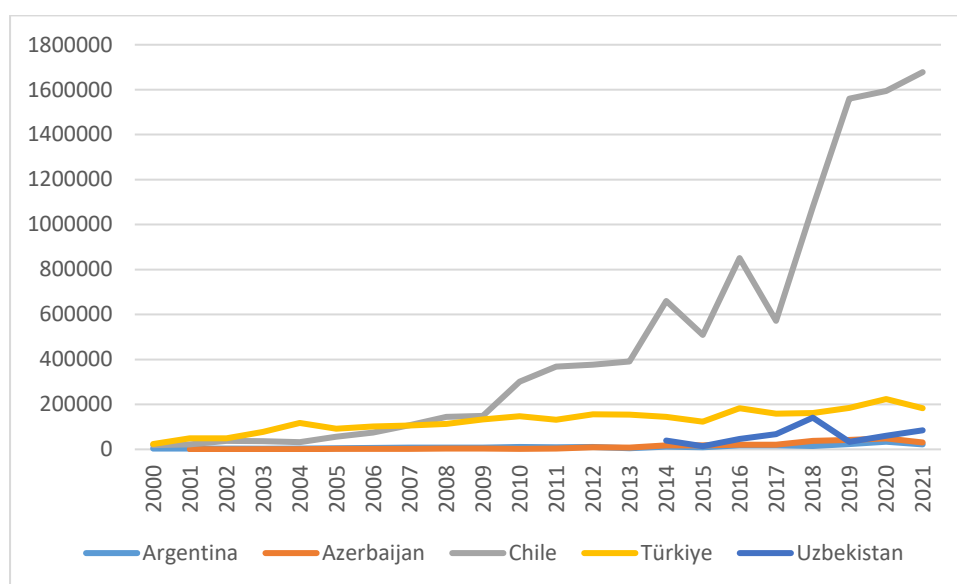
Figures 3, 4 and 5 give three examples of individual fresh commodity exports: avocados, cherries and blueberries respectively. As is clear from Figure 3, Mexico in particular, but also Peru, has achieved sustained expansion of avocado exports. And Chile's extraordinary expansion over the past two decades in cherry exports is the striking feature of Figure 4.

Figure 3: Avocado exports



Source: FAOSTAT

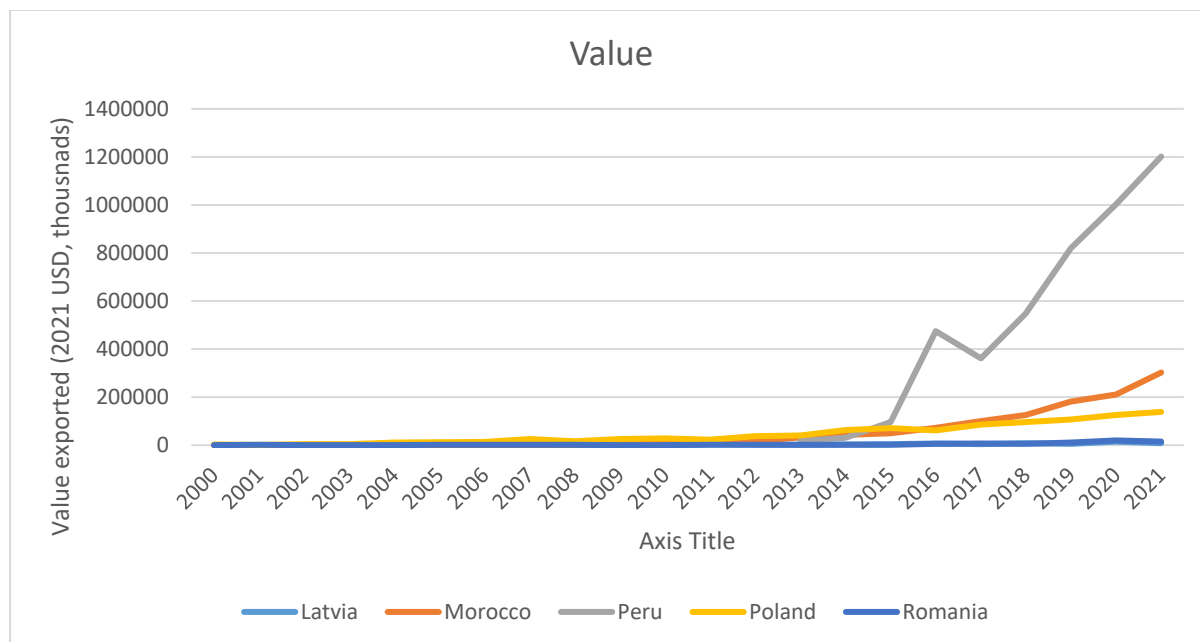
Figure 4: Cherry exports



Source: FAOSTAT

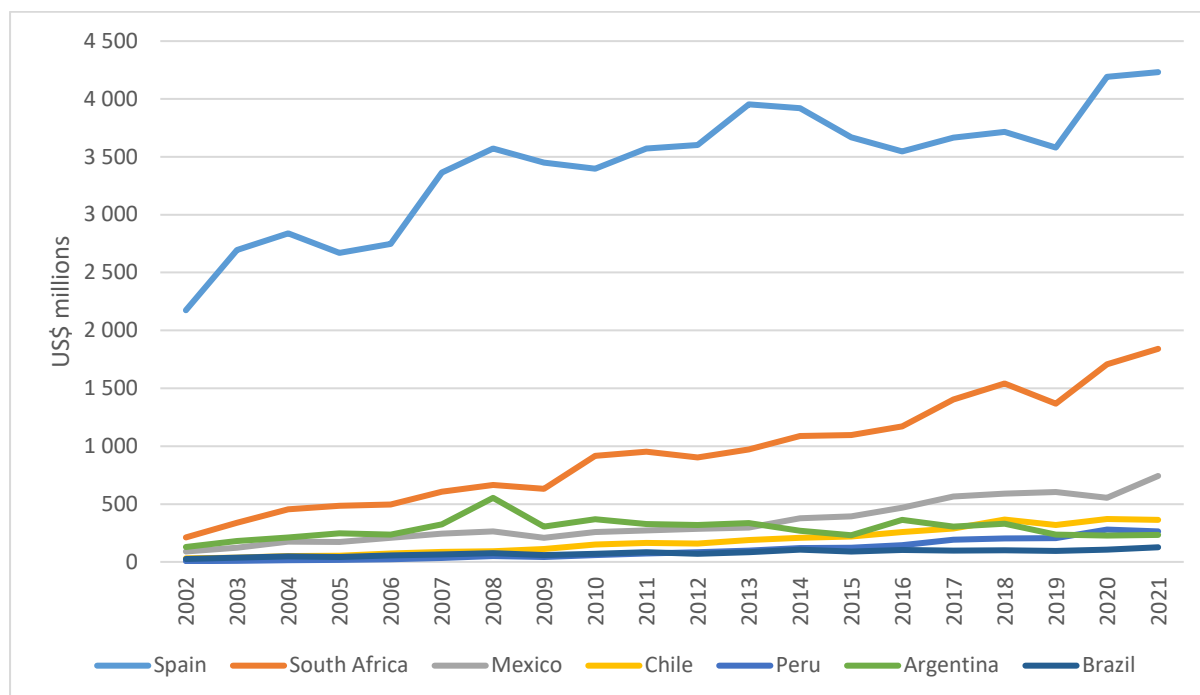
Figure 5, meanwhile, shows the dramatic recent expansion of Peruvian blueberry exports. Peru's dramatically rapid shift to becoming a 'global powerhouse' in fresh produce exports (Paus et al. 2023) is discussed further below.

Figure 5: Blueberry exports, selected countries, 2000 to 2021



Source: FAOSTAT

African economies have thus far, and for the most part, not succeeded in generating sustained rates of growth of the same order, despite some expansion in Kenyan vegetable exports and, for a while, from a very low base in Ethiopian cut flower exports. But South African citrus exports have been something of an exception, as is clear in Figure 6 below. It should also be said that there has been more recent, rapid expansion of another high-value, high labour demand fresh agricultural commodity export from South Africa: blueberries. Although South African citrus exports remain significantly smaller than Spain's, growth has been more rapid in South Africa over the past few years. To get some idea of the relative contribution that 'fresh' HVAX generate, South African fresh fruit account for two thirds of the country's citrus export output, but generate 95% of citrus export earnings. The remaining one third of citrus exports, earning 5% of total citrus export earnings, comprises juices and other processed fruit products (conserves, fruit leathers, etc.) (Cramer and Chisoro-Dube 2021).

Figure 6: Citrus export earnings

Source: FAOSTAT

4. Policies

Fresh is the thing that matters to consumers. So you look at all these folks, and they're all very motivated to have a stable supply. They're all very motivated to have stable price. They're all very motivated to have a predictable system. And it's just this continuous evolution up the spectrum of control to something that's more predictable, less risky.⁵

Consumers are demanding. They increasingly demand fruit and vegetables that meet strict sanitary and phytosanitary requirements, and importers and retailers demand stable supplies of high-quality goods. The pressures of a competitive global market for high-value agricultural goods have historically required a range of policies. Agricultural 'catch-up' is in many ways like manufacturing catch-up, as well as having some specific features less common to manufacturing (Parente et al. 2021). The research literature is unanimous in making it clear that relying on comparative advantage is a necessary but insufficient condition for succeeding in high-value agricultural exports. Favourable natural endowments – agroclimatic conditions, freedom from particular pests – are helpful but not

⁵ Nate Storey, co-founder of Plenty, interviewed in Foroohar (2022).

enough, not least when importing countries impose an array of barriers to entry to their markets.⁶

One of the most obvious ways in which governments – and semi-autonomous public agencies – have been fundamental to the expansion of export earnings has been through helping secure access to markets – Peru, for example, has 23 free trade agreements. To break into foreign markets may involve negotiating reductions in tariffs and quotas, and it has increasingly involved meeting a variety of sanitary and phytosanitary standards, which are especially strict in some markets. These difficulties are viewed as hurdles, but countries differ in whether they develop the market muscle to leap over these hurdles, or whether they effectively refuse the jump. Interviews in South Africa revealed a common frustration that South Africa had invested too little in building a sufficiently large and well-trained team of trade negotiators, while the evidence has been that some Latin American countries have far more effectively developed trade negotiation capabilities. Sometimes natural advantages help. One South African exporter acknowledged that the Department of Trade and Industry (DTI) had made efforts, but not enough, and contrasted South African commitment to market access with a Chilean ‘armada’ of people pressing East Asian governments for market access (Cramer and Sender 2015).

A comparison of French and Chilean apple exporting shows that Chile, which has expanded apple exports dramatically in recent years, has partly benefited from lower market entry barriers because it is free from particular pests that affect French (and many other producers’) crops (DeMaria et al. 2018). But it generally takes more than the luck of the geographical draw. Further, the constraint of meeting sanitary and phytosanitary (SPS) standards has clearly stimulated some LMICs to develop competitiveness (DeMaria et al. 2018), acquiring capabilities that build economies of scope, as new export crops come on stream over time. Argentina’s effective development – coordinated through public-private collaboration – of a SPS protocol for cherries allowed Argentine exports of cherries to China to expand from 3% of Chinese imports in 2018 to 38% in 2020/2021, despite Argentine cherries facing a 10% tariff (while competitors like Australia, New Zealand and Chile pay zero tariff on cherry exports to China) (Ghezzi et al. 2022:192). This experience contrasts with complaints in South Africa that the government had simply stalled on signing an Apple Export Protocol with China before 2014 and had taken far too long to reach agreement on acceptable levels of fungicide and chemical residues on apple exports; it took eighteen years for South African apples to get access to China (Cramer and Sender 2015; Cramer and Chisoro-Dube 2021). “Similarly, South Africa’s fruit exporters have been denied access to Thailand since 2008 because the South

⁶ One indicator of how competitive and fast-moving these markets are is the sharp decline in Argentine blueberry exports, which halved in 2022 compared to previous years’ averages: “We didn’t have the vision to take advantage of our position ... We didn’t increase our volumes back then because no one thought that the world would consume so much blueberry ... Our fruit is no longer competitive” (Alejandro Pannunzio, quoted in Fresh Plaza 2022).

African government has failed to update the phyto-sanitary rules applicable to the sector, thus hindering the certification process' (Viviers et al. 2014:195).

What Figueiredo (2014) calls 'government policy orientation' – the network of institutionalised interactions among actors that includes laws, policies, incentives, sectoral plans and industry associations – involves regulating inputs just as much as ensuring export standards are met. In one especially egregious case of a fragile system, South Africa, for some years in the 2000s, imported Chinese fertiliser with high levels of toxic cadmium for pineapple production. The hazards involved led to legal cases and very real losses for the canned pineapple export business: 500 jobs lost at a processing plant in the Eastern Cape, a serious threat to thousands of jobs in pineapple production and trade, and cancelled export orders (Cramer and Sender 2015).

Failure to negotiate trade agreements has been a significant constraint on exports. The Argentine cherry export expansion to China belies the difficulties Argentina has had. Argentina is known to have relatively few trade agreements, for example, and this has hampered export earnings. Argentine fresh lemon exports to the EU face a 9.6% tariff, while South African and Chilean lemons enter without tariffs. Much the same issue has hobbled Argentine exports of blueberries and cherries. South Korea pays a price premium on Amazon chestnuts, but Argentina, the biggest producer of these chestnuts by far, has been unable to take advantage of the premium for lack of a trade deal. Meanwhile, a Bolivian subsidiary of a major producer in Argentina can export from Bolivia to South Korea because there is a trade agreement between the two countries (Cramer and Sender 2015).

Both public and private sector organisations have been key to most experiences of rapid expansion of HVAX. In Chile this has involved organisations like ProChile, Fundacion Chile, ASOEX, Viñas de Chile, and others. Prompex (Comisión para la Promoción de Exportaciones) played a similar role in Peru before being rebranded as export and tourism promotion agency, Promperu. Prompex helped to found industry associations such as the Peruvian Institute of Asparagus, and collaborated with other public bodies to create crop-specific quality standards (Shimizu 2022:20). One of the key features of South Africa's relative success with citrus exports has been that the all-important coordination of producers was led by the industry rather than the state. The private sector led the state to play a more effective role, but that has left citrus exports exposed to the frailties of South African government department silos and weakening infrastructure investment. The Citrus Growers Association (CGA), formed in the late 1990s, at first relied on a voluntary levy from members before it succeeded in getting government support to make the levy statutory. Since then, the levy has increased, membership has expanded and become more inclusive, and the CGA formed its own research agency, making it less dependent on the thinning capabilities of the public Agricultural Research Centre (Chisoro-Dube and Roberts 2021). The CGA also effectively pushed government to sign trade deals on its behalf. The CGA, meanwhile, secured additional public

funding through an extension of the Sector Innovation Fund from the Department of Science and Technology – channelled through two programmes, the Citrus Research Programme, and the public-private partnership of the Post-Harvest Innovation Programme.

Beyond negotiating reduced tariffs and quotas, public agencies have also been important in supporting marketing/branding efforts. For example, ProChile has supported YouTubers and other social media influencers to promote Chilean fresh exports to South Korea, backing their efforts to develop narratives around product origin that have been key to product visibility and acceptability. Key Korean buyers have also been supported on structured visits to Chilean vineyards, while Chilean SMEs have been supported to club together and share the benefits of travel to South Korea (Muñoz et al. 2021). More generally, ProChile organises trade shows, builds and shares its contacts list, and facilitates exporter travel. Private organisations and associations like Fundacion Chile have also played a key role: for example, supporting the joint efforts of salmon exporters with legal, technical, environmental, research and market access services (Bianchi and García 2007). Not surprisingly, Chile has become a benchmark in these kinds of public-private services for other exporters in the region, such as Ecuador (Herrera Criollo 2022). At another level, public-private coordination has been highly effective in Brazil's efforts, not only to open specific markets to Brazilian agricultural exports, but also in giving Brazil a louder voice in influencing global agricultural governance in general (Søndergaard and Dias da Silva 2020).

But having access to markets is useless if exporters do not have the requisite know-how, experience and ability to produce a reliable supply of high-quality goods. This means that exporting countries have to develop productive capabilities, which is a system-wide business involving not only firm nous, but effective infrastructure and an ecosystem of knowledge acquisition. Modern agriculture is knowledge-intensive: this means the development of knowledge capabilities (for technology adoption, creative imitation, adaptation to local conditions and innovation) is key to success. Figueiredo (2014), for example, highlights the role of knowledge-related institutions in relation to latecomer firms – those dealing in education, research, training and standards, which can involve both public and private institutions. Paus et al. (2023:8) argue that, in contrast, the lack of an agro-focused industrial policy in Peru is the reason why domestic innovation in agricultural-related technologies and genetic research into new varieties has been scarce, even within the National Institute for Agricultural Innovation.

Building the capabilities and productive efficiency to take advantage of growing global demand for high-value agricultural goods takes time – often quite a long time. It requires a gradual build-up of know-how (both tacit and codified knowledge), research to adapt cultivars to local conditions, market research, etc. As a result there is a need both for 'patient finance' and 'patient learning'. The building of knowledge capabilities is never just a matter of a single agency, organisation or institution, but – very much in the spirit of Allyn Young's (1928) ideas

about ‘intimate connections’ among firms – involves a productive knowledge ecosystem. It may be that a particularly effective public organisation like Brazil’s Embrapa is at the heart of this system, with a strong applied research ethos, but Embrapa has never acted in isolation. Sometimes it has been more central to learning and innovation (as through its soy research programme, Embrapa Soja), while at other times it has played a different supportive role later in the process (as in the genetic research underpinning industry innovations in eucalyptus and the paper and pulp industry) (Figueiredo 2014).

A group of delegates from Brazilian agricultural export associations visiting London in 2022 emphasised that their successes to date had been underpinned by support and learning over several decades.⁷ Brazil’s transformation from a food insecure nation to one of the world’s largest agricultural exporters goes back, in particular, to national food security threats in the 1970s, when a range of institutional and policy interventions developed momentum.⁸ Public agricultural research, through Embrapa, which was created in 1973, has played a key role in this process in Brazil, among others through specific projects such as running one of the world’s largest peach-breeding programmes (which has reduced the fruit development period (FDP), and increased fruit weight across canning peaches, fresh peaches and nectarines over 16 years and more) (Corrêa et al. 2019), as well as larger involvement in the huge expansion of Brazilian soy output. Embrapa has supported an accelerated ‘catching up’ at the same time as promoting innovation at the technical/production frontier, in a good example of the non-linear, ‘out of sequence’ and simultaneous processes often involved in economic development (Whittaker et al. 2020). Embrapa, as a public organisation chartered by the Brazilian government, first built up capabilities for soy production (largely around fairly small-scale output in southern states), before then developing an ‘innovation/diffusion network’ (Parente et al. 2021) (involving Embrapa, universities, other public agencies and public-private partnerships) that enabled the reclaiming of land (‘liming’ the acidic soils of the Cerrado region) that had been thought barren and the development of new seed varieties. A World Bank study summarised the key features of Embrapa’s success: sustained and substantial government funding; investment in the organisation’s people, to the point where 80% of Embrapa’s 2 400 research staff have PhDs (Figueiredo 2014); a focus on research excellence and international collaborations; and an open intellectual property rights policy that promoted the diffusion rather than private capture of innovations (Correa and Schmidt 2014). More recently, public agencies in Brazil (including the national development bank, BNDES, Banco do Brasil, and the Ministry of Agriculture, Livestock, and Food Supply, MAPA) have been at the forefront of a national programme to promote climate-smart agriculture through the ABC (low carbon agriculture) programme (Arias et al. 2017).

⁷ Author interview with a delegation of Brazilian agricultural export association representatives at SOAS, University of London, September 5th, 2022.

⁸ An earlier background included the introduction of minimum wages in the 1940s and, in the 1950s, new initiatives around dining halls for workers and school meal programmes (Chmielewska and Souza 2011).

Recent Chilean export expansion also has deep roots in the early to mid-20th century. ProChile itself began as an export-promotion institute in 1974 and began investing in R&D to support berry production in the 1980s. CORFO, the Production Development Corporation, developed a fruit production plan in the 1960s, while the Institute for Agricultural Research and Chilean universities started expanding technical training programmes for the fruit sector around the same time, while the Chile-California programme, funded by the Ford Foundation, started accelerated Chilean learning in 1965 that would underpin the growth of fruit production and exports. But, as Lebdioui (2019) highlights, drawing on Tinsman (2013, p32), the Chilean government had identified fruit exports as a possible replacement for falling revenue from nitrate exports during the First World War, and shortly after that war, a senator led a state-financed commission to California where he “identified the mysterious force at work in California not as the market’s invisible hand but as the enormous presence of the US Ministry of Agriculture”.

Lebdioui (2019) also shows how public policy was fundamental in the compressed development of Chile’s salmon industry, growing from virtually nothing in the 1980s to be the world’s second largest salmon exporter after Norway. Again, the salmon surge in the 1980s had earlier foundations in being backed by government and public agencies. The Japan-Chile Salmon Project built up Chilean technical knowledge from the late 1960s. Fundacion Chile – a semi-public agency – acted as a venture capitalist in the sector and also as a conduit for knowledge diffusion. Government funding of some \$70 million for salmon-related research and development helped establish the knowledge base for the sector, while Chilean universities launched a string of sector-relevant degree modules and programmes in aquaculture, biochemistry and marine sciences. The state also had to design and enforce new legislation to regulate fishing and overcome diseases resulting from overly intensive fishing.

One general measure of governments’ support for agriculture is the agricultural orientation index (AOI), which measures government spending on agriculture relative to the share of agriculture in GDP. Table 2 below shows both the global variation in the AOI and trends over time.

Table 1: Agricultural orientation index (AOI) by region

Region	2001	2005	2010	2015	2020
World	0.52	0.49	0.46	0.50	0.51
Sub-Saharan Africa	0.16	0.19	0.17	0.14	0.12
North Africa & West Asia	0.33	0.32	0.28	0.31	0.32

Central & Southern Asia	0.33	0.37	0.47	0.37	0.34
Eastern & Southeastern Asia	0.64	0.77	0.77	0.98	1.08
Latin America & the Caribbean	0.47	0.43	0.40	0.35	0.22
Oceania	0.32	0.37	0.40	0.22	0.22
North America & Europe	0.68	0.64	0.52	0.40	0.51

Source: FAO 2022

Underpinning the expansion of high-value agricultural exports is infrastructure: a reliable supply of high-quality exports requires a reliable supply of energy and transport infrastructure, as well as, increasingly, internet services. Chilean fruit exports, for example, are hampered by very long distances to import markets, and yet they benefit from logistics costs that are low in comparison to most of the country's competitors. Not only that, but fruit exporters also are able to get their produce to ports easily; since with the expansion of domestic airports and port networks, no fruit has to travel more than 250 km by land to reach a port (Bamber and Fernandez-Stark 2016).

A dramatic case of high-value agricultural export growth is Peru's development of the northern coastal zone – principally in La Libertad region (through the Chavimochic project) and the Lambayeque region (through the Olmos project). This area has been transformed from what was considered desert into a highly productive area. The government began investing in irrigation infrastructure during the 1980s; by 2017, 25 000 hectares were covered by irrigation schemes and the area is a major exporter of asparagus, avocados, blueberries and grapes. Thus in 2010, for example, Peru exported virtually no blueberries: by 2020 it was the world's biggest blueberry exporter, earning \$1 billion (Crespi 2022). When major projects like the Olmos and Chavimochic projects reached completion (or when stages of them did), the state auctioned off irrigable land to individuals and firms (Shimizu 2022) at subsidised prices. The state's infrastructure investment helped create an environment in which a web of interconnections evolved between private investors, Peruvian universities (UNALM in particular), overseas universities such as the University of Georgia in the USA, animal and plant health agencies, and government policies facilitating genetic material imports for

testing. Twenty-seven per cent of Peru's arable and permanent crop land is irrigated. That compares with 140% in Chile and 6.8% in Brazil; and with 8.4% in South Africa and 16% in Morocco (International Commission on Irrigation and Drainage 2023).

One of the most important features of Ethiopia's initially rapid expansion of cut flower exports was the existence of, and expanding investment in, the state-owned Ethiopian Airlines and Bole International Airport in Addis Ababa. Cut flowers need to be brought to the airport very quickly, held in appropriate cold storage facilities, and dispatched as air freight fast. The expansion of the cut flower export industry (which also had benefited from extremely cheap leases of state-owned land and from Development Bank of Ethiopia credit, not to mention Dutch state-backed concessional credit to Dutch investors) benefited greatly from investments in cold storage facilities and the EAL freight fleet. The forward and backward linkages between new cut flower firms and the airline spun new forward linkages to related fresh exports (herbs, fruit and vegetables). Meanwhile, the Ethiopian state underwrote fresh export expansion by providing armed security for every truck carrying cut roses to the airport to protect against theft. However, the infrastructure picture for high-value agricultural exports from Ethiopia was not entirely rosy. For a number of years, neither the federal nor regional government followed through, for example, on pledges to grade the road leading through the Upper Awash Valley and connecting a string of productive exporting farms in the valley with the Addis trade hub and airport. One firm estimated revenue losses of about 12% of the value of exports because of vacuum packs bursting in trucks on the ungraded road (Cramer et al. 2022).

Infrastructure is often a major constraint on export success and reflects a failure to connect policy priorities across government. A good example is South Africa, where under-investment in electricity, rail and ports infrastructure has seriously weakened prospects, even for the relatively successful citrus export producers in the country. From the frustration of the South African Roads Federation that the number of potholes in the country's roads had increased from 15 million to 25 million within five years, to the South African Institute for Civil Engineering (SAICE) Infrastructure Report Cards, which have increasingly and stridently castigated the lack of maintenance, the absence of long-term infrastructure planning, the lack of data collection and under-financing, the evidence piles up on a disintegration of South African infrastructure (Ludidi 2022; Fogel 2022).⁹ Citrus and berry exporters are often at the sharp end of this decline, compounded by repeated industrial action at the country's ports, which costs millions per day and threatens the viability of businesses and the jobs they have created. Meanwhile, despite a striking modern history of agricultural expansion, Brazil's prospects are also hampered by poor infrastructure compared to many of its competitors.

⁹ The SAICE 2022 Infrastructure Report Card for South Africa notes that, after great initial strides in improving social and economic infrastructure after the end of apartheid, "the condition of infrastructure has been in steady decline" from 2006 (SAICE 2022:6).

One example is the estimate that, in Mato Grosso state, which contributes 7% of Brazilian soy output (which in turn accounts for around 11% of total exports), production costs are very low but logistics costs are high – amounting to 32% of export costs – because of long distances travelled by trucks over very poor-quality roads to the Santos port (Arias et al. 2017:35-46).

Telecommunications infrastructure is also important for raising productivity in agricultural exports. This is not simply because of mobile telephony helping overcome information asymmetries, or even because of its role in signalling wage employment opportunities, but also because of the increasingly important need to be able to ensure precise traceability of output and its use in precision agriculture, and the use of ever-more sophisticated technology (monitoring fertigation equipment and plant development, etc.). Given that only 37% of the rural population of Latin America and the Caribbean have decent connectivity, this imposes a real constraint on productive efficiency (Ghezzi et al. 2022:208).

5. Constraints

Global demand for high-value agricultural goods has increased, but there is fierce competition to satisfy the demand and, besides tariffs and quotas, market access is made more difficult by stringent, and varying, sanitary and phytosanitary standards. Unpredictable weather and climate change only make things more challenging. Every policy involved in the discussion and examples above has worked – or failed to work – to overcome constraints. Here we summarise some of the most difficult and common constraints, including factors that have not been mentioned in the foregoing discussion.

Time plays a powerful role in agricultural production and trade. As noted above, developing the productive capabilities to thrive in global agricultural markets takes considerable time, and most ‘success stories’ have emerged against a longer background than often is evident at first sight: the pre-history of Embrapa and the evolution of commitments to end food insecurity and hunger in Brazil, the institutional developments in Chile long before its fruit, wine and salmon industries took off, infrastructural investments in the northern coastal desert of Peru, and so on. The pay-off for agricultural research also typically takes substantial amounts of time. It is inevitable, then, that the risks and uncertainties involved will need to be socialised. And public expenditure on agricultural R&D has been very uneven across LIMICs. While China, India and Brazil lead in absolute terms, public spending on agricultural research across much of the world has been stagnant or declining – despite evidence of the positive effects of such spending on growth and poverty reduction (Pardey et al. 2006; Akroyd and Lawrence 2007).

But the long timespan of developing agricultural export capabilities exposes the actors involved to swings of politics and ideology. Embrapa in Brazil has been through periods of strong central government and political support, but also through spells when it has had its budget cut and when public interventions in general have been out of favour. Through the

1990s, for example, Embrapa (as well as Brazilian universities) suffered severe funding shortages and the discontinuation of some research programmes (Figueiredo 2014:18). Extension services were also sharply weakened by the closure of EMBRATER (the Brazilian Corporation for Technical Assistance and Rural Extension). Chilean political swings have been at times quite extreme, threatening the consistency of the policy regime and of knowledge-related institutional networks, thereby affecting agricultural exports. In South Africa, early post-apartheid investments in social and economic infrastructure, some of it easing conditions for agricultural exporters, faded into a decline in reliable energy supplies, rural internet connectivity, ports and rail facilities, and secondary and tertiary road quality. Organisational fragility in South Africa has also led to high turnover in government departments, which in turn lengthens delays in responding to applications for government grant schemes (Cramer and Sender 2015:3). Equally, the formation of political interests and urgency around the need to resolve food insecurity and/or to address balance of payments concerns has in some places helped in the formation of institutional and policy regimes that have, to a significant extent, weathered the flux of political settlements and ideological waves.

A related constraint is instability over time in both political regimes and macroeconomic management, including inconsistencies between stated policy aims of supporting exports and policies that keep exchange rates at uncompetitive (overvalued) rates. Especially given the often-high logistics and transport costs and rising competition among countries exporting similar goods, exchange rate policy for high-value agricultural exports is just as key an 'industrial policy' as it is for manufacturing (Guzman et al. 2018).

It is probably all the more important, given this context – the time component and the vagaries of politics – to ensure a widespread understanding that high-value agricultural exports can be, and have in many places been, a powerful contributor to easing the balance-of-payments constraint and to generating employment. It is also important to counter the often vague and ill-informed notions of sectoral distinctions, and the pessimism that so often attaches to agricultural exporting in LIMICs.

In these ways, the time factor compounds Hirschman's (1968:24) insight that the most important constraints on economic development are social and political. But where coalitions and circumstances favour decisive support for agricultural exports, that support needs to focus on overcoming infrastructural bottlenecks, on scaling barriers to market entry, and on bridging knowledge gaps. Infrastructural constraints may involve irrigation structures and equipment, energy supply, connectivity, transport and logistics services, and air freight and port facilities. Again, contrast Chilean investment in ports and airports, or the extension of the Tucumán Airport runway in Argentina that allowed blueberries to be exported directly from there, rather than first being transported by land to Buenos Aires (Ghezzi et al. 2022:208), with chronic difficulties in South African transport and port facilities. But infrastructure also involves clear and stable land policies. A new land law was a key feature

of Peruvian agricultural export expansion (Ghezzi et al. 2022:208), while ongoing uncertainty around land policy in South Africa has not helped encourage investments, and conflicts over land-use rights (and water-use rights), combined with failure to grade a key road, unsettled performance and prospects in Ethiopia's Upper Awash Valley (Cramer et al. 2022).

In countries that have lagged in negotiating trade deals, the constraint often is not a lack of knowledge per se, but a lack of scale and of political commitment. Argentine negotiators have been able to develop and agree effective SPS protocols, but have not pushed for negotiating trade deals in the way that other Latin American countries have. South Africa has expert trade-negotiating capabilities, but has not scaled these up to the levels of the 'Chilean armada' of negotiators, nor has it backed up trade negotiation know-how with sustained support for developing 'brand awareness' in target countries in the way that, for example, ProChile has worked to promote Chilean wines in South Korea. Where there is inadequate drive behind trade promotion and negotiation efforts, it reflects a failure at senior government levels to prioritise agricultural exports, which again turns on outmoded and misplaced pessimism about the prospects for 'primary commodity exports' *tout court*.

6. Conclusions

A blueberry producer in South Africa suggesting that a blueberry should be thought of as a pill is reflecting the 'roundabout', sophisticated nexus of activities in producing high-quality blueberries that combine knowledge intensity, industrial processes and services, including those that 'brand' blueberries as health products, thereby making them part of 'big pharma' more than 'mere' farming. A Dutch cut flower firm manager in Ethiopia likewise invokes the influence of servicification and the industrialisation of freshness in saying that he used to think he sold flowers, but now realised he 'exported emotions'. Advanced Dutch agricultural technology is used to monitor and regulate grass growth at different points of the Anfield (Liverpool) football pitch (and doubtless others), reflecting yet another blurring of boundaries between economic 'sectors', firms, and activities (Cramer and Sender 2015; Cramer et al. 2022; interview at Anfield, December 2019). These trends are developing apace. And 'manufacturing' firms in Peru have been among the leading investors in large-scale high-value agricultural export production, bringing economies of scope to the exploitation of scale economies in agriculture (Shimizu 2022).

Policy officials in LMICs are advised to abandon outmoded ideas of clear distinctions among sectors and the often-misleading development implications associated with them. The fundamental point – that it matters *what* you export – remains unchanged, but the implications for what exports to prioritise have shifted. Where once the implication was straightforwardly that LIMIC governments ought to prioritise manufacturing, now it is far less clear that all manufacturing has more developmental properties than all 'unprocessed' primary commodities. Even the industrialisation of freshness is playing havoc with inherited

categories of processed and unprocessed, and the statistical observations and significance associated with these categories. Furthermore, conventional assessments of economic complexity are, by their own assessment (Gala et al. 2018), limited by their reliance on trade statistics that are not changing to reflect the realities or granular detail of actual economic activities.

High-value agricultural exports offer potential – realised in several countries in particular in recent years, including Brazil, Chile and Peru – to ease the balance-of-payments constraint on sustained growth, to promote structural transformation and linkages, and to generate large-scale employment in countries where there still are very large rural populations. The evidence suggests that these benefits are significant enough that LIMIC policy officials should consider making accelerated export earnings from HVAX a high-level priority.

In the short-run, this is likely to mean taking measures to relax immediate bottlenecks: conflict resolution in labour relations at ports, for example, or speeding up SPS protocols and switching resources to focus on particular trade deals likely to yield large gains from easier market access in major import markets. In the medium term it may mean building productive relationships with private producer associations and using development finance mechanisms to adjust incentives. In the longer run it will mean larger infrastructure investments and deepening the knowledge ecosystem that enables firms to accelerate technology adoption, creative imitation and innovation. With many potential crops involved, policy officials need a clear and simple set of criteria to guide the allocation of scarce decision-making capabilities in government and the reallocation of (or assessment of the opportunity cost of) incentive resources. These criteria should, for example, assess the contribution to the balance of payments by looking at rates of growth of consumption in large import markets, and at the scale of export earnings from different crops in competitor countries. And they should assess the potential contribution to employment by gathering data comparing labour input demand across different agricultural export crops. Without clear criteria, policy is more likely to be prey to the pressure and allure of particular lobby groups.

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