Is Chile a role model of export diversification policies? A reassessment*

¿Es Chile un modelo en políticas de diversificación de exportaciones? Una reevaluación

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Abstract

Largely because of its vast copper reserves, Chile's exports are highly concentrated on this low complexity product and this is often cited as a major drawback of its economic policy framework. However, its exogenous copper abundance conceals the country's success in developing non-mineral and complex exports. This achievement is remarkable considering its remoteness from the large international economic centers, which limits its integration to global value chains. As suggested in this paper, this accomplishment reflects Chile's strength in policy areas that foster non-mineral exports (including complex exports), making the country a role model in export diversification policies among emerging market countries.

Key words: *International trade; economic growth; economic development; export diversification; export complexity.*

JEL Classification: *F1, O1, O4*

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Resumen

En gran parte debido a sus vastas reservas de cobre, las exportaciones de Chile están altamente concentradas en este producto de baja complejidad y esto a menudo se cita como una importante desventaja de su marco de política económica. Sin embargo, su exógena abundancia de cobre oculta el éxito del país en el desarrollo de exportaciones no minerales y complejas. Este logro es notable considerando su lejanía de los grandes centros económicos internacionales, lo que limita su integración a las cadenas de valor globales. Como se sugiere en este estudio, este logro refleja la fortaleza de Chile en áreas de políticas que fomentan las exportaciones no minerales (incluidas las exportaciones complejas), siendo así un modelo para seguir en políticas de diversificación de exportaciones para otros países de mercados emergentes.

Palabras clave: *Comercio internacional; crecimiento económico, desarrollo económico, diversificación de exportaciones, complejidad de exportaciones.*

Clasificación JEL: *F1, O1, O4*

1. Introduction

Although strong economic fundamentals have allowed Chile to experience economic growth and poverty reduction on par with East Asian countries, its continued dependence on copper exports nurtures a perception that the country has underperformed in promoting export diversification and structural transformation. This hypothetical failure is considered of particular importance by many economists who argue that developing other more labor-intensive export sectors (such as manufacturing and services) may have more direct social benefits than copper exports and that export diversification, by lowering output volatility, could further enhance Chile's long term economic growth (see for example Haddad and others, 2010). Nonetheless, Gonzalez and others (2020) counter this argument by noting that Australia and New Zealand prospered socioeconomically while preserving their export concentration on traditional products.

While the need to diversify Chile's exports is still under debate, this paper reassesses its success in promoting export diversification. It finds that, though it is factually correct that Chile has an export basket highly concentrated in copper products, it is also true that it has superlatively developed non-hydrocarbon/mineral (NHM) exports (including of complex products, as defined in Hidalgo and Hausmann, 2009), which is the ultimate goal of export diversifica-

tion policy strategies. This country has also performed well in the development of *complex* exports, products that are considered more valuable according to a large empirical public policy literature (see Annex 1 for its description).[1] Chile's traditional indicators of export diversification and complexity are not favorable because of its exogenous abundance of copper and high international copper prices, not because of a weak capacity of the country to develop non-copper exports. The paper further shows that Chile's positive performance in developing other exports is in line with its significant strength in often cited horizontal policy determinants of export diversification and complexity. In fact, its policy strength is such that, controlling for the negative effect of its remoteness to other markets, Chile's per capita exports of NHM and complex exports are among the highest in the world.

Section 2 describes the analytical framework under which this study assesses the success of Chile's export diversification policies. Section 3 discusses how Chile's development of NHM exports is significantly better than implied by common export diversification and complexity indices while Section 4 shows how this performance is even more impressive considering its remoteness from large international markets, which most likely reflects its strength in diversification policies. Section 5 describes how Chile's development of NHM exports in recent decades happened while the country strengthened its export diversification policies, particularly its governance and trade policy openness. Section 6 presents concluding remarks.

2. A New Assessment Framework

This section, based on Salinas (2021), presents a more accurate and meaningful perspective to gauge the progress of commodity dependent countries in developing non-commodity exports that can lead to export diversification and structural transformation. Specifically, it proposes switching focus away from tracking commonly used indices of export diversification and complexity to tracking levels of NHM and complex exports, because those indices are largely determined by exogenous fluctuations in Hydrocarbon and Mineral (HM) reserves and international prices, not just by policy frameworks. Furthermore, by switching focus from traditional indices to export levels, the identification of policy determinants of export diversification can be grounded in a gravity equation setting, which is widely backed by the theoretical and empirical trade

[1] Although the concept of complexity is not part of mainstream economic growth or international trade theory, it is used in this paper given its wide influence on the empirical public policy literature, and because its related Product Complexity Index is broadly related to an intuitive understanding of the complexity or sophistication of products.

literature. In other words, and from a regression analysis viewpoint, these proposed two changes to the analytical framework of export diversification can be described as a change in the dependent variable from indices to export levels and the inclusion of independent variables better rooted in international trade theory. The next paragraphs deepen this discussion.

The Dependent Variable

Most empirical attempts to identify the factors that foster export diversification use as dependent variable an export concentration index, such as the Herfindahl-Hirschman Index (HHI), while those aiming to identify the determinants of exports complexity use the Economic Complexity Index (ECI) (Hidalgo and Hausmann, 2009). Nevertheless, these indices are substantially affected by exogenous factors, thus weakening their statistical link to policy determinants. Take for instance the HHI of export concentration for country j including exports (x) of several sectors (s):

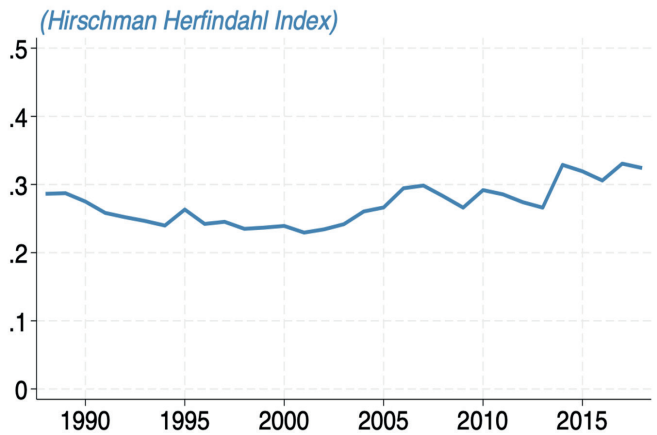
$$HHI_j = \sum_s \left(\frac{x_{sj}}{\sum_s x_{sj}} \right)^2 \quad (1)$$

This index is higher when the nominal export value of one or few commodities is high relative to the total export basket, indicating more (less) exports concentration (diversification). In most developing countries, partly due to their weak production capacity, a handful of hydrocarbon/mineral (HM) exports account for most of their total exports. Hence when aiming to diversify exports these countries seek policies to nurture NHM products. If successful, the value of these products will narrow the gap with respect to the dominant HM exports and this would reduce their HHI.

But the HHI can also significantly fluctuate in response to variations in the nominal value of their HM exports, which are commonly the result of largely exogenous events such as changes in international commodity prices or findings of additional HM reserves. Such fluctuations can considerably weaken the statistical relationship between policy frameworks and the desired development of NHM exports needed to diversify export baskets.

This is quite evident when looking at the evolution of the concentration index in Chile and other commodity exporters (Figure 1). Chile's HHI remained flat in the 1990s after a previously downward trend and then markedly reverted in the early 2000s. Assuming a significant connection between the HHI and the policy framework, Lebdioui (2019) argues that this end of the downward trend in export concentration is the result of the abandonment of some industrial policies that were implemented in previous decades.

FIGURE 1
EXPORT CONCENTRATION IN CHILE



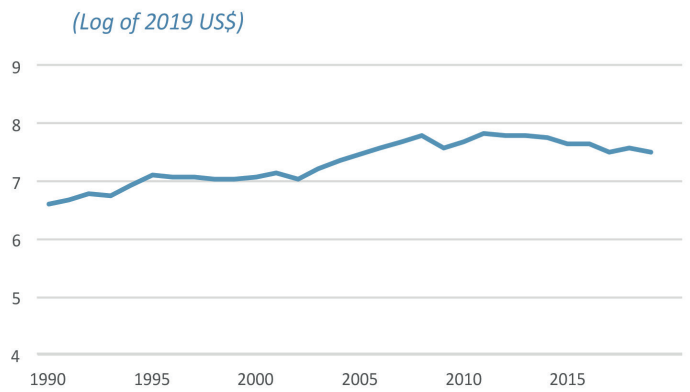
Source: UN Comtrade.

However, the evolution of per capita NHM shows a completely different picture (Figure 2).[2] Its continued upward trend throughout the 1990s and 2000s confirms that the surge in export concentration was not related to a weakening in Chile's NHM export policy determinants. The surge in concentration in the early 2000s is evidently related to the international copper boom, which multiplied the value of Chile's copper exports from US$ 8 billion in 2003 to a peak of US$ 54 billion in 2011, when it accounted for half of its goods exports. Because most countries that seek export diversification are strongly dependent on HM exports, this disconnect between the HHI and policy determinants of NHM exports due to commodity fluctuations is highly consequential.[3]

[2] In this paper, NHM exports are estimated based on SITC Rev 2 classification, and include codes 0-2700, 2900-3000, and 5000 and higher, excluding 5121, 6831, 6841, 6851, 6861, 6871, 6880-6895, 9310-9610.

[3] In a regression analysis with the concentration index as dependent variable and a set of policy variables as covariates, heterogeneity in HM abundance and prices could bias coefficients of policy variables that are correlated to HM heterogeneity and/or inflate error terms thus lowering estimation efficiency. In general, countries with high HM abundance could be unfairly judged as failures of pro-diversification merely because of their exogenous HM abundance.

FIGURE 2
NON-HYDROCARBON/MINERAL EXPORTS PER CAPITA



Source: UN Comtrade; and author's calculations.

A similar confusion occurs when trying to identify a statistical relation between export complexity and policy variables by using the ECI as dependent variable.[4] This index can be broadly understood as the product of each exported product's complexity (measured by the Product Complexity Index (PCI), defined in Hidalgo and Hausmann, 2009) times the product's share in the country's export basket. Because HM products have low PCIs, exogenous increases in international HM prices or HM discoveries lower the ECI without any change in the value of exports of higher complexity. Regression specifications that aim to identify a link between policies and complex exports using the ECI as dependent variable are thus weakened by exogenous commodity related fluctuations.[5]

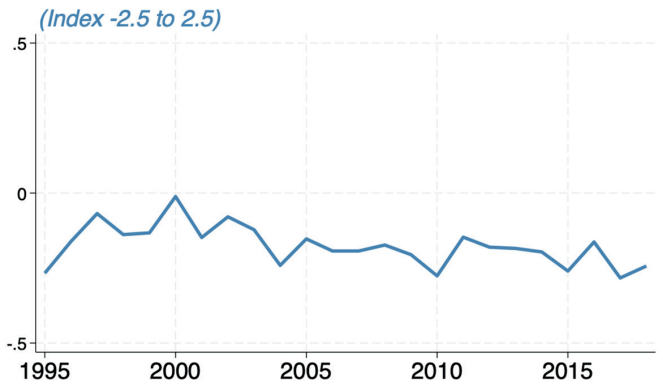
Chile during the early 2000s is also an illustrative case of how these indices can mislead the identification of policies that foster *superior* exports. Chile's ECI slightly declined from close to zero in 2000 to about -0.25 in 2015, a considerable fall as the ECI broadly ranges between -2.5 and 2.5 (Figure 3). This decline seems at odds with the sustained productivity growth that Chile experienced those years which, a priori, should have increased its capacity to produce complex goods for exporting. As was the case with the HHI, Chile's ECI decline is most evidently related to the boom of copper (a low complexity

[4] Hidalgo and Hausmann (2009) argue that countries need to enhance the complexity of their export basket to attain sustained economic growth.

[5] The notable inaccuracy of the ECI in measuring an economy's complexity and productive capabilities if further discussed in Salinas (2021).

product), thus showing again how commodity fluctuations erode the relation between target variable (complex exports) and dependent policy-related variables.[6]

FIGURE 3
ECONOMIC COMPLEXITY INDEX IN CHILE



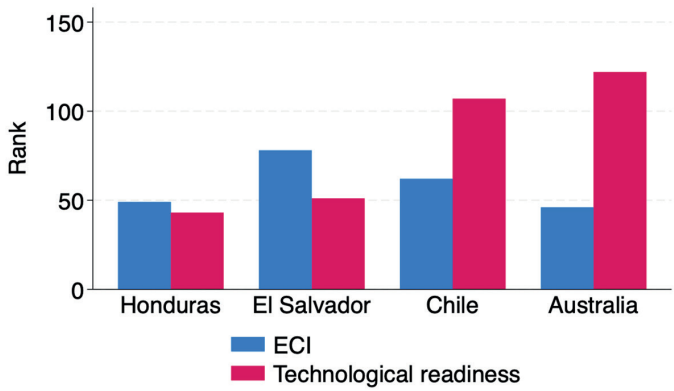
Source: Hausmann and Hidalgo (2013).

The disconnect between the ECI and a country's policy framework is similarly evident in very telling cross-country comparisons. A priori, the advanced Australian economy, with strong institutional and educational quality, should be more capable of producing complex products than Latin American countries. Yet the ECI of Australia is considerably below the ECIs of El Salvador and Honduras (Figure 4). According to its authors the ECI is a proxy for *productive capabilities* and measures *the knowledge of a society* (Hausmann and others, 2013), but it is questionable that Australia's *productive capabilities* are inferior in this illustrative cross-country comparison. Also, the ECI appears unrelated to the Technological Readiness index of the World Economic Forum's Global Competitiveness Report (GCR). Australia's low ECI is clearly

[6] As an example of a similar disconnect in oil exporting countries, Nigeria's ECI has considerably deteriorated during oil price booms (in the early 1970s and early 2000s) and improved significantly in 2008, as a result of the oil price collapse of that year. At a regional level, as noted in Ding and Hadzi-Vaskov (2017), a growing trend in the share of complex exports in Latin American and Caribbean in the 1990s was reversed in the 2000s because of the commodity price boom, as the region is a major exporter of these products.

related to its exogenously high mineral endowment and resulting high exports of minerals (which are low complexity products), not to its capacity to export complexity.[7]

FIGURE 4
WORLD RANKS OF ECI AND TECHNOLOGY 2016-2019



Source: Hausmann and Hidalgo (2013), World Economic Forum and Harvard University (2020)

The evident disconnect between the above discussed indices and policy determinants that foster exports diversification and complexity can be simply and effectively addressed by focusing directly on the evolution of the export products that lead to diversification and export complexity. Since export diversification is commonly sought in countries that are dependent on a handful of HM exports (such as Chile), the relevant dependent variable is the value of NHM exports.

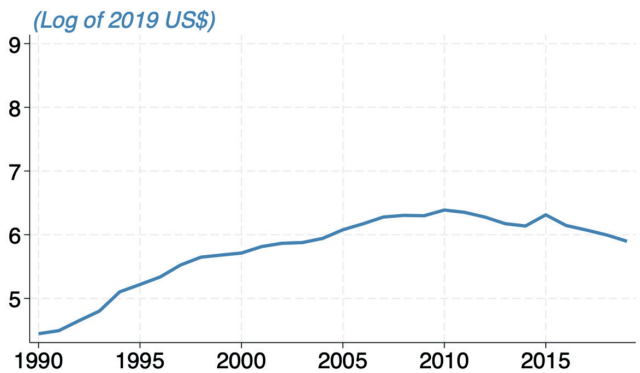
Similarly, when aiming to foster export complexity the dependent variable can be directly defined as the value of exports of high complexity. Doing this filters out any effect of low-complexity HM export values, which policy makers have little influence over. For cross-country comparability the value of NHM and complex exports can be normalized by population or labor force to control for size. Thus, the following sections analyze complexity through the value of *complex exports* per capita, hereby defining as *complex exports*

[7] Another illustrative case of the limitations of the ECI as a measure of complexity due to natural resource abundance is the U.S. state of Texas. Despite being a global technology leader its ECI is only 0.29, similar to the Philippines. This evident inconsistency likely results from Texas superlative petroleum endowments and the extremely low (-2.57) Product Complexity Index (PCI) of Petroleum Oils in Hausmann and others (2013).

those products with Product Complex Index (PCI) above zero (the top half of the product complexity range in Hausmann and others (2013) categorization).

Assessments change substantially when focusing directly on the evolution of the targeted export groups per capita. As seen above, although Chile's HHI pointed to declining diversification in the early 2000s, NHM exports per capita continued to increase during that period. The picture similarly changes when looking directly at the value of per capita *complex exports*. Unlike the ECI, the value of Chile's *complex exports* per capita continued to grow during the copper boom (Figure 5) and, as expected, *complex exports* per capita is higher in Australia than in Honduras and El Salvador and, unlike the ECI, the complex exports per capita ratio is broadly in line with the GCR's Technological Readiness index (Fugure 6).[8][9]

FIGURE 5
COMPLEX EXPORTS PER CAPITA

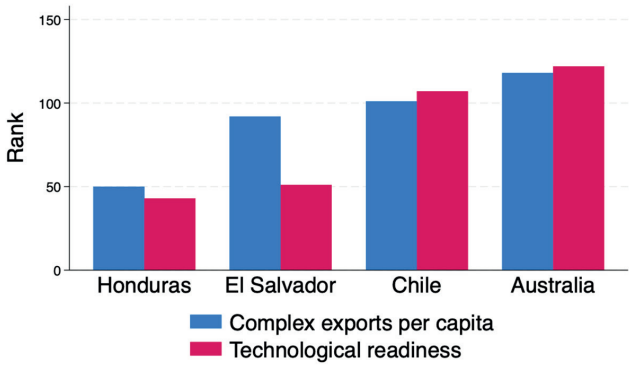


Source: UN Comtrade and authors calculations.

[8] The upper half of PCI includes products with a PCI above 0. Similar results as those described in this paper are observed when focusing on products with PCI above 1 (about a quarter of all tariff lines) or when focusing on complex exports per worker instead of complex exports per capita. Note that complex exports per capita measure neglects intra-temporal and cross-country variations in the average PCI of each country. An alternative approach that would capture PCI heterogeneity and filter out exogenous commodity related developments would be to calculate the average PCI only for NHM exports. However, that would not a be an accurate measure of complexity (productive capability of a society) as it does not give a sense of the scale of complex exports production. Hence, countries with a small share of complex products that have a high PCI would appear more complex than countries with a large share of complex products but with a lower average PCI, no matter how minuscule the share of complex products would be.

[9] Relatedly, according to Haver Analytics data, the volume of industrial exports grew faster than the volume of copper exports over the last two decades, also suggesting that the declining ECI during that period was driven by copper prices not by weakness to develop more complex exports.

FIGURE 6
WORLD RANK OF COMPLEX EXPORTS AND TECHONOLOGY 2016-19



Source: UN Comtrade; World Economic Forum and Harvard University (2020); and author's calculations.

Independent Variables

Because the proposed dependent variables are levels of exports, independent variables can be defined based on traditional modelling of trade (exports and imports) levels. Specifically, regression specifications with export levels as dependent variables can be based on the empirically effective gravity equation specification. This is particularly convenient as Arkolakis and others (2012) have shown that a large class of international trade models generate isomorphic gravity equations, and therefore the results of gravity equation-based estimates should be significantly robust to model selection.

For selection of covariates, in addition to standard gravity equation variables we consider the main variables of an EK02 (Eaton and Kortum, 2002) Ricardian general equilibrium model. We can relate the target export categories (NHM, manufacturing, complex, and services) to the manufacture sector in EK02's two-sector setting of manufactures and non-manufactures (equation 17 in EK02):

$$\frac{X_{ni}}{X_n} = T_i \left(\frac{\gamma d_{ni} w_i^{\beta} p_i^{1-\beta}}{p_n} \right)^{-\theta} \tag{2}$$

where the fraction of total expenditure of country n on manufacturing goods from country i (X_{ni}) divided by its total expenditure (X_n), is a function of country i's state of technology (T_i), wages in country i (w_i), and prices in

both countries *i* and *n*.[10] Note that while distance-related variables are mostly exogenous, those related to technology and wages are largely determined by public policies of the exporting economy. Other empirical studies on the determinants of export diversification and complexity include covariates related to productivity/technology (T-variables) of the exporting country (*i*), but do not include wage and gravity equation variables.[11]

Regression specifications in most related studies include T-variables such as institutional development, educational attainment, trade policy openness, and infrastructure development.[12] These four variables appear significantly (though not robustly) associated with diversification, sophistication, and complexity in several studies (for example, Hausmann and others, 2006; Weldemicael, 2012; Ding and Hadzi-Vaskov, 2017), including through Bayesian identification (Giri and others, 2019).

Within its gravity equation methodological framework, Salinas (2021) also identifies these four policy variables as the most economically and statistically significantly related to NHM exports (including exports of manufacturing, services, and complex products), in addition to a country's distance to other markets. An implementation of those regression specifications with updated data (Table 1) confirms that distance is particularly relevant, as reducing it by half is associated with an 80 percent increase in NHM exports. Note that the distance of the remote SCC and OCE regions is about twice that of CAM, EE, and East Asian regions and therefore the exogenous distance factor on its own can substantially explain the lower level of exports per capita in these remote regions.

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10 Parameter γ is a measure of the sensitivity of local prices to foreign cost structures and geographic barriers. θ represents product homogeneity across countries, which governs comparative advantage. A low θ implies high product variability and in that case comparative advantage exerts a bigger force for trade. β is labor's share in production, while $(1-\beta)$ is intermediate inputs' share in production.

11 Empirical findings from the GVC literature also hint at the importance of distance to large markets and other gravity equation variables in the development of complex exports. Raei and others (2019) and Kowalski and others (2015) identify gravity variables as key determinants of Global Value Chain (GVC) participation. Since participation in GVCs is seen as a major force behind the growth of more complex, manufacturing products, it is very likely that gravity-related variables are significant determinants of export complexity.

12 Trade policy openness and transport infrastructure can be alternatively considered proxies for effective distance between countries.

TABLE 1
DETERMINANTS OF EXPORTS BY EXPORT TYPE

Variables	Non-hydrocarbon/ mineral	Complex	Manuf.	Services	Hydrocarb. & Mineral
Log GDP reporter	0.584***	0.664***	0.545***	2.070***	0.889***
Log GDP partner	0.899***	0.766***	0.761***	0.639***	0.841***
Log distance	-1.328***	-1.687***	-1.526***	-0.18	-1.744***
Common currency dummy	0.410**	0.570***	0.494**	0.807***	0.429*
Common border dummy	1.813***	1.417***	1.735***	1.687**	1.628***
Common language dummy	0.605***	0.521***	0.474***	0.51	0.292**
Common colonizer dummy	0.655***	0.363**	0.411***	4.628***	0.457***
Post colonial link dummy	1.302***	1.446***	1.562***	-0.21	1.283***
Log of hydrocarbon/ mineral assets	0.078***	0.119***	0.092***	0.06	0.334***
Landlockedness	-1.690***	-1.749***	-1.605***	5.345***	-0.687***
Log GDP per capita	-0.10	-0.427***	-0.08	-2.073***	0.22
Governance (WB Index)	0.297***	0.426***	0.324***	4.069***	-0.498***
Education (UN Index)	5.868***	6.788***	5.300***	-5.703***	0.78
Infrastructure (GCR Index)	0.212***	0.344***	0.336***	-0.04	0.616***
Average Tariff	-0.0281***	-0.044***	-0.0570***	0.011	-0.025***
Labor market flexibility (GCR Index)	-0.05	-0.0825*	-0.03	-0.189**	0.244***
Constant	5.249*	9.535***	10.07***	-62.56***	6.860*
Observations	37,866	35,649	35,903	4,279	32,332
Rho	0.92	0.91	0.92	0.98	0.86

Source: Author's elaboration.

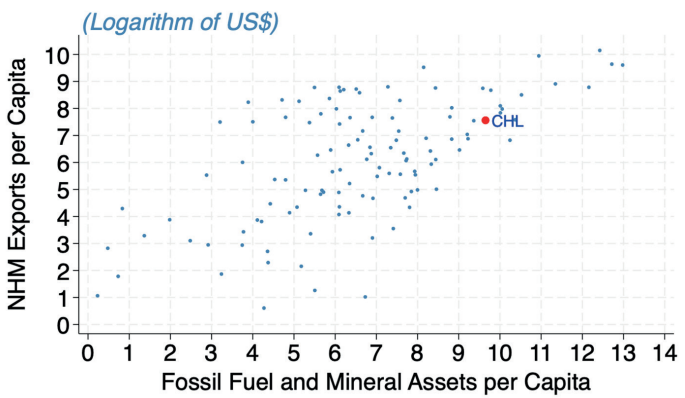
Note: * p<0.1, ** p<0.05, *** p<0.01. Panel regressions based on Hausman and Taylor (1981) technique with groups consisting of all combinations of reporter and partner countries in UN Comtrade database. Observations are non-overlapping 5-year averages within the 1962-2017 period, depending on data availability. Regression specification based on equation (7). Multilateral resistance terms and partner country's policy variables included (coefficients not reported). Non-hydrocarbon/mineral exports include SITC2 codes 0-2999, 4000-6772, 6900-8999. Manufactured exports include SITC2 6900 to 8999 products. Complex exports are products with a Product Complexity Index (PCI) above zero according to Hausmann and others (2013).

Landlockedness, another geographic exogenous regressor, has a major impact on NHM exports too, as being landlocked is associated with an 80 percent lower level of NHM exports. Interestingly, higher HM assets is associated with higher NHM exports, as many NHM products are derived from raw HM products.

Education appears as the most influential policy determinant of NHM exports. A one standard deviation increase in educational attainment is associated with a 215 percent increase in Complex exports. One standard deviation increases in governance and infrastructure quality each increase NHM exports by 30 percent, and reducing the average import tariff from 15 to 5 percent is also associated with a 30 percent increase in NHM exports. The impact of these policy variables and distance is even more important for Complex and Manufacturing Exports.

As seen in the last column of Table 1 and in Figure 7, hydrocarbon and mineral (HM) exports are significantly determined by available assets per capita of these products, and not much by the strength of its policies. In fact, governance appears negatively associated with HM exports, a surprising result that may reflect causality from HM wealth to governance erosion related to the natural resource curse (see a related review in Busse and Gröning, 2019).

FIGURE 7
NHM EXPORTS VS ASSETS PER CAPITA

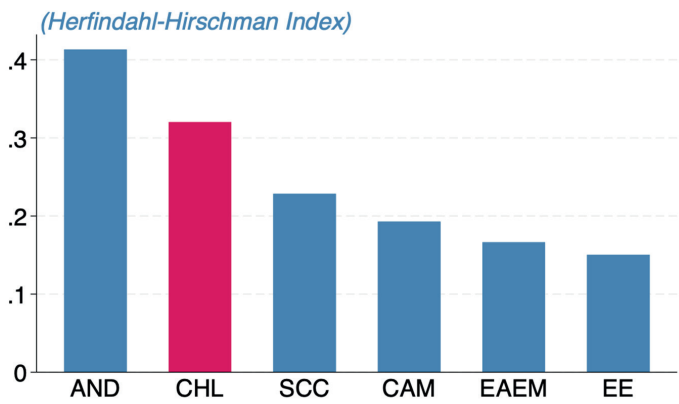


Source: UN COMTRADE; World Bank's Wealth of Nations database; and author's calculations.
Note: Annual average of years 2016-2018

3. Reassessing Chile's Export Diversification Performance

Within this framework, we reassess Chile's success in promoting export diversification. Traditional quantitative measures of export concentration are high for Chile relative to the average in other emerging market regions (Figure 8). With a Herfindahl-Hirschman index of exports concentration above 0.3 in 2015, Chile's export basket appears less diversified than those of the manufacturing powerhouse countries of Central America and Mexico (CAM), and East Asian Emerging Markets (EAEM). As suggested above, this seems a result of Chile's strong dependence on copper exports, as copper represents about half of Chile's goods exports. This, in turn, is a natural consequence of Chile's superlative copper wealth, which results in Chile having hydrocarbon/mineral assets per capita among the top 20 countries worldwide, and much above its comparators in this study (Figure 9).

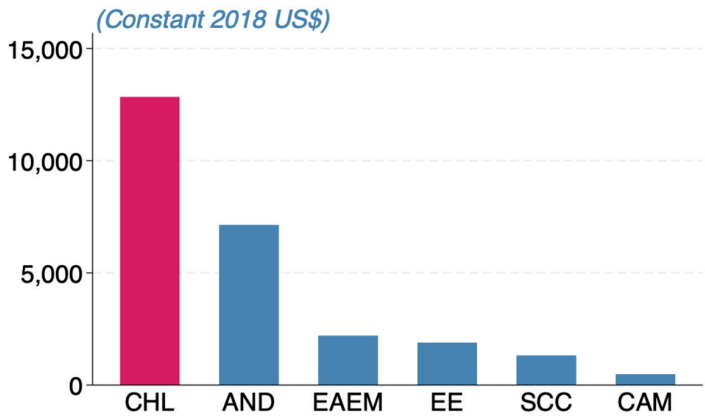
FIGURE 8
EXPORT CONCENTRATION INDEX IN 2016-19



Source: UN COMTRADE

Note: AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

FIGURE 9
FOSSILE FUEL AND MINERAL ASSETS PER CAPITA IN 2016-18



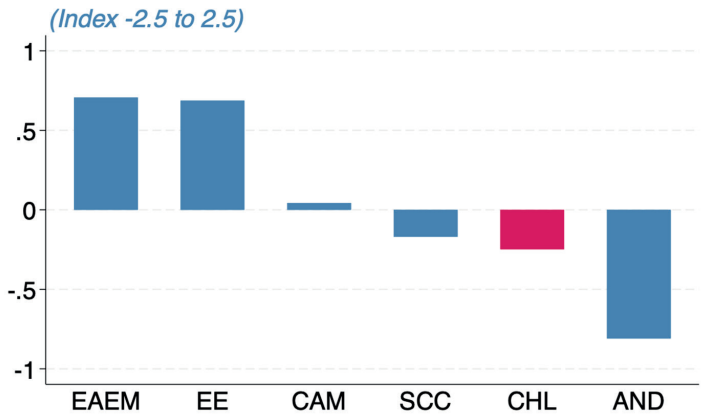
Source: World Bank's Wealth of Nations database; and author's estimates

Note: AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

Also, partly because of copper dominance, Chile ranks low in the Economic Complexity Index (ECI).[13] Since copper appears in the bottom 5 percent of the Product Complexity Index (Hausmann and others, 2013), Chile's ECI is lower than in most other emerging market regions (Figure 10). This is the case although Chile performs strongly in factors that are statistically related to exports diversification and complexity identified in Giri and others, (2019), Ding and Hadzi-Vaskov (2017), and Salinas (2021) such as educational attainment, institutional strength, and infrastructure development.

[13] The ECI of a country is calculated in Hidalgo and Hausmann (2009) based on the diversity of exports a country produces and their ubiquity, or the number of the countries able to produce them (and those countries' complexity). According to its authors, this index aims to measure the *productive capabilities* and knowledge in a society as expressed in the products it exports.

FIGURE 10
ECONOMIC COMPLEXITY INDEX IN 2016-19

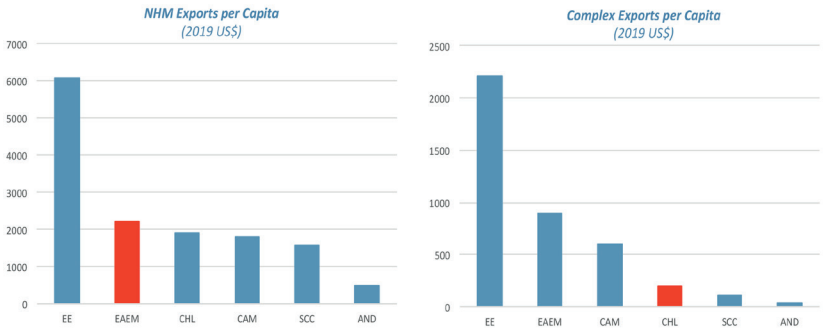


Source: Hausmann and others (2013)

Note: AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

Switching the unit of analysis from indices to levels of relevant exports considerably improves Chile's relative standing (Figure 11). Following its success in developing non-copper export products in recent decades, Chile's NHM exports per capita now is similar to those of the manufacturing powerhouse regions of CAM and EAEM.

FIGURE 11
CHILE AND COMPARATORS IN 2016-19



Source: UN COMTRADE; Hausmann and others (2013); and author's calculations.

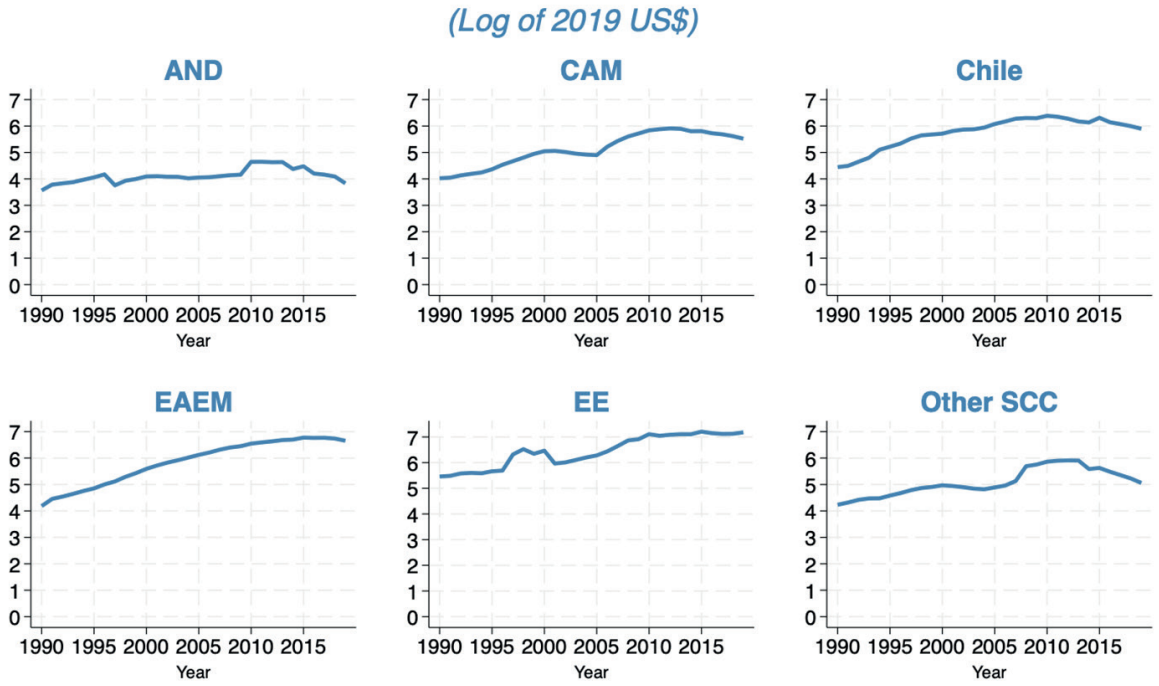
Note: NHM exports exclude SITC rev 2 codes 3000-4999; 6772-6999, and 9000-9999. Complex exports are goods with Product Complexity Index (Hausmann and others, 2013) above Zero. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

Because some of Chile's NHM exports are of natural resource-based products with low complexity, the country does lag CAM and EAEM in terms of complex exports per capita. But it is also noteworthy that the growth rate of Chile's complex exports per capita is not too different from the average in emerging market regions with successful manufacturing export sectors (Figure 12). Growing by a factor of eight in the last three decades since the mid-1980s, Chile's complex exports per capita performance has been more similar to the average in CAM and EAEM countries, than to nearby Andean (Bolivia, Colombia, Peru, and Venezuela) and Southern Cone (Argentina, Brazil, Paraguay and Uruguay) subregions, which increased exports complexity by factors of two and three, respectively.[14] Thus, by 2014-16 Chile's complex exports per capita were six times higher than in Andean countries (AND) and three times higher than in the average in other Southern Cone countries (SCC).

[14] Besides Central American countries (Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador) CAM includes Mexico. EAEM includes China, Indonesia, Malaysia, Thailand, and Vietnam.

FIGURE 12

COMPLEX EXPORTS GROWTH IN CHILE AND COMPARATORS



Source: UN COMTRADE; Hausmann and others (2013); and author's calculations.

Note: Complex exports are goods with Product Complexity Index (Hausmann and others, 2013) above zero.AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

At least two methodological issues help explain CAM's and EAEM's higher complex exports per capita. One is that even though the production of copper is not particularly labor-intensive, the share of labor it demands directly and indirectly is not negligible. With less labor force available to non-copper sectors, the per capita level of complex exports is expected to be lower than in the absence of such large copper production. CAM countries do not have significant HM exports and although EAEM countries also have significant HM exports per capita, in 2017, Chile had a ratio about four times higher.

A second issue is that CAM and EAEM countries participate more intensively in GVCs than Chile, so that their gross NHM exports overstate their domestic value added. According to the OECD Trade in Value Added (TIVA) database (OECD, 2019), in 2018 the domestic value added of NHM exports of Mexico, Malaysia and Thailand, the CAM and EAEM economies with highest complex exports per capita, was around 60 percent.[15] In comparison, the domestic value added of NHM exports of distant Australia and Chile was 81 and 88 percent of their gross exports, respectively. Thus, the difference in the value added of complex level per capita between EAEM and Chile is likely much lower (about 2 to 1) than the difference in gross complex exports per capita shown in the chart above (about 3 to 1).

While some of Chile's complex exports are linked to its abundant natural resources, many others are not. Looking at a list of Chile's top ten complex exports we see that only few (Processed Copper and Converted Paper), are products that industrialize natural resources (Table 2). Most are manufacturing products, such as telecommunications products, vehicles, machinery and medicaments, that are not linked to natural resource abundance. This is a positive sign that Chile's comparative advantage is not solely related to its natural resources but also to its strength in policies that nurture export complexity (which we discuss below). Noteworthy also, Chile produces many highly complex products, with PCIs above two, such as medical equipment, electrical instruments, and metal working machine tools.

[15] Data on exports value added is not available for most countries, therefore the rest of the analysis centers on gross exports. Note that all indices of diversification and export superiority are subject to this caveat.

TABLE 2
LIST OF TOP 10 COMPLEX EXPORTS FROM CHILE, 2016-19

Product	US$ m (annual average)
Rubber tyres & tubes for vehicles and aircraft	312.1
Paper and paperboard in rolls or sheets nes	311.7
Copper and alloys of copper, worked	258.3
Bodies & parts motor vehicles ex motorcycles	166.2
Alcohols, phenols, phenol alcohols, glycerine	162.1
Medicaments	153.2
Other artificial resins and plastic materials	121.8
Construction and mining machinery, nes	119.7
Iron and steel forgings in the rough state	97.7
Rail & tram. freight cars, not mechanically propd.	90.1

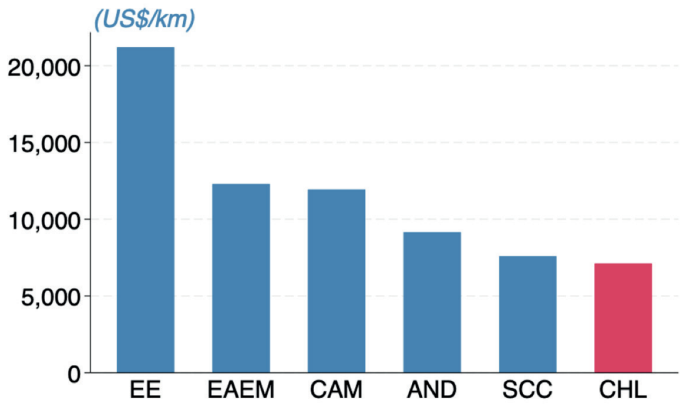
Source: UN Comtrade.
Note: Complex exports are goods with Product Complexity Index (Hausmann and others, 2013) above zero.

4. Chile's Diversification Hampered By Remoteness

Chile's major limitation in developing complex and non-mineral exports in general is most likely its remotenesss from the main centers of global economic activity or its low Proximity to other Markets as defined in Salinas (2021) (Figure 13).[16] Far from the large Asian, European, and North American markets, the costs of transporting Chile's exports are considerably higher than for countries that are located in the close periphery of these regions. This limits its potential to join GVCs and therefore it is not surprising that its level of complex exports per capita is considerably lower than in other regions that are closer to the major world economic centers.

[16] In that study, GDP per capita is added as an independent variable acknowledging that it can also approximate wage costs, but mainly to control for potential endogeneity between NHM exports per capita and T-variables. Higher NHM exports can foster GDP and higher GDP can help strengthening T-variables (for example, higher output can facilitate/finance higher educational attainment). Note though that GDP per capita is not included in the calculation of goodness of fit when estimating the predictive power of policy variables.

FIGURE 13
PROXIMITY TO MARKETS IN 2016-19

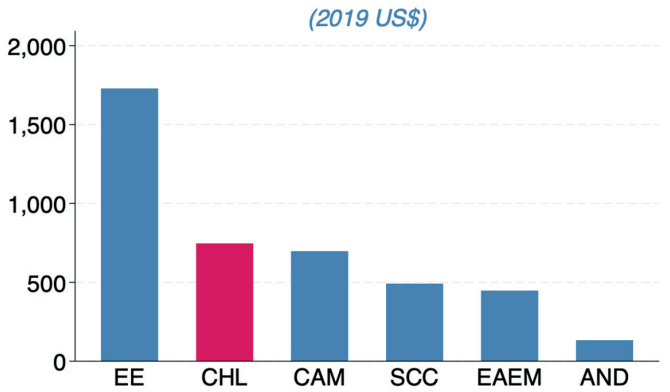


Source: UN COMTRADE; and author's estimates.

Note: Proximity to Markets is the sum of GDP of partner countries weighted by their distance to the country. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

Interestingly, because non-tourism services are less sensitive to the distance factor, Chile's per capita exports of services compares favorably to other regions including EAEM (Figure 14). Chile's service exports include those of its largest airline (the largest in Latin America), as well as Business, Information Technology, and Financial Services (Table 3). These are skill-intensive products which show that the Chilean economy has the capabilities to produce high value-added exports especially when distance is a less limiting factor.

FIGURE 14
SERVICE EXPORTS PER CAPITA IN 2016-17



Source: EBOPS; Hausmann and others (2013); and author's calculations.

Note: Complex exports are goods with Product Complexity Index (Hausmann and others, 2013) above zero. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

TABLE 3
SERVICE EXPORTS FROM CHILE, 2016-19

Product	**US$ m (annual average)**
Transportation	3152
Travel	2853
Other business services	2545
Computer and information services	357
Insurance services	301
Financial services	298
Royalties and license fees	56
Personal, cultural, and recreational services	43

Source: EBOPS Database in UN Comtrade.

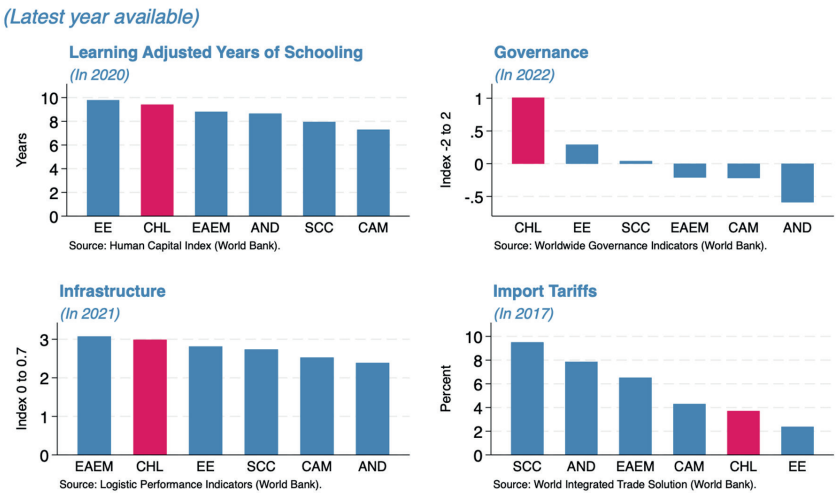
Statistical estimates of the impact of geographic remoteness on export development in Salinas (2021), predict a large difference in complex exports per capita between Chile and less remote emerging market regions. Specifically, as Chile's PM index is about half of the average of EAEM countries, these statistical estimates predict that its complex exports per capita should be about a third of the EAEM average level only due to distance.

Strengthening connectivity to other markets is thus crucial for Chile's efforts to increase export diversification and complexity. Although geographic distance is a fixed variable, "effective" distance can be lowered through investments in transports and communications infrastructure that lower the cost of goods and knowledge exchange.[17]

For sure, Chile's exports can also be fostered by strengthening diversification policy fundamentals discussed above. In fact, Chile's diversification policy framework appears relatively strong in comparisons to other emerging market countries (Figure 15).

FIGURE 15

DETERMINANTS OF COMPLEX EXPORTS IN CHILE AND COMPARATORS IN 2016-19

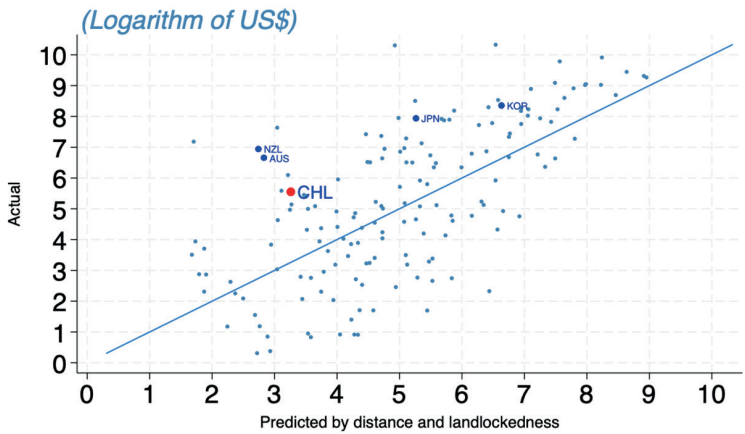


Note: Country acronyms are ISO3. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern Europe; SCC=Southern cone countries. Regional subgroupings described in Table A.1.

[17] Proximity to markets can also increase with higher GDP of nearby trading partners, but this is of course largely out of control of local policy makers.

Another indication of Chile's strong diversification policy fundamentals is that its complex exports per capita are much higher than predicted only by the PM index (distance) and landlockedness (Figure 16a) or by the PM index, landlockedness, and HM assets (Figure 16b). This suggests that Chile's policy framework help it offset its distance disadvantage. In general, all countries that are significantly above the fitted line very likely have strong export diversification policy frameworks that allow them to surpass expectations anchored in geographic determinants and therefore hint at "role models" of export development policies.

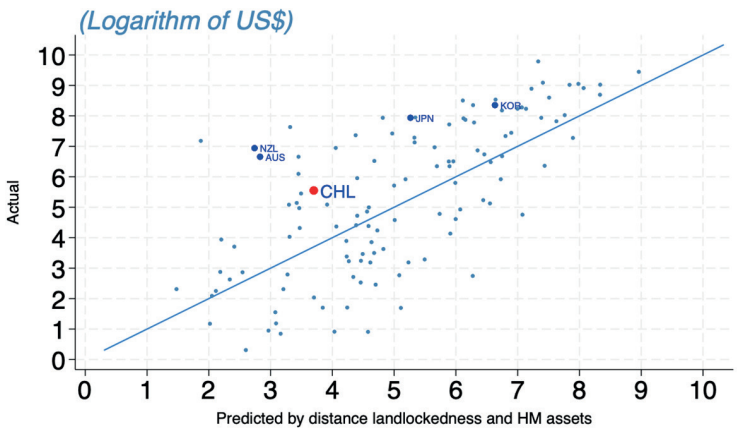
FIGURE 16a
COMPLEX EXPORTS PER CAPITA - ACTUAL VS PREDICTED



Source: Salinas (2021)

Note: Adjusted R-squared 0.35. Acronyms are ISO3. Annual average of years 2016-19. Predicted by distance and landlockedness.

FIGURE 16b
COMPLEX EXPORTS PER CAPITA - ACTUAL VS PREDICTED



Source: Salinas (2021)

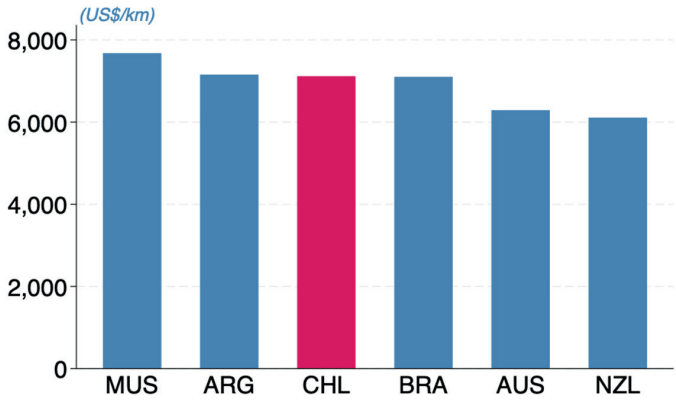
Note: Adjusted R-Squared 0.38. Acronyms are ISO3. Annual average of years 2016-19. Predicted by distance, landlockedness, and hydrocarbon/mineral assets.

The world maps in Panel Figure A.1 similarly indicate deviations from distance-predicted complex and NHM exports per capita. Countries in darker blue are those with higher upward deviation and those in darker red have higher downward deviation. In the case of complex exports, superlative countries include well known models of export development in East Asia, such as Japan, Malaysia, South Korea, and Thailand. Remarkably, the upward deviation of Chile's complex exports per capita with respect to the level predicted by distance is also among the highest in the world, as is the case of also remote Australia (AUS) and New Zealand (NZL). Chile's upward deviation in NHM exports per capita is even higher, reflecting its success in promoting some natural resource based products (fisheries, agroexports, forestries).

Acknowledging Chile's remoteness, its export promotion success is better judged by comparing it with other remote countries (Figure 17 and 18). In such comparison, Chile has the highest level of per capita complex exports among emerging market regions and only trails high-income Australia and New Zealand.[18]

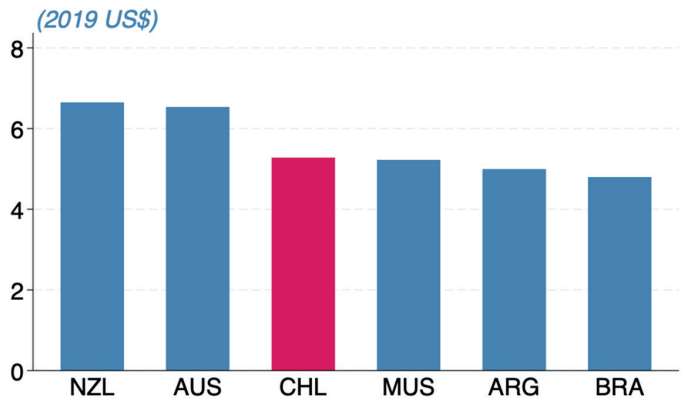
[18] The comparator remote countries include those with an income per capita above 8,000 US dollars per capita, population above 1 million, and located at a southern latitude similar to Chile's.

FIGURE 17
PROXIMITY TO MARKETS IN 2016-19



Source: UN Comtrade; and author's estimates.
Note: Proximity to Markets is the sum of GDP of partner countries weighted by their distance to the country. Country acronyms are ISO3.

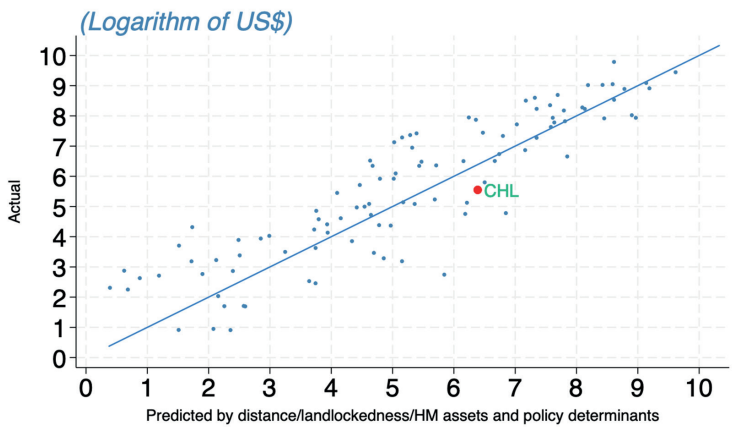
FIGURE 18
COMPLEX EXPORTS PER CAPITA IN 2016-19



Source: UN Comtrade; and author's estimates.
Note: Country acronyms are ISO3.

A scatter plot comparing the level of complex export per capita predicted by distance plus policy variables (governance, education, infrastructure, and import tariffs) does a much better job at predicting Chile's complex exports (Figure 19). This improvement in fit when adding policy variables is further evidence that Chile's strong diversification policy fundamentals considerably improve its complexity.

FIGURE 19
COMPLEX EXPORTS PER CAPITA - ACTUAL VS. PREDICTED



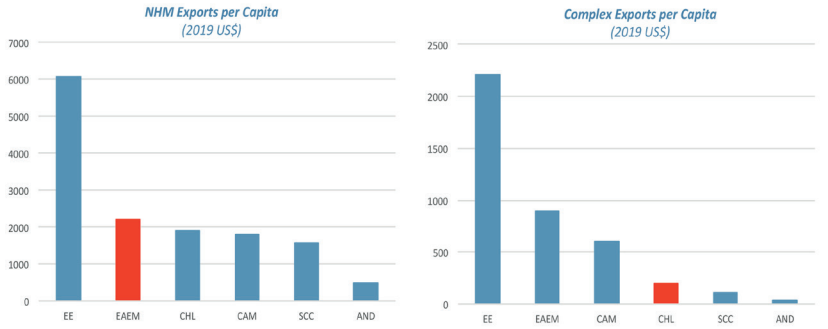
Source: Salinas (2021)
Note: Acronyms are ISO3. Annual average of years 2016-19.

5. Chile's Strengthening Of Diversification Policies in Recent Decades

Additional corroboration of the effectiveness of Chile's diversification policy framework is that, in recent decades, its NHM and complex exports have increased relative to other regions at the same time as its policies have also significantly improved, particularly in the areas of governance and trade policy openness.

Chile's NHM exports per capita among comparator regions was only above the average of Andean countries back in 1980 (Figure 20). Since then, it has gradually reached the average level of high performing EAEM and CAM regions, despite its remoteness to the large economic centers. Its progress in fostering complex export development has not been as impressive, only surpassing SCC countries and lagging the EAEM average (Figure 21).

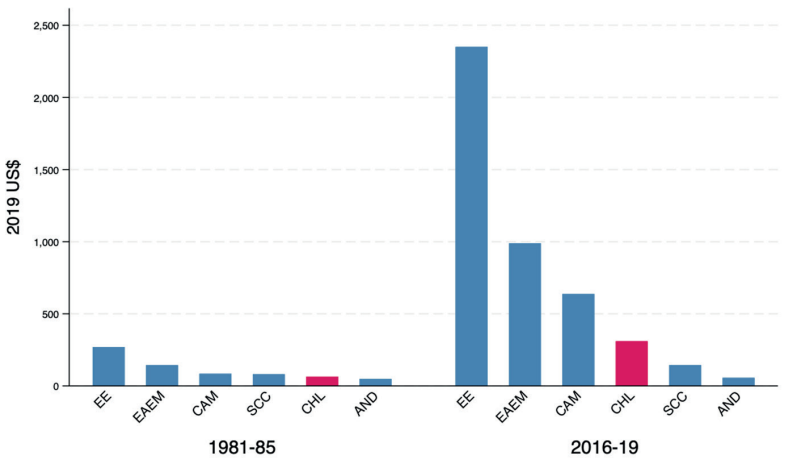
FIGURE 20
NHM EXPORTS PER CAPITA



Source: UN Contrade; and author's calculations.

Note: AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

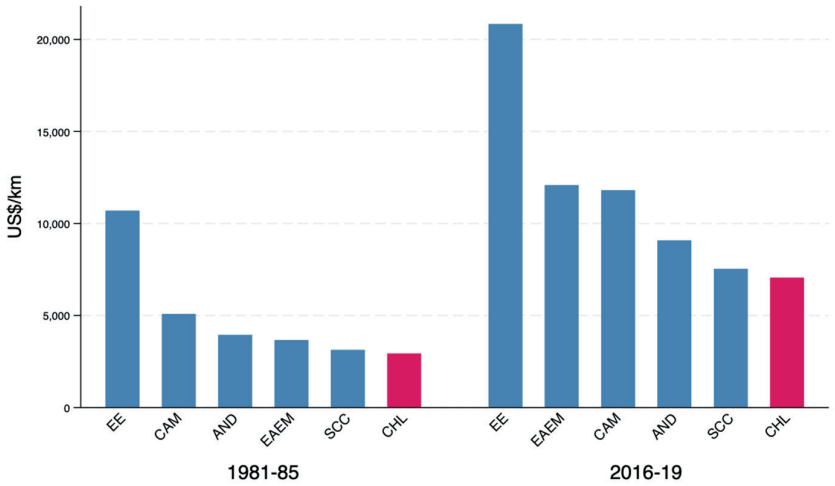
FIGURE 21
COMPLEX EXPORTS PER CAPITA



Note: AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Subregional grouping described in Table A.1.

Chile's less impressive development of complex exports relative to EAEM is likely related to its remoteness, as these exports commonly develop within GVCs, which are strongly dependent on proximity to large economies. Importantly, Chile's distance disadvantage relative to EAEM's has increased, as its PM index relative to this region decreased from two thirds in 1980 to one half in 2017 (Figure 22). This is likely because the large East Asian economic agglomeration (efficiently linked through sea-based transportation) benefits from a virtuous circle through which the high initial PM of these countries fosters their intraregional exports and economic activity, and this in turn increases the regions PM. As many of these countries still have significant room to converge to the income per capita of advanced countries this virtuous circle will surely continue in coming decades.

FIGURE 22
PROXIMITY TO MARKETS

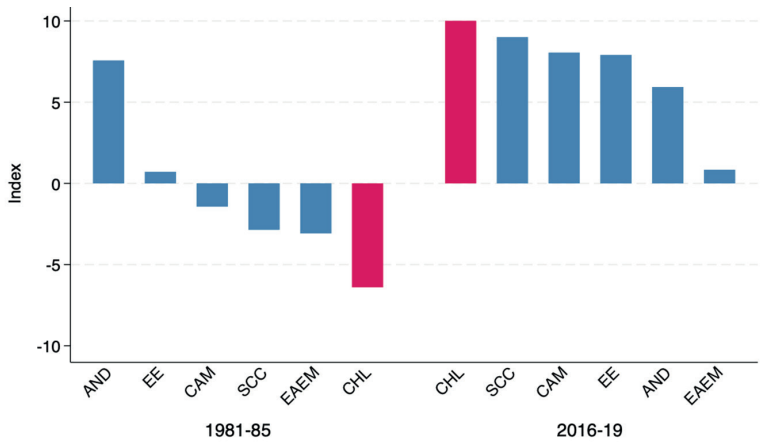


Note: Proximity to Markets is the sum of GDP of partner countries weighted by their distance to the country. Regional acronyms described in Table A.1.

In contrast, Chile's relatively isolated South American neighbors have low PMs and this limits their potential for intraregional export development and economic growth. Without the impulse from a nearby and fast-growing economic agglomeration, Chile's development of non-copper exports has hinged on the strength of its policy determinants of export diversification and complexity.

An important area of progress has been the strengthening of political stability and governance (Figure 23). After a politically unstable period that included an almost two-decade long military government, Chile returned to a democratic system and experienced a long period of uninterrupted development of political and economic institutions. This is reflected in an improvement in its Polity IV index from a negative to the maximum score, reaching the same score as for Australia and New Zealand. And by 2016-19, the World Bank's overall governance index indicates that Chile is considerably ahead of the average in comparator emerging market country groups, as seen in Figure 15.

FIGURE 23
POLITICAL STABILITY INDEX

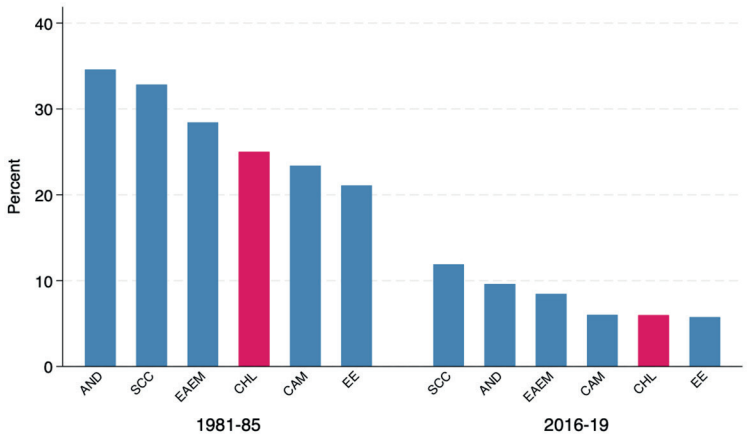


Note: Polity IV Governance Index. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Regional grouping described in Table A.1.

Chile's progress in liberalizing its trade policies has been particularly outstanding too. Its average Most-Favored-Nation (MFN) tariff has been reduced from about 100 percent in the 1970s to about 25 percent in 1980, and to low single-digit in 2017 (Figure 24). This 95-percentage point reduction in Chile's average tariff on its own is statistically associated to a twenty-fold expansion in complex exports per capita according to estimates in Salinas (2021). Chile is also one of few countries that wiped out non-tariff barriers, and did it ahead of most developing countries, in the 1970s. Moreover, Chile has been notably active in signing Free-Trade Agreements, especially with its largest trad-

ing partners, including the United States, East Asian countries, the European Union, Oceanic countries, and other South American countries. Hence, most of Chile's exports and imports are subject to the relatively open trade conditions established in these agreements.

FIGURE 24
AVERAGE IMPORTS TARIFF

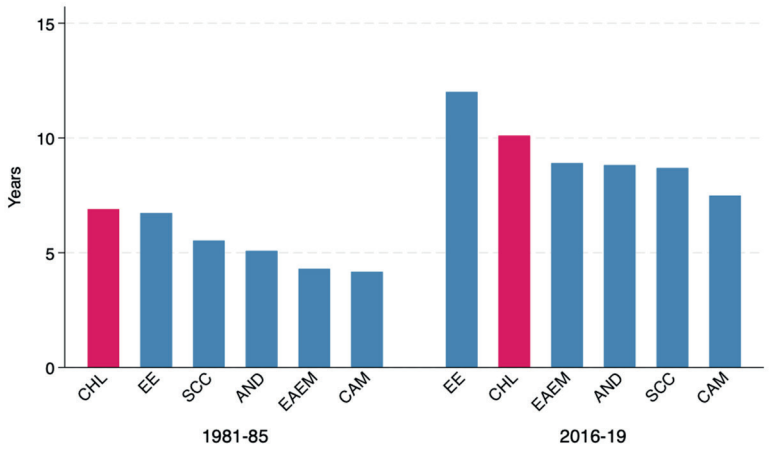


Source: World Development indicators (World Bank)

Note: Simple average imports tariff. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Regional grouping described in Table A.1.

Chile's educational attainment has been an important contributor to its export's development for several decades. Although its educational attainment has been recently surpassed by the EE region, it remains above that of other emerging market regions, including EAEM (Figure 25). A comparison of Harmonized Test Scores (the measure of quality of learning in the World Bank's School Years Adjusted by Learning Indicator) suggests the quality of learning in Chile is also above other emerging market regions except EE countries (Figure Panel A.2).

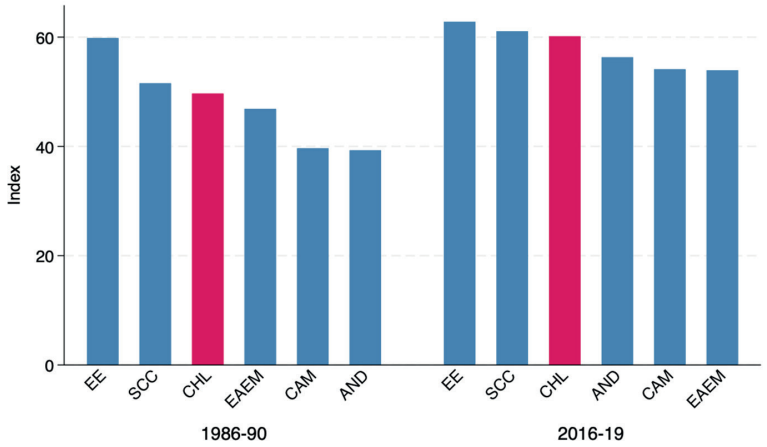
FIGURE 25
EDUCATION ATTAINMENT



Note: Barro-Lee average years of education attainment. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Regional grouping described in Table A.1.

Infrastructure coverage in Chile has rapidly expanded in recent decades and its quality is superlative in some areas (Figure 26). An index of infrastructure coverage that factors in electricity and phone line infrastructure going back to 1985, shows that Chile's coverage has remained about average among emerging market regions but has closed the gap with respect to Eastern Europe. In addition, the Infrastructure Pillar of the Global Competitiveness Index (World Economic Forum), which factors in quality for a wider set of infrastructure areas, indicates that Chile infrastructure excels in most areas (see Panel Figure A.3). This is particularly the case of ports and electricity quality, identified in Salinas (2021) as the areas of infrastructure most strongly associated with export development.

FIGURE 26
INFRASTRUCTURE



Note: Infrastructure index based on electricity and fixed phone line coverage from World Development indicators (World Bank). AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Regional grouping described in Table A.1.

In light of its geographic disadvantage Chile should aim to foster its exports diversification and complexity by strengthening its policy framework to reach Australia and New Zealand, remote countries that have successfully developed NHM and complex exports way above EE and EAEM countries. Except for trade policy openness, Chile has significant room to catch up with these two advanced countries in all the other three factors associated with export development.

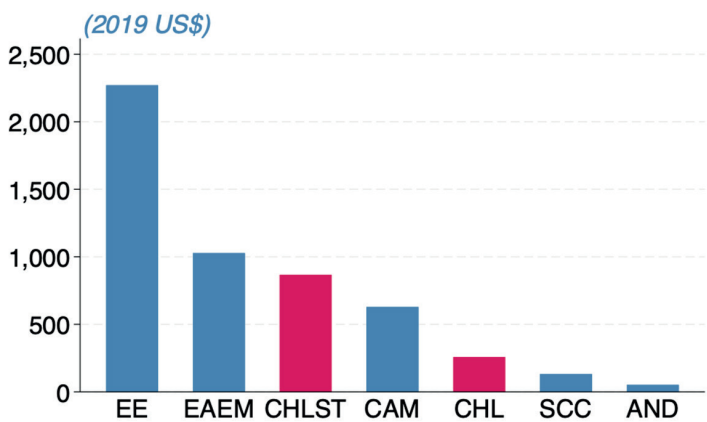
According to regression analysis in Salinas (2021), strengthening these factors could increase Chile's complex exports subtantially. From these estimates it is infered that eliminating the significant gap in the education attaintment gap with respect to, for example, New Zealand is associated with 113 percent increase in complex exports (Table 4). Eliminating the gap in governance and infrastructure relative to New Zealand could increase complex exports by 27 and 26 percent, respectively. And lowering average tariffs to New Zealand's level could increase complex exports by 11 percent. Attaining all these improvements would quadruple Chile's complex exports, considerably nearing the average in EAEM although not attaining EE's average largely because of remoteness (Figure 27).

TABLE 4
CHILE COMPLEX EXPORTS PER CAPITA IN 2016-19 WITH NEW ZEALAND POLICIES

Description	US$
Actual	215
Predicted with New Zealand Policies	
Educational attainment	480
Governance	275
Infrastructure quality	273
Average import tariff	239
Combined policies	867

Source: EBOPS; Hausmann and others (2013); and author's calculations.

FIGURE 27
COMPLEX EXPORTS PER CAPITA IN 2016-19



Source: Hausmann and others (2013).

Note: CHLST stand for Chile Strengthened, the predicted level of Chile with the level of education, governance, and infrastructure of New Zealand.AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern European; SCC=Southern Cone Countries. Regional grouping described in Table A.1.

A simple cross-country analysis suggests that despite its strong performance in export diversification determinants, Chile can still substantially further strengthen them. Figure Panel A4 includes scatter plots with log of GDP per capita in the x-axes and horizontal policies in the y-axes. Countries that appear above (below) best fit lines have stronger (weaker) horizontal policies than expected given their income level. Chile's governance is way above what would be predicted from its GDP per capita, so it is harder to expect more significant improvements in the short run. On education, Chile appears to have as strong education as expected given its GDP per capita, but Eastern European countries like Poland or Ukraine have education levels significantly above the best fit line and broadly like those of much wealthier Western European countries. Chile's infrastructure quality is also about what is expected from its GDP per capita, but those of East Asian countries like China, Malaysia, or Thailand are much higher than predicted, considerably above those in similarly wealthy countries in Latin America. Therefore Eastern Europe and East Asian countries can be thought of as role models of education and infrastructure development, respectively.

6. Conclusions

Chile's development of non-mineral and complex exports has been more successful than implied by commonly used diversification and complexity indices. When observing the level and long term growth of NHM and complex export categories, Chile's performance appears as strong as its overall economic performance and more similar to the average in the high performing East Asian region than to other South American countries. This has been the case despite Chile's remoteness from the large global economic centers and likely a result of its well-recognized efforts to strengthen its institutional development, educational attainment, trade policy openness, and physical infrastructure.

If Chile has low diversification and ranks low in terms of the ECI it is because of exogenous copper abundance and distance to large international markets, not because of an ineffective policy framework. In fact, among remote countries, Chile has seen the fastest growth in exports complexity per capita, owing to its strong horizontal policy framework.

For sure, as described in Lebdioui (2019), Chile has also relied on vertical policies for export promotion, but it did so decades ago and avoiding the now controversial industrial policies that generated major macroeconomic imbalances in many developing countries, such as SOEs or trade protectionism. In contrast, it relied on now widely recommended policies, such as technology transfer and diffusion, R&D support, and export marketing, which are unlikely

to lead to macroeconomic disarray. In the 1970s and 1980s, it relied on more controversial credit subsidies, but less so in later decades without apparent impact on its development of NHM exports. Nowadays, with a much larger global capital pool and its very low sovereign spread, financing is not a bottleneck to Chile's exports development.

Going forward, this analysis underscores the need to preserve Chile's leadership in strengthening its economic fundamentals and redouble its efforts to overcome the hurdles imposed by distance to large markets. Australia and New Zealand are role models of high complexity development despite long distance from large international markets. With these countries and other advanced economies as benchmarks, Chile should continue to strengthen governance, education, and infrastructure to reach higher degrees of complexity. Transports infrastructure is particularly important, as this can help reduce the cost imposed by remoteness.

Sectorally, Chile can focus on the development of exports of services and of high value-to-weight products, which are less affected by transportation costs. Improving telecommunications and electricty infrastructure towards the quality level of advanced countries would be key to foster exports of services. In general, technology will clearly be Chile's best ally in overcoming its distance hurdle.

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Appendix

APPENDIX 1: EXPORT COMPLEXITY AND COMPLEX EXPORTS

Although not part of mainstream economic growth or international trade theory, the concept of *Economic Complexity* presented in Hidalgo and Hausmann (2009) has attained a significant impact in the empirical public policy literature, with this paper having over three thousand citations to date (according to J-STOR). More importantly, the concept of *Economic Complexity* is now widely acknowledged and used in policy analyses in think tanks (for example, Escobari and others, 2019; Mealy and Colyle, 2021), flagship publications of international organizations (for example, World Bank, 2019; International Monetary Fund, 2015), and in governmental analytical units some of which, as mentioned in Hidalgo (2021), have created complexity data observatories in ministries of economy or production, and national innovation or statistics agencies. *Economic Complexity* data observatories have been set up in Harvard University and MIT.

The *Economic Complexity Indicator* (ECI) that is produced under this conceptual framework aims to measure the complexity of an economy through its export basket, using an algorithm that produces an ECI that is higher for export baskets that are more diverse and have higher exports of goods that are produced by fewer countries. See Hidalgo (2021) for a recent technical description of the ECI. Also under this framework, a Product Complexity Index (PCI) is elaborated, which assigns higher scores to goods that are produced by fewer countries.

Although not directly rooted in conventional economic theory, this indicator is broadly related to the well-established empirical facts that (i) advanced economies tend to produce a large variety of products, and (ii) more complex products (for example, iPhones or airplanes) are produced by a small number of countries.

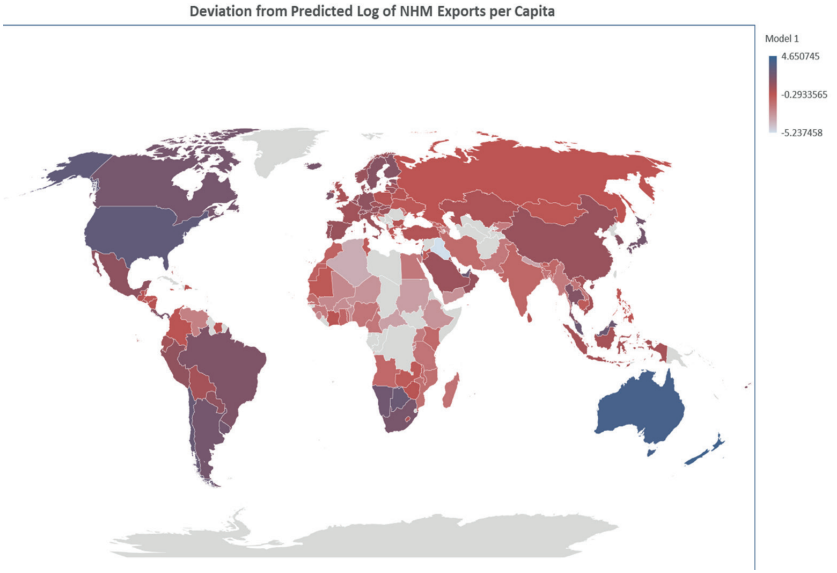
As indeed, more complex goods are produced in only few countries, the PCI does rank highest those products that are widely considered more complex (for example, machinery for specialized industries) and lowest products like raw hydrocarbon and mineral commodities that are widely considered less complex. However, as is explained in the main text of this paper, the ECI is determined exogenously by stocks and prices of hydrocarbon and mineral products, which is not related to a country's capabilities to produce and export complex products that the creators of the ECI intend to measure.

TABLE A1
LIST OF COUNTRIES BY REGIONAL GROUP

Region	Region Code	Countries
Andean	AND	Bolivia, Colombia, Ecuador, Peru, Venezuela
Arab	ARB	Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, UAE, Yemen
Central Asia	CA	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan
Central Am & Mexico	CAM	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama
Caribbean	CAR	Antigua & Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts & Nevis, St. Lucia, St. Vincent, Suriname, Trinidad & Tobago
East Asia Emerging	EADM	Cambodia, China, Fiji, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Thailand, Timor-Leste, Vietnam
East Asia High Income	EAIH	Brunei, Hong Kong, Japan, Korea, Macau, Singapore, Taiwan
East Asia Others	EAOHT	Australia, New Zealand, Papua New Guinea
Eastern Europe	EE	Albania, Bosnia Herz., Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Moldova, Montenegro, North Macedonia, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Ukraine
EU	EU	European Union
Pacific Isl.	PAC	Tonga, Tuvalu, Vanuatu
South Asia	SAR	Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
Southern Cone	SCC	Argentina, Brazil, Chile, Paraguay, Uruguay
Scandinavia	SCN	Denmark, Finland, Iceland, Norway, Sweden
Sub-Saharan Africa	SSA	Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Rep, Chad, Comoros, Congo, Dem. Rep. Congo, Côte d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé & Príncipe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

FIGURE A1

DEVIATION OF ACTUAL EXPORTS FROM PREDICTED-BY-DISTANCE EXPORTS



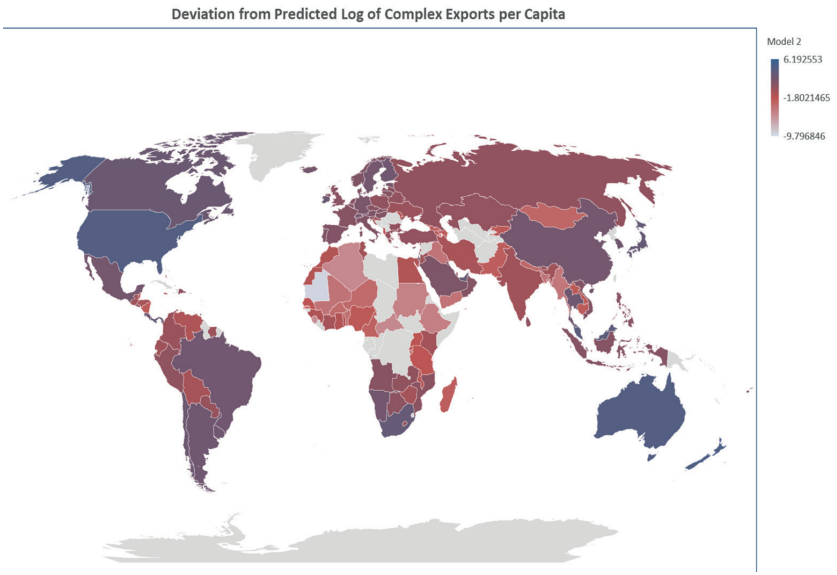
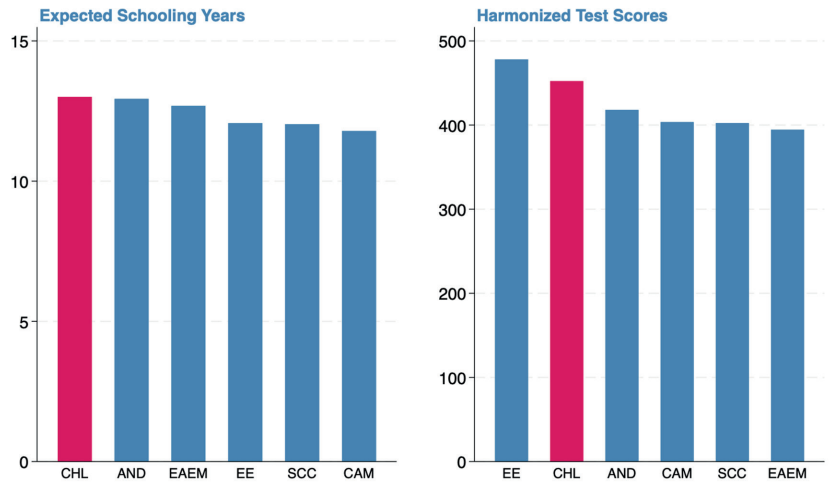


FIGURE A2
HUMAN CAPITAL COMPONENTS IN CHILE AND COMPARATORS



Note: Country acronyms are ISO3. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern Europe; SCC=Southern cone countries. Regional subgroupings described in Table A.1.

FIGURE A3
INFRASTRUCTURE SUBINDICES IN CHILE AND COMPARATORS IN 2017

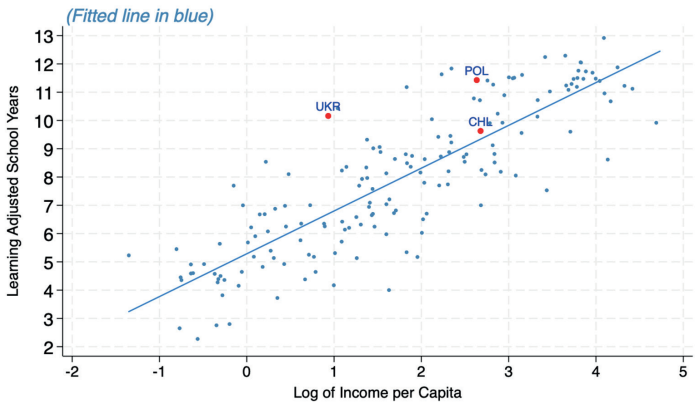
Source: Global Competitiveness Report (World Economic Forum).

Note: Country acronyms are ISO3. AND=Andean countries; CAM=Central America and Mexico; EAEM=East Asia Emerging Markets; EE=Eastern Europe; SCC=Southern cone countries. Regional subgroupings described in Table A.1.

FIGURE A4

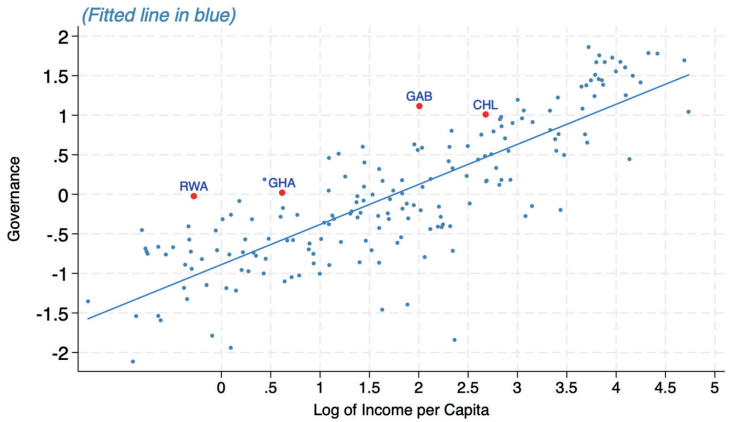
EXPORTS DETERMINANTS AND GDP PER CAPITA

LEARNING ADJUSTED SCHOOL YEARS VS. INCOME PER CAPITA



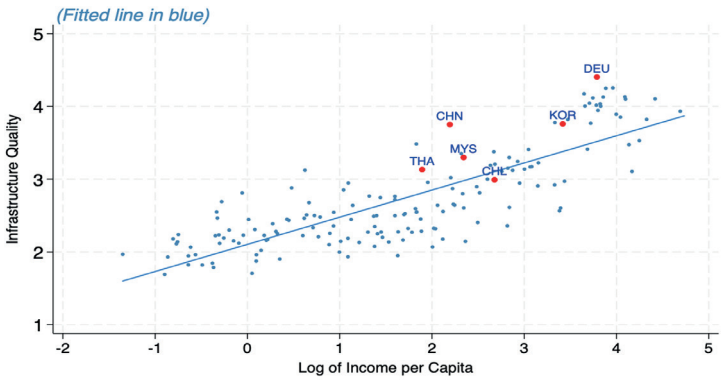
Source: Human Capital Indicators and World Development Indicators (World Bank).
Note: Acronyms are ISO3. Values are averages of available years in 2016-19.

GOVERNANCE VS. INCOME PER CAPITA



Source: Worldwide Governance Indicators and World Development Indicators (World Bank).
Note: Acronyms are ISO3. Values are averages of available years in 2016-19.

INFRASTRUCTURE VS. INCOME PER CAPITA



Source: Logistics Performance Indicators (World Bank).
Note: Acronyms are ISO3. Values are averages of years 2016-19.