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Tiivistelmä/Referat – Abstract

The industrial structure of Finnish exports was dominated by wood-processing industries since the first globalization period. Yet after the Second World War and hastened by the liberalization of foreign trade, new exports of metal, chemical and textile industries emerged and the traditional forest industries raised their level of refinement. While previous historical research has recognized these tremendous changes, there is no comprehensive study attempting to explain what determined this development in export structure. The handful of previous studies that refer to possible factors do so with lacking empirics and particularly without utilizing econometric methods.

The econometric method used in thesis is fixed effects regression, besides which quantitative tables and graphs are used as well. The input-output tables of Finland calculated by Statistics Finland and covering 1956–1989 were the main source of data. The input-output tables also provide a technique for obtaining figures regarding both direct and indirect use of different factors. While direct use accounts for the use of a factor by the industry itself, indirect use also reflects how the industry's input providers use that factor. This technique was also used to calculate domestic value-added of exports, which is a key novelty of this thesis. Gross exports remain the standard measure of historical trade studies even if they include the value of imported inputs, the share of which increased over the post-war period. Domestic value-added of exports removes this bias.

Previous historical research has also had a loose theoretical underpinning where it is not made explicitly clear on what grounds mentioned determinants of trade are given weight. It was judged not only important for this thesis' empirical approach to adhere to an economic trade model but also to assess which one was the most valid in the Finnish post-war context. The model chosen was the Chamberlin-Heckscher-Ohlin model where factor intensities – labour, physical and human capital and natural resources – are complemented by horizontal differentiation and scale advantage. It was also deemed important to consider several institutional characteristics of that time: export cartels, state-owned companies, customs barriers and Eastern Trade.

Each export industry had its own determinants. Forest industries used domestic natural resources to a great, but decreasing, extent with capital, cartels and state-owned companies being other features. While basic metal industry was similar to paper industry in many respects such as in its capital intensity and scale advantage, metal engineering industries tended to be more characterized by R&D, product differentiation and Eastern Trade. Chemical exports were also determined by many different factors, such as skill intensity and R&D whereas the labour intensive consumption goods exports were initially dependent on customs barriers. After free trade integration reduced tariff rates these industries shifted their focus to Eastern Trade which was in its own way a form of protectionism too. Service exports tended to be capital intensive, or skill intensive in a few cases, whereas exports of the primary sector used labour, resources and also capital to a great extent.

The econometric results suggest that the export structure of 1956–1970 was driven by capital intensity specifically related to the use of machinery and transport equipment and by the declining use of natural resources. This is not only reflective of increasing level of refinement in wood and paper exports, but also by the emergence of new export industries. Factor intensities are less explanatory in the 1980s where the evidence suggests that scale advantage may have become an important determinant of exports. Surprisingly, Finnish exports were characteristically homogenous and not horizontally differentiated in the late post-war period. A closer inspection revealed that this was specifically a feature of exports to Western markets, which were also slightly characterized by technological differentiation. Horizontal differentiation was a feature of Eastern Trade which supports the argument that it functioned as a springboard for raising the technological level of Finnish exports. However, econometric results also support the notion that labour intensive industries used it as an extension of customs barriers.

While several determinants of export structure are identified in this thesis, so were many venues for future research such as an international perspective. While there were indications that skill intensity and know-how were important in Finland it seems that this was on a lower scale than in other European countries. Although Finland shared some of its features with other Nordic countries, its exports were less diversified than in Denmark, or Sweden where metal industries developed earlier. Particularly the importance of Eastern Trade in Finland also indicates that demand-side theories might be applicable in the Finnish post-war export structure besides the supply-side approach used in this thesis.

Avainsanat – Nyckelord – Keywords
Foreign Trade, Exports, Value-added of Exports, Export Structure, Post-War Period, Heckscher-Ohlin Model, New Trade Theory, Chamberlin-Heckscher-Ohlin Model, Forest Industries, Forest Exports, New Exports, Natural Resources, Capital, Human Capital, Labour, Scale Advantage, Product Differentiation, Eastern Trade, Customs Barriers, Cartels, State-owned Companies, Finland

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The Determinants of Finnish Export Structure, 1956–1989

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Symbols and Abbreviations

a_{ij}	Input Coefficient
A	Matrix of Input Coefficients
x_{ij}	Inputs used in product of the input-providing industry i in a final
x_j	Production in a given final product industry *j*
e	Diagonal matrix of export demand
$(I - A)^{-1}$	Leontief Inverse
v	Diagonal matrix of value-added relative to production
DVA	Domestic value-added of exports
l	Direct labour input of working hours per one million 2017 euros
L	Direct and total labour input required to satisfy one million 2017 euros worth of production
ES_j	Average establishment size in industry *j*
VA_j	Value-added in industry *j*
n_j	Number of establishments in industry *j*
MC_j	Share of employees working in large establishments relative to all employees in industry *j*
ne_j	Number of employees in establishments employing more than 199 or 200 personnel in industry *j*
Ne_j	Total number of employees in industry *j*
ET_j	Share of Eastern Trade out of total exports in industry *j*
$ecom_j$	Gross exports to communist countries in industry *j*
E_j	Total gross exports in industry *j*
ERP_j	Effective rate of protection in industry *j*
t_j	Nominal tariff rate, measured by the value of collected duties relative to the value of imports, in final product industry *j*
t_i	Nominal tariff rate, measured by the value of collected duties relative to the value of imports, in input-providing industry i

I–O	Input-Output
H–O model	Heckscher-Ohlin model
C–H–O model	Chamberlin–Heckscher–Ohlin model
NTT	New Trade Theory
IIT	Intraindustry trade

1. Introduction

> The Finnish economy is built upon foreign trade. Such has been the state of things since time immemorial.[1]
>
> But above all it is the forest industry that holds the key position in Finnish economic life, not least because its exports are of overwhelmingly greater importance than any other products.[2]

Finland is a small open economy and has been so since the middle of the 19th century.[3] The dependence on exports is as much a foregone conclusion in modern public discussion as it was during the early 1950s, when the above quotes were written. Even today one can hear the phrases "Finland lives on exports",[4] or the 1980s catchphrase "Finland lives on forests".[5]

It would be a nigh heretical act to disregard the importance of exports in Finland. However, the notion that the country's abundant forest resources are the main determinant of economic development above all else has had an exaggerated, even a mythical quality. Even then Markku Kuisma describes this notion of forest fundamentalism as broadly correct: in the long run forests were the thing that integrated Finland into Europe by the way of foreign trade.[6] While this cannot be denied in the long duration, the statement is less accurate in the decades following the 1950s. New export industries, composed of metal, chemical and textiles products, came into existence and surpassed the forest sector in size.[7]

Although the diversification of exports and the reducing importance of forest industries has been noted in economic historical literature, there has not been a comprehensive empirical study of what spawned the development of new export industries in the post-war period. There have been general overviews of foreign trade for this period, but none that that use econometric methods of contemporary economic history. More importantly, determinants of export structure are usually only mentioned, not analysed. If there are empirical studies, they are restricted to a short time frame, or limited in perspective when

[1] Bärlund 1951, 46. Translated from: "Suomen kansantalous rakentuu ulkomaankaupan varaan. Näin on ollut asianlaita jo ikimuistoisista ajoista alkaen".
[2] Karjalainen 1953, 24
[3] Heikkinen 1994, 106–107; Schybergson 1980, 451–452, 457–458
[4] Translated from: "Suomi elää viennistä".
[5] Translated from: "Suomi elää metsästä". See Kuisma 1999, 51–52.
[6] Kuisma 1999, 51–52. Actually Kuisma's statement is stronger since he describes not only economic but also societal development as dependent on forest industries and resources.
[7] Kaukiainen 2006, 150–151; Paavonen 2008, 11, 258

pertaining to trade integration or intraindustry trade for instance. Therefore a study where the determinants of export structure are inspected and analysed is justified.

The period of 1956–1989 corresponds nicely with the post-war decades, but it was chosen according to the availability of input-output tables which form the basis of the many measures used in the thesis. The late 1950s is a relevant starting point for this enquiry because it encompasses the protectionist period shortly before the free trade era whereas the early 1950s constituted for a distinct period characterized by the Korean Boom, post-war reconstruction, war reparations to the Soviet Union and a regulated economy. The FINEFTA trade agreement in 1961, followed by the EEC trade deal in 1973, resulted in gradually lower trade barriers that possibly distorted trade patterns in the previous decades. The year 1989 is a natural ending point, since it precedes a fundamental break in Finnish economic history: the Finnish Great Depression, the collapse of the Soviet Union, Finland's entry into the European Union and the meteoric rise – and eventual fall – of Nokia.

I am specifically interested in the change that happened before the emergence of Nokia, important as it was. As Yrjö Kaukiainen writes, Finland of the 1980s was no more a country of cheap labour as other factors, such as capital and know-how, were more important determinants of the country's specialization. Even before the 1990s there had been a decisive change in the economic life of the country and its exports.[8]

A comprehensive empirical study in this context, besides incorporating a suitably long timeframe, means that the research design ought to identify the most relevant variables based on the literature and analysed with quantitative methods. Indeed, how else to identify significance if not by measurement? The study would need to account for particular phenomena of the era such as intraindustry trade, which coincided in many industrial nations and the centrally organized Eastern Trade, an institutional characteristic specific to Finland and a few other Western countries. Furthermore, the substantial overinflating bias in gross exports caused by foreign inputs imported into production should be removed. A key contribution of this thesis is that it corrects for import values with a novel series of domestic value-added of exports, calculated by the author for eight cross-sections in 1956–1989.

[8] Kaukiainen 2006, 150–151

Based on this value-added series it is possible to examine the export industries in greater depth than before. It is quite probable that using biased gross exports in an econometric study would result in biased results, whereas the value-added figures can be used to obtain more accurate levels of different factors' magnitudes. The input-output calculations are also used to obtain figures for many of the determinants of export structure.

Yet the question regarding which factors and determinants are explanatory is not an easy one. I deem that the best available theoretical framework for this question consists of the trade models found in international economics: Ricardian, Heckscher-Ohlin and New Trade Theories to name a few. While the nature of this thesis is decidedly empirical, it cannot be denied that the plurality of conflicting trade models remains an issue. Since the correct specification of relevant variables is less than clear, a substantial portion of the thesis is devoted to considering what models and what determinants should have been relevant. Apart from the use of value-added series, the methodological approach here is not revolutionary, as input-output calculations and regression analyses is common in quantitative economic history. Graphs and tables are also used. The data consists of statistical material obtained mostly from national input-output tables, official foreign trade statistics, industrial statistics and other statistics compiled by Statistics Finland.

In conclusion, this thesis attempts to explain asks what determined the structure of exports during 1956–1989, a time of significant changes in the Finnish economy and export structure. What were the drivers of exports specialization during this time? While Eloranta and Hannikainen have noted that the service sector has often been consigned to the sidelines of economic history, I also consider it important to study service exports.[9] Therefore the Finnish export structure studied here comprises of primary and tertiary sectors alongside the secondary one. This is another novelty of this thesis in comparison with previous research that focuses on only manufacturing or commodity exports.[10]

To summarize the thesis' main task is as follows:

> To locate the most important supply-side determinants of exports' industrial structure in 1956–1989.

The focus on the supply-side is a conventional one in economic history. Riitta Hjerppe for example stresses that while demand-side characteristics are important in the short-

[9] Eloranta & Hannikainen 2018 (unpublished), 9

[10] See for example Varian 2017 or Crafts & Thomas 1986.

term, it is the supply-side factors or "the availability of labour, capital and natural resources; and the development of technological and institutional circumstances" that ultimately determine the pattern of long-term production.[11] Yet as Pat Hudson opines:

> – – the supply-side still dominates, this despite the flowering of global histories demonstrating that new consumption and demand impulses and continuous product innovation came from long-distance connections and reciprocal dynamics.[12]

This is not a frivolous point. It is quite feasible that the Finnish export structure could have evolved quite differently had international demand patterns done so as well. To what direction would have the composition of forest exports evolved, had industrialized countries not demanded paper prompted by higher living standards?[13] As another example, it is curious to note how Finnish metal and textile exports initially developed in the 19th century based on the Russian market, only to cease in the interwar period after the revolutions of 1917 and then to resume in the post-war period as a part of Eastern Trade. Here I must stress that the export structure at the heart of my research question refers to the industrial structure, not the country structure, of exports. However, one must account for differences in market areas in the case of Eastern Trade since there seems to be a connection of some kind with export industries and demand-side factors there.

Generally speaking though, the demand-side is not studied here comprehensively, since even the conventional supply-side approach is time-consuming. Furthermore, considering that the supply-side approach has not been applied empirically before, it could be said that the customary foundation ought to be laid first before embarking on a more heterodox line of inquiry. However, some institutional circumstances – which Hjerppe mentions – are included in this thesis, if literature suggests that they might have mattered. These features include Eastern Trade alongside export cartels, customs barriers and state activities in the form of state-owned companies and public funding of innovations. It is important not to dismiss these aspects of the post-war economy without consideration simply on the grounds that they are not explicitly addressed by economic trade models.

There are a number of points that this thesis will not consider. Most importantly, the thesis considers only Finland due to excessive demands of a cross-country study. Additionally, I will not address whether the diversification or growth of exports were useful

[11] Hjerppe 1989, 169
[12] Hudson, 2014: Tawney Lecture 2014. Industrialisation, global history and the ghost of Rostow
[13] Saarinen 2005, 31

developments for the Finnish economy. In other words, I do not consider whether economic growth was export-led. I am also largely uninterested in export industries' rates of value-added which is a continual point of mention in Finnish economic industry.[14] Although domestic value-added of exports is certainly an important topic in this thesis, the inherent arbitrariness of industrial classifications makes it hard to say anything meaningful about the share of value-added in individual industries. Public policy and the persistent post-war devaluation cycle are also mostly disregarded with a few exceptions.

Finally, it should be admitted that despite the empirical nature of this thesis, the results here cannot be construed as causal strictly speaking. As Hjerppe and Jukka Jalava argue in the context of growth accounting, variables such as labour, capital and productivity are proximate sources of growth, not fundamental sources. Dani Rodrik proposes that these fundamental determinants are geography, trade integration and institutions.[15] Geography is explicitly considered here in the guise of natural resources, trade integration partly through customs barriers and institutions in a limited fashion through Eastern Trade, state-owned companies and export cartels. Yet with regards to labour or capital, a study such as the one here does not reveal why these factors developed, only what was each one's relative contribution.[16]

The sections after this introduction detail the theories related to the determinants of export structure and previous research regarding Finnish and foreign contexts that follow these theories (chapter 2). After discussing theory and previous research, data and methodology of the thesis are briefly considered (chapter 3) – the majority of the discussion related to data sources is left for the appendices however (appendix chapter 6.2). Before moving onto the econometric analysis of export structure, possible determinants are also examined with quantitative tables across export industries (chapter 4). This section also includes a brief review of Finnish exports in the long-term. The final chapter (5) considers the results in the context of previous research and concludes the thesis.

[14] See Paavonen 2008, 257; Kaukiainen 2006, 150 or Pihkala 1982a, 376.
[15] Rodrik 2003, 3–5
[16] Hjerppe & Jalava 2006, 56, 315

2. Theoretical framework, Trade Models and Previous Research

In this chapter the choice of theoretical framework and the problems and benefits of applying economic models into economic history are briefly considered before reviewing the main economic theories of foreign trade. I also review different lines of research on determinants of trade, particularly for Finland and to lesser extent concerning economic historical studies of foreign countries. Finally, I consider what trade models and determinants of exports structure should be relevant in analysing the Finnish economy of 1956–1989 with Rodrik's diagnostic framework for model verification in mind. Some attention there is also devoted to discussing institutional characteristics of Finnish export structure that are often not considered in trade models.

2.1 On the Approach Adapted Here

> A researcher's voyage between the "Scylla" of a theoretical straightjacket and "Charybdis" of a chaotic multitude of facts is not easy be he an economist, historian or, working between them, a proponent of new economic history – –.[17]

As Erkki Pihkala puts it an economic historical study must strike a balance between the freedom to account for empirical facts and the need to assign those facts into a sensible framework. Although there are no obvious solutions to this trade-off, the approach adopted in this thesis could be characterized as the standard solution in economic history. I deem that the research questions cannot be answered without the guidance of trade models of neoclassical economics nor without quantitative techniques. The approach therefore conforms to Sakari Heikkinen's and Jan Luiten van Zanden's definition of economic history as a combination of economic theory and "empirical, quantitative economic research".[18] However, economic history has also been described as an "uneasy waltz"[19] between economics-oriented and humanities-oriented research approaches. Humanities-oriented researchers have accused economists of utilizing faulty models and

[17] Pihkala 2007, 50. Translated from: "Tieteenharjoittajan matka teorian pakkopaidan 'Skyllan' ja tosiasioiden kaaosmaisen runsauden 'Kharybdiksen' välillä ei ole helppoa, olipa tämä ekonomisti, historioitsija tai näiden välissä toimiva instituutioiden merkitystä korostava uuden taloushistorian harrastaja".
[18] Heikkinen & van Zanden 2004, 11. Note that the qualitative approach is implicitly ruled out here.
[19] Jalava, Eloranta & Ojala 2007, 10

statistics and being ignorant of previous research while they have been in turn criticized of shoddy methods and impressionistic theories.[20]

Yet regardless of these debates between humanities- and economics-oriented schools of thought, modern historians increasingly apply methods and theories of social and economic sciences. This presents another problem: historians' source criticism has failed with the uncritical use of economics. Indeed, Jalava, Jari Eloranta and Jari Ojala assert that while simply disparaging economics is not sustainable, economic models cannot be given a carte blanche either. It is important to judge the relevance of the utilized models by examining the assumptions of economics, which requires understanding those assumptions in the first place. The argument on proper understanding of models is not only applicable to economic history, but to economics in general. For example, as Rodrik puts it:[21]

> Rather than a single, specific model, economics encompasses a collection of models. The discipline advances by expanding its library of models and by improving the mapping between these models and the real world. The diversity of models in economics is the necessary counterpart to the flexibility of the social world. Different social settings require different models.[22]

Rodrik writes that economics accumulates knowledge by expanding horizontally, or by adding new models to the library of economics. The older models are not necessarily obsolete – the new ones merely incorporate aspects that were not previously addressed and are more relevant in certain contexts. The author criticizes economists because they "are prone to mistake a model for *the* model, relevant and applicable under all conditions" while they should instead "select their models carefully as circumstances change, or as they turn their gaze from one setting to another".[23]

The difficulty of choosing the right model is especially severe in foreign trade theory, where there is no standard model. Three main strands exist: Ricardian, Heckscher-Ohlin and the New Trade Theory. Each tried to clarify the blind spots that the contemporarily popular model had failed to account for, yet none has managed to supplant the others

[20] Jalava, Eloranta & Ojala 2007, 10–11. For an alternative approach, see Boldizzoni 2011, or Boldizzoni & Hudson 2016 where global, "interpretive" approach to economic history is advocated.
[21] Jalava, Eloranta & Ojala 2007, 10–11
[22] Rodrik 2015, 5
[23] Ibid., 6, 67

completely. There has even been a Neo-Ricardian resurgence in the 2000s. On top of this one can also combine different models.

Although the discussion here has highlighted the need for verifying the right model for the right context, some readers might still object to usage of economic models because they are unrealistic. That they are unrealistic is abundantly clear, but that does not mean that they cannot be explanatory. As Rodrik maintains models are essentially attempts to capture relevant aspects of reality by isolating certain mechanisms from confounding effects in an artificial setting. Models leave out some aspects of reality to highlight causal mechanisms and their implications.[24]

Indeed, even though conventional trade models can be considered lacking in many grounds, Pihkala states that they are still necessary for a conceptual understanding of historical development.[25] Thus economic models can be used to interpret a multitude of facts, but not without criticism.

2.2 A Survey of Theories of International Trade

> Dostoevsky apparently once remarked that all of Russian literature emerged from under Gogol's *Overcoat*. It is at least as true that all of the pure theory of international trade has emerged from chapter 7 of Ricardo's *Principles*.[26]

The first of the modern trade theories is the Ricardian one. David Ricardo's idea of comparative advantage is still the prism through which economics considers trade patterns even though it was formulated in the 19th century. Anecdotally it was also Paul Samuelson's, a Nobel laureate economist, pick for a single economic theory that is both true and still not self-evident.[27] Conceptually Ricardian theory rests on comparative advantage, which is caused by labour productivity and technology.

The key idea behind comparative advantage is that countries do not specialize per absolute advantage – i.e. which country can produce the commodity cheaper. Unlike this seemingly intuitive idea, trade patterns are determined by comparative advantage. A country will specialize in exporting the product which it finds easier to produce than the other product. If the domestic economy has a lower opportunity cost in this good, relative

[24] Rodrik 2015, 11–12, 25–29. Models can also be treated as fables or thought experiments. See Rodrik 2015, 18–25.
[25] Pihkala 2007, 50
[26] Findlay 1984, 186
[27] Feenstra & Taylor 2012, 27

to the other one, compared with the foreign economy it will specialize in its production. Even if a foreign country has absolute advantage in the production of all goods, both countries will specialize according to their relative efficiency. It should also be noted, as Ville Kaitila has, that comparative advantage can change in time and one can attempt to influence it.[28] Reino Hjerppe adds that specialization according to comparative advantage leads into greater gains from division of labour, long product lines and experience in the relevant sectors, which intensifies existing comparative advantage.[29]

Comparative advantage is hard to observe, since theoretically a country would export the product whose relative price in terms of another good would be lower in autarky than in free trade. Empirically one would need to observe a move from closed economy to free trade, which is a unique occurrence. Since most countries, including Finland, have not been characterized by total autarky in recorded history, indirect or general measures related to trade or specialization are often used instead.

The Ricardian model itself states that comparative advantage is mainly determined by productivity which is in turn determined by technological differences across countries and industries. It is simplistic in the sense that it considers only one factor of production: labour. This deficiency led in part to the formulation of the Heckscher-Ohlin model (H–O model) which considers a number of factors: in its most limited form only labour and capital, but sometimes also natural resources or human capital.[30] At its core it assumes that the main determinant of trade patterns lies in the factor proportions of each country, and in the factor intensity of different industries. In a way, countries export those factors that they have in abundance and import those that they lack. The notion also works on an industrial level, where a capital abundant country will focus on production that is capital intensive and a labour abundant country on labour intensive production.[31] In contrast with the Ricardian model, Heckscher-Ohlin model assumes technology to be identical across countries. Both the Ricardian and the Heckscher-Ohlin model share a similar focus on the supply-side rather than on the demand-side.[32]

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[28] Kaitila 2007, 2
[29] Feenstra & Taylor 2012, 38–40; Hjerppe 1975, 165–166
[30] See Wright 1990, 654 for example.
[31] Kauppila 2007, 41
[32] Feenstra & Taylor 2012, 87–98; Kaitila 2007, 2; Hjerppe 1975, 62, 68

Heckscher-Ohlin theory became quite influential in the 20th century, which is exemplified by Reino Hjerppe referring to it as the "modern" perspective on foreign trade in 1975.[33] Even in 2006, Kevin O'Rourke called the model "intuitively appealing" and "the bedrock of modern trade courses".[34] The intuitive appeal of the model did not lead into empirical validity however. In 1953, one year after Eli Heckscher's death, Wassily Leontief tested the theory, which predicted that the capital abundant United States would export capital intensive goods. Leontief's finding that the U.S. *imports* consisted of capital intensive goods was a decided blow to the validity of the H–O model. The Leontief paradox resonates even today and is routinely mentioned in different articles.[35]

O'Rourke and Jeffrey Williamson acknowledge that after Leontief's study, "simple versions" of the H–O model have been criticized.[36] Williamson also admitted in a different text that testing the technological rationale versus the Heckscher–Ohlinian one has not been kind to the H–O model, though he characterizes the debate as unresolved.[37] However, the authors do make a point of arguing that there is evidence for the model being successfully applied to the late 19th and early 20th century citing Nicholas Crafts and Mark Thomas concerning British manufacturing 1910–1935 and Gavin Wright regarding 1870–1940 for the United States. They also refer to Antoni Estevadeordal's study of 18 countries and 46 sectors in 1913.[38]

Indeed, Estevadeordal did maintain in 1997 that the H–O model is a valid explanatory framework for studying the era prior to the Great War.[39] He evidently changed his mind in a study with Alan Taylor in 2002. To be fair, they do state that several predictions of the H–O model, such as the pattern of traded goods and factor price convergence, have been substantiated by economic historians regarding the pre-1914 era. While acknowledging the model's primacy for research considering that period, the authors concluded, on the basis of testing the factor content of trade,[40] that the model's fit for the pre-1914 era is as ill-performing as it is for the modern period, although renewable and non-renewable resource endowments are predicted relatively well by the model.[41]

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[33] Hjerppe 1975, 53
[34] O'Rourke 2006, 107
[35] Jones 2006, 91
[36] O'Rourke & Williamson 2000, 66
[37] Aghion & Williamson 2000, 172–173
[38] O'Rourke & Williamson 2000, 66
[39] Estevadeordal 1997, 96
[40] Factor content of trade refers to the notion that countries export abundant factors of productions.
[41] Estevadeordal & Taylor 2002, 383–388

Even if one would still argue that the Heckscher-Ohlin theory is appropriate for the first era of globalization that still does not mean that studies focusing on the modern post-war period can apply it without problems. Williamson himself admits that the idea of Heckscher-Ohlin model explaining wage inequality by itself in the modern era is contested at best.[42] Estevadeordal and Taylor likewise note that tests of "pure" H–O model applied to the modern period have been less than stellar and that Heckscher and Bertil Ohlin themselves might be critical of how modern researchers use their theory in a context that is very different from the one they themselves lived in.[43]

At any rate, the number of modifications needed to incorporate into the H–O model for the modern period is rather long.[44] There seem to be two particular problems related to the model. First is the assumption of identical production functions, technology in layman's terms. Secondly, the model cannot account for modern international trade because it cannot account for the existence of intraindustry trade (IIT), the trade in goods of the same industry, which are assumed to have similar factor intensities.[45] It has been stated that the former assumption is "generally accepted as one of the – if not *the* – major obstacles for the empirical applicability of the Heckscher-Ohlin model".[46]

One additional issue is the question over natural resources. Crafts and Thomas designate them as "Ricardo goods" that cannot be plausibly explained with the factor endowment model.[47] They do not explain the rationale in great detail, but the issue can perhaps be understood through Pekka Parkkinen's comparison of natural resource content of exports versus imports in Finland during 1970. Exports containing renewable natural resources were not as intensive in physical capital compared with exports containing non-renewable resources. Since the former dominated Finnish exports and the latter was consigned to imports, Finnish exports were less capital intensive relative to imports. Parkkinen mentions that a similar situation characterized U.S. foreign trade. Leontief paradox could be thereby solved by separating natural resources in the empirical approach.[48]

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[42] Aghion & Williamson 2000, 173, 175
[43] Estevadeordal & Taylor 2002, 383, 385
[44] O'Rourke 2006, 107. Referring to Davis and Weinstein, O'Rourke mentions technology differences, factor price equalization not holding, non-traded goods and trade costs as the necessary modifications needed in the standard H–O model in order ensure its consistency with the data.
[45] Aunesluoma 2011, 154; Parjanne 1992, 6
[46] Hamilton & Söderström 1981, 198–199
[47] Crafts & Thomas 1986, 631
[48] Parkkinen 1977, 161–162. Note that the imports here refer to hypothetical import-substituting production.

After the Leontief paradox and the appearance of intraindustry trade, yet prior to the New Trade Theory (NTT) that would become the textbook alternative to the H–O model, there emerged new demand-side theories. Take for instance Staffan Burenstam Linder's theory which emphasized market area expansion as a possibility for trade. Supposing that two countries are in the same customs area and have similar demand structures, there is scope for expanding domestic production abroad. That would not apply to export industries based solely on satisfying foreign demand though.[49]

Additionally, there was Irving Kravis' theory of availability which stressed that countries import products which are not obtained domestically or are, but only under great cost. While Hjerppe criticized this theory for not having an explicitly defined testable hypothesis, he did mention that one can postulate on it that export industries have faster technological growth than in other industries. Parkkinen also mentions the technological gap theory, developed by many authors including Kravis, which centres on innovation. The model states that technologically advanced countries export products without close substitutes and which require innovation whereas poorer countries have to compete with lower production costs and abandon monopolistic pricing that the original companies could sustain. However, in the theoretical timeline of the model developed countries and companies are already creating new innovations at this point.[50]

These notions developed into the product cycle theory which underlined the level of technology as the main determinant of trade pattern. It was developed by Raymond Vernon who theorized that novel products are developed in short assembly series by different companies using different technologies. When demand for these novelties increases, the production process is honed and eventually becomes common knowledge allowing less-developed countries to produce these goods and diminishing the comparative advantage of developed countries in manufacturing them.[51]

Moving on to New Trade Theory, we first need to define the phenomenon that gave impetus to its formulation. Marja-Liisa Parjanne defines intraindustry trade as "simultaneous import and export of differentiated products within the same industry or

[49] Pihkala 2007, 38–39
[50] Parkkinen 1977, 44; Hjerppe 1975, 67
[51] Pihkala 2007, 39; Parkkinen 1977, 45. Pihkala adds that while product cycle theory assumed that home market advantages of large companies would support exports, production based on U.S. development was increasingly moved and sometimes even offshored to U.S. companies' foreign subsidiaries.

product group" exclusive of homogenous goods or re-exporting for example.[52] The general gist is this: France might export Renaults to Italy, but it also imports Fiats from Italy.[53] IIT should be positively associated with similarity of production structures and high income per capita in both countries and negatively with distribution of per capita income in each country. Empirical studies have confirmed the size of a country, low trade barriers and similarities between countries as further indicators of IIT. A related discovery has been that geographic proximity and similar consumption patterns result in trade with differentiated products of the same category.[54]

On the other hand, intraindustry trade has been criticized on the grounds that the phenomenon is simply a by-product of statistical aggregation where similar product types are added together – there might be back-and-forth trade in the same industry and even on the SITC 3 and 4 digit levels, but not on the product level. Pihkala is quite sceptical with regards to this claim. In his mind the phenomenon is more related to branding and not statistical falsehoods. I am inclined to agree with Pihkala. If IIT, which increased in the post-war period, is merely a statistical accident, there would have had to have been a growing tendency of trade statisticians to group different products into same categories. However, it is true that aggregated categories overestimate the amount of intraindustry trade and disaggregated product levels would be preferable.[55]

Parjanne denotes two critical characteristics of models related to intraindustry trade: "diverse consumer preferences and increasing returns". The latter feature is especially interesting, since allowing a departure from the simplified assumption of constant returns to scale by explicitly including increasing returns in the model has showcased an alternative source of specialization to that of comparative advantage. However, despite calling economies of scale a particularly simple explanation for trade, Parjanne notes that there is a great deal of difference between models and there is lack of a general theory of imperfect competition or of preference for differentiated products.[56]

Product differentiation is empirically difficult to measure and could be theoretically either technological, vertical or horizontal in nature. Horizontal differentiation reflects goods that have similar prices and production functions – and quality – but are different in colour

[52] Parjanne 1992, 14
[53] Ibid., 6
[54] Pihkala 2007, 39–40
[55] Ibid., 40
[56] Parjanne 1992, 8

or concerning other attributes. Vertical differentiation reflects different levels of quality. Average cars with different models are horizontally differentiated whereas Volkswagen or Mercedes reflect vertical differences of quality. Technological differences are not connected to NTT, but to product cycle and technological gap theories, and they arise from technical innovations that transform goods into new and improved ones regardless of quality. In empirical terms research intensity could be related to either horizontal or vertical differentiation. In fact, if it increases beyond some point it may reflect technological differentiation, which has a negative relationship with intraindustry trade.[57]

The new insights into intraindustry trade concerning monopolistic competition, differentiated products and increasing returns to scale were combined by Elhanan Helpman and Paul Krugman in 1985. According to their model there will be gains from trade due to product differentiation which will most likely lower prices and also increase the variety of products. Furthermore, economies of scale and specialization should increase industries' efficiency and lower their average costs. It should be noted though, that according to Parjanne, this model is compatible with Heckscher-Ohlin theory – "two kinds of trade are thus distinguished: inter-industry trade based on comparative advantage and intraindustry trade based on scale economies".[58]

Lisbeth Hellvin and Johan Torstensson claim that the empirical relevance of Heckscher-Ohlin theorem was vindicated by the emergence of New Trade Theory once the theorem was shown to be combinable with "imperfect competition, increasing returns to scale and trade impediments".[59] The possibility of combining elements from two main models of foreign trade has to be considered then. There are two alternative Heckscher-Ohlin augmented models that can account for both inter-industry and intraindustry trade: Chamberlin-Heckscher-Ohlin model and Robert Falvey's neo–H–O model.

In the Chamberlin-Heckscher-Ohlin model (C–H–O model) factor endowments determine industrial structure of a given country, but economies of scale and product differentiation may also affect the internal structure of these industries, creating intra-industrial specialization. Free trade will create export patterns per comparative advantage as with the H–O model but preferences for and production of different varieties can also lead into simultaneous intraindustry trade. IIT encompasses all foreign trade if trade

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[57] Parjanne 1992, 27–28, 91. This non-linear relationship can be captured with a quadratic specification.
[58] Ibid., 7, 10–12
[59] Hellvin & Torstensson 1991, 380. One should note that they did not test such a combination in their own article – only the basic H–O model with capital and labour.

partners' factor proportions are identical. However, the converse is not true since different factor proportions lead to both types of trade. Another way of expressing the C–H–O model is to think of H–O model explaining inter-industry trade and economies of scale and horizontal product differentiation explaining intraindustry trade.[60]

The impact of economies of scale is not clear though. Don Clark suggests that it is unrelated to intraindustry trade, which should be explained with product differentiation instead, and that most tests of NTT find a negative relationship between IIT and scale economies.[61] Helpman elaborates that "what matters is that economies of scale exist, not their size".[62] While the existence of economies of scale alongside product differentiation could determine specialization and trade volume, this complicates its testing. No trade model has argued that, holding other variables fixed, the partial correlation of scale economies on intraindustry trade would be positive.[63] It should also be noted that the type of increasing returns in the C–H–O model is internal, not external, although Parjanne adds that the model's predictions are broadly similar if external returns are assumed.[64]

A model that concentrates solely on product differentiation is Falvey's neo-H-O model, which Parjanne defines as a "minor extension of the H-O model" as it does not alter its set of assumptions greatly, particularly not the constant returns to scale.[65] Falvey essentially assumes that there is income-determined demand for products characterized by vertical differentiation or different levels of quality. Goods of higher quality are exported by relatively capital intensive countries, which conversely import low-quality products. Parjanne points out that Falvey's model is reminiscent of Linder's idea of market extension.[66] The Neo–H–O model can be tested by unit-value dispersion of exports compared with imports, assuming that prices therein are determined by.[67]

However, NTT's general relevance has been questioned in an empirical study by David Hummels and James Levinsohn who conclude that intraindustry trade seems more

[60] Parjanne 1992, 31, 46
[61] Clark 2010, 190–191
[62] Helpman 1999, 136
[63] Leamer 1994, 87
[64] Helpman 1999, 136; Parjanne 1992, 11, 46–47
[65] Ibid., 10
[66] Ibid., 10
[67] Varian 2017, 140; Greenaway, Hine & Milner 1995, 1508–1509; Falvey 1981. Varian's cut-off point is +/- 15% while Greenway et al. use both it and +/- 25% thresholds. These can be considered somewhat arbitrary. The idea is that large deviations can be accounted only by quality and minor price differences are caused by horizontal differentiation or consumer preferences.

associated with country-pairs than with factor differences.[68] Indeed, model literature after the emergence of NTT began to revolve around different schools of though and economists began to combine Heckscher-Ohlin and Ricardian models.

For example, Donald Davis argues that an H–O model augmented with technological differences, the Heckscher-Ohlin-Ricardo model, can result in IIT. His argument is that there is a rationale for trading products characterized by similar factor intensities if there are even small technology differences across countries considering this industry. Davis asserts that if these differences exist, expanding the production of one intraindustrial product can be done by releasing factor inputs from another intra-industrial good without rising marginal opportunity cost. However, the model is not verified empirically. Additionally, its concept of technical advantage is more absolute than comparative.[69]

Helpman, perhaps unsurprisingly considering that he formulated NTT with Krugman, argues that Davis' approach of homogenous products with differing production technology is more cumbersome than explaining IIT more "naturally" with product differentiation.[70] Kwok Tong Soo on the other hand states that the impact of Davis' model is driven by consumer appreciation of technically differentiated goods relative to technically identical goods.[71] The intuition is quite close to Falvey's neo–H–O model.[72] Unfortunately, neither Soo nor Davis offer much guidance in on how to adapt the theory in an empirical framework. Davis did consider a Heckscher-Ohlin-Vanek model application in 1997, but its cross-country approach is outside of the scope here.[73]

Other combinations of H–O and Ricardian models were formulated by James Harrigan in 1997 and Peter Morrow in 2010. I must praise Harrigan for actually empirically verifying the relevance of his trade model, although this was based on GDP shares and not on measures of trade. He attempts to model technology differences by benchmarking sectoral technologies relative to a given country,[74] which requires a cross-country study that is beyond the scope of this thesis. Morrow's study is rather simplistic in the sense that it considers only skill intensity as a factor endowment.[75] Yet he does show that while

[68] Hummels & Levinsohn 1995, 813–814, 828. They consider income, capital and land per worker.
[69] Davis 1995, 206–207, 209–218. The model also assumes that the technologically advantageous good is produced at home completely.
[70] Helpman 1999, 139
[71] Soo 2009, 752
[72] Soo 2005, 3
[73] See Davis 1997.
[74] Harrigan 1997, 476–478
[75] Morrow 2010, 144

productivity differences across industries should not constitute an omitted bias for H–O model, there is some evidence that the reverse is true. A key point of interest is that Morrow argues that both the H–O and Ricardian models are explanatory in explaining commodity structure. These associations are robust and factor endowments' impact is as twice as strong as Ricardian productivity.[76]

It should be noted that most of the discussion here predates Jonathan Eaton's and Samuel Kortum's article from 2002.[77] According to David Chor, older Ricardian models were not easily applied empirically since they were two-country models with complete specialization. Indeed, Ricardian models were criticised for lacking the qualities of the H–O model namely "simplicity, clarity and intuitive appeal" in 1981 for example.[78] Eaton and Kortum were game-changers in a way since the pair managed to obtain a good fit with Ricardian theory and empirical data. I will not go over the mechanics of the model, as what is important is how it was viewed as "an important piece of evidence of the role productivity differences in determining comparative advantage".[79] What ensued in its wake was a growth in neo-Ricardian modelling.[80]

One such trade model was formulated by Arnaud Costinot, Dave Donaldson and Ivana Komunjer who explicitly refer to this "seminal" article.[81] The trio maintain that the lack of an interest in Ricardian empirics was not due to a lack of appreciation for technology among economists, but rather because there was no theoretical foundation for guiding empirical studies. The authors derive a model that can be tested empirically by using a differences-in-differences regression where log of exports is explained by trade and productivity data. The model can be viewed as ground-breaking, if it is indeed "the first theoretically consistent Ricardian test" that captures what the authors call fundamental productivity, which consists of institutions, infrastructure and climate here.[82]

There seems to be an increasing acknowledgement of the plurality of explanations in modern trade literature, which can be seen in Costinot's, Donaldson's and Komunjer's list of empirical studies of comparative advantage – ranging from institutional to factor

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[76] Morrow 2010, 138, 149. The author's argument is based partly on an IV variable of lagged values, which is not a good IV measure. See Morrow 2010, 147.
[77] See Eaton & Kortum 2002
[78] Hamilton & Söderström 1981, 198–199
[79] Chor 2010, 152
[80] Eaton & Kortum 2012
[81] Costinot, Donaldson & Komunjer 2012, 581
[82] Ibid., 581–582

endowment explanations.[83] Chor mentions two strands of literature in addition to the Ricardian resurgence: models based on institutional variables such as contract enforcement, financial development and labour market flexibility and those pertaining to the conventional Heckscher-Ohlin theory. On one hand this reveals that "moving beyond this neoclassical focus" institutional theories have become more prominent, if not standard, explanations.[84] On the other hand, New Trade Theory is not mentioned by the author at all which is quite telling in its own way.[85]

The appreciation of institutions and a variety of models is perhaps exemplified by articles where comparative advantage is explained with factors unmentioned by conventional models. One study for instance argues that institutional differences, especially labour market flexibility, can give rise to comparative advantage,[86] whereas another one concludes that financial liberalization tends to increase exports, particularly in "sectors intensive in external finance and softer assets".[87] Infrastructure has also been suggested as a source of total factor productivity differences between countries and industries by Stephen Yeaple and Stephen Golup, although they note that Finland's rapid productivity growth did not coincide with increases in infrastructure during 1979–1997.[88]

While one often assumes that the discussion of foreign trade pertains to commodities, there is evidence to suggest that the notions suggested here do apply also to trade in services. According to André Sapir and Chantal Winter, empirical studies have suggested that within the framework of H–O model a country abundant in physical capital enjoys an advantage in transportation exports whereas a country well-endowed in human capital will specialize in insurance and private services. There is also non-empirical research that suggests that theories of comparative advantage apply to service trade, but these industries are more likely to be subjected to increasing returns to scale and imperfect competition.[89]

It could also be noted that there are alternatives to the neoclassical and institutional trade theories reviewed here such as structuralist theories that interpret international trade as a

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[83] Costinot, Donaldson & Komunjer 2012, 583
[84] Chor 2010, 152
[85] Ibid.
[86] Cuñat & Melitz 2012, 225–226, 236, 247–248. The model implies that a country with inflexible labour can import flexible labour from other countries. Finland's labour market flexibility index is 56 for the year 2004, which is larger than indices for France or Spain, but much smaller than Singapore and Hong Kong.
[87] Manova 2008, 33–35. The result is based on the idea that industries which can satisfy their financial needs internally have lesser need for external finance.
[88] Yeaple & Golup 2007, 223–224, 232–237
[89] Sapir & Winter 1994, 282–283

form of exploitation. Yet they are not easily combined with the Finnish development of the recent decades.[90]

Another blind spot in the discussion here is the implicit assumption that industries, products and companies are equivalent. In fact companies may differ to great extent in their productivity even if they belong to the same industry. Exporting companies tend to be "larger, more productive, more capital intensive and more research and development -oriented" than home market companies.[91] Since this applies to present-day developing countries, one might assume that it also applies to the Finnish economy of the past. In conjunction with institutional and policy indicators, firm-level factors, such as quality and firm appeal, explain a significant amount of differences in competitiveness across countries. This is a potential source of the Leontief paradox as exporting companies tend to be capital and skill intensive. It has also been suggested that international trade requires more skill intensity than domestic production in the first place.[92]

2.3 Previous Research on Determinants of Export Structure

> A typical feature of the literature on international trade is that there is an infinite amount of theorems, models and logical argumentation, but not much attention has been paid to the operationalization and testing of these theoretical relationships.[93]

Arguably, formulation of trade theories is more common than their estimation in economics. That is not say there have not been empirical studies, but that the link between the two is often flimsy. However, in the Finnish case economic studies of trade structure during 1956–1989 tend to be few and far between. The situation is not that different in historical studies. Although the diversification of Finnish exports has been noted, there is no comprehensive text on the determinants of exports structure nor have there been econometric cross-sectional, time-series or panel data analyses on the question. Relevant research tends to entail either general overviews or studies covering a limited time span.

There are also some contemporary economic studies or historical research on certain industries. Forest industries have been researched to a great extent in Finland,[94] and there are also studies regarding metal industries. Tuomas Larjavaara's study of metal

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[90] Paavonen 2008, 23
[91] Haaparanta et al. 2017, 68
[92] Ibid., 68–70; Bernard et al. 2012, 287; Melitz 2003.
[93] Parjanne 1992, 14
[94] See Jensen-Eriksen 2007, Heikkinen 2000 or Ahvenainen 1984 for example.

engineering exports is somewhat like mine since he noted that the H–O model could not explain these exports comprehensively and a wider approach was required.[95] Yet these studies do not consider the determinants of all exports. I will therefore only mention them when they can illuminate certain observations or points of detail.

Here I consider several strands of research pertaining to the topic: general economic histories, monographies on trade integration by Juhana Aunesluoma and Tapani Paavonen, contemporary input-output studies influenced by Heckscher-Ohlin model by Reino Hjerppe in 1975 and Pekka Parkkinen in 1977 and index calculations by Ilkka Kajaste for the 1980s. Additionally, there are interesting economic historical applications of the H–O model, both by Finnish researchers and others. International research that does not focus on Finland, but is relevant to the approach at hand is considered too then.

The only economic historical research in Finland that is influenced by the H–O model consists of an article by Heikkinen and Hjerppe for the years prior to both the First and the Second World War respectively, and its critique by Jari Kauppila. Since the latter is based on the historical input-output tables for 1928, it is the more convincing one. However, H–O notions are covered only to a limited degree in both texts. Labour intensity was the only factor quantified explicitly by Heikkinen and Hjerppe with the wage sum's share of value added, which was also compared to value-added.[96] Applying this approach on nine industries, the authors conclude that there were no capital intensive sectors with high value-added in Finland. In fact, only paper and foodstuffs, beverage and tobacco industries were capital intensive in this framework. The authors explain the results on the grounds that paper industry had raised its productivity through mechanization and more effective production processes. Metal and woodworking industries were conversely labour intensive.[97]

Following Leontief,[98] Kauppila calculates the ratio of comparative capital/labour intensity of imports compared to exports for 1928: 0.5. He concludes that "Finland exported commodities which absorbed more capital and less labour, on average, than

[95] Larjavaara 1978, 194
[96] Capital intensity was assumed to be inversely related labour intensity.
[97] Heikkinen & Hjerppe 1983, 122–123
[98] The basic calculation is as follows: total labour and capital requirements are calculated for exports and competitive imports, which are then used to calculate capital/labour ratios for both. The ratio for imports divided by that of exports yields an index number which Leontief assumed to correspond with relative capital abundance when less than 1.0 and with relative labour abundance when over 1.0. See Leontief 1956 for more details.

would have been required for the production of the goods it found cheaper to import".[99] However, there were only two industries with capital-labour ratios clearly higher than average: paper manufactures and mining, with chemical and non-metallic mineral industries being borderline cases. The paper industry's high ratio is related to the development identified by Heikkinen and Hjerppe – mechanization and the rationalization of production – whereas woodworking was relatively labour intensive probably due to seasonal labour force used in the exploitation of forest resources. Taking into account both direct and indirect requirements, Kauppila notes that the Heikkinen and Hjerppe seem to have overemphasized capital intensity of food manufacturing.[100] Metal manufacturing's labour intensity increased substantially when including indirect requirements, but it was still more capital intensive than what was argued by Heikkinen and Hjerppe.[101]

In conclusion, there exists "partial support to Heckscher-Ohlin theorem" in the Finland of 1928, since the country exported relatively more capital intensive products and imported relatively more labour intensive products.[102] However, woodworking industry was relatively labour intensive export industry, which is contrary to what the model predicts. Kauppila argues that this industry was based on forest resources and on log-floating on Finland's river network which was effectively a natural infrastructure endowment. Therefore Finnish comparative advantage was based on natural resources and "a sufficient stock of labour to exploit these advantages", but this changed when capital intensive paper exports became predominant during the depression of the 1930s.[103]

Although I argued before that Finnish economic historians have not engaged in empirical work with the intent of locating the most important determinants of Finnish export structure in the post-war period, I am not claiming there has been no discussion on the topic. Justification on the choices of determinants is not always explicit however, and these statements are not verified with econometric methods for example.

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[99] Kauppila 2007, 122–124
[100] Ibid., 123–125
[101] Ibid., 122–125. Kauppila criticises Heikkinen and Hjerppe on several grounds. First, their measure is calculated with wages instead of working hours or years, secondly they forego the possibility that an industry is simultaneously using capital and labour inputs less than average and lastly they consider direct labour inputs instead of both direct and indirect requirements.
[102] Ibid., 249
[103] Ibid., 125–126

Take Kaukiainen who states that labour costs rose in the post-war decades to the extent that export specialization began to depend on other factors. Both export diversification and intraindustry trade indicate that "comparative advantages, at least those that depend on resources and other natural endowments, have lost in importance compared with capital and know-how".[104] However, how the author arrived at such a conclusion is not clear: the statement seems to have been derived from Pihkala's description of the increasing amount of demand, neo-technological and New Trade theories.[105]

As mentioned before, Riitta Hjerppe stresses that in the long-term Finnish economic life was shaped by supply-side factors such as "labour, capital and natural resources" but also by technology and institutions.[106] She mentions human capital, but argues that it and professional skills, know-how and technological innovation depend on each other. She concludes that while wood is the most abundant resource in Finland, production based on other materials has grown. Yet this is only a general account on Finnish economic development and regarding specifically post-war exports Hjerppe only notes that they tended to be capital intensive "with regard to their resource base".[107]

The claim there is based on Reino Hjerppe's model, which is considered later.[108] Elsewhere she maintains that Finnish manufacturing as a whole was primarily based on forest resources in the 1950s. From the late 1950s to the 1960s, liberalization of foreign trade induced an investment programme in wood and paper industries – which can be considered as capital intensity. Hjerppe mentions that the ability to use foreign technology – as most novel technology was acquired through the imports of production machinery and licences – reflected satisfactory professional skills of labour which can be interpreted as human capital's newfound importance. Hjerppe's views are very much framed in a Heckscher–Ohlinian perspective.[109]

Paavonen adds that Finland's foreign trade was based on comparative advantage during the *protectionist* period before the 1960s. Although not explicitly stated as such Paavonen's idea of comparative advantage is related to the H–O model as well. Finland

[104] Kaukiainen 2006, 151
[105] Based on Kaukiainen 2006, footnote 21 and Pihkala 1988. There is no description quite like Kaukiainen's in the pages mentioned. It is also not explicitly argued how IIT is connected with capital or know-how, although Kaukiainen could be considering Falvey's model or product quality implicitly.
[106] Hjerppe 1989, 169
[107] Ibid., 162, 169–170
[108] Ibid., 162
[109] Ibid., 430–431

was endowed with “forest resources, relatively abundant ore of non-ferrous metals, water resources and log floating ways and cheap, uneducated workforce”.[110] Aside from forest industries, comparative advantage was also found in particularly clothing industry, due to abundance of cheap labour. In the 2000s, the forest endowment and the respective sector remain significant – though in smaller scope – whereas hydropower was already fully utilized by the 1970s which was followed by the depletion of ore resources in the 1980s. During the same time Finland ceased to be a source for cheap labour, which Paavonen partly attributes to solidary wage policy of the time. This effectively meant that wage differences between productive and unproductive industries were flattened, which according to Erik Dahmén led to slower structural transformation.[111]

Aunesluoma argues that unlike the 19th century globalization, characterized by raw materials and comparative advantage, the post-war period was conversely defined by manufactures and taking advantage of economies of scale.[112] Paavonen sees this shift into scale advantage as linked with the integrationist period starting in the 1960s and export diversification.[113] Neither researcher empirically verifies whether scale advantage was a determinant of exports. Both of them seem to derive the claim’s validity from New Trade Theory and its ability to explain IIT. While Paavonen does link IIT to product differentiation, he treats NTT primarily as a synonym for economies of scale, which is somewhat misleading since product differentiation is an important topic there as well.[114]

Economic historical research has mentioned other possible determinants of trade as well. Pihkala juxtaposes structural changes in foreign trade with free trade integration and remittent devaluations of markka. For instance, the devaluation of 1957 was motivated by the expansion of paper industry and the exploitation of forest resources. The resulting growth in exports ended in the mid-1960s, after which focus shifted onto increasing the value-added of forest sector – from pulp to paper and then to paper products – due to the limited availability of forest resources. The devaluation of 1967 was also not only related to the general competitiveness of exports but also to the marketing of “new exports” comprised of metal, textile and chemical exports.[115]

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110 Paavonen 2008, 257
111 Ibid., 257, 262–262; Dahmén 1963, 44
112 Aunesluoma 2011, 154
113 Paavonen 2008, 260. Paavonen argues that comparative advantage still had a role in increasing the value-added in traditional export industries.
114 Aunesluoma 2011, 154; Paavonen 2008, 22
115 Pihkala 1982a, 376

I already mentioned studies by Aunesluoma and Paavonen. They are mostly concerned with free trade integration and hence connect the changes in Finnish export structure to trade liberalization and tariff reductions beginning in the 1950s. Indeed, trade was liberalized to some extent already between 1956 and 1959 – for example 76% of Finland's imports from Western Europe were liberalized in conjunction with the devaluation of 1957. Subsequent trade agreements included FINEFTA in 1961, EEC agreement in 1973 and different global agreements related to GATT.[116]

At the time, predictions on FINEFTA's impacts were mostly interpreted through the conventional H–O model. Free trade was believed to enlarge labour intensive industries, since Finland was poor in capital yet rich in relatively affordable labour – although this was not necessarily the case based on Pohjola's arguments in 1996.[117] Free trade integration ended up affecting the formerly protected labour intensive textile industry the most, but also metal industry which was dependent on both home markets and Eastern Trade. As a consequence of FINEFTA, trade to signatory countries both increased and diversified. That trade integration might have been an important determinant of exports structure needs to be acknowledged then.[118]

To understand this argument more in detail, one needs to remember that there was a clear division between Finnish industries. The internationally oriented forest industry was counterbalanced by an uncompetitive domestic manufacturing. This fact of economic life harkens back to the interwar period. Finnish domestic manufacturing, protected by tariffs, was diverse in sectorial terms – but basic on a product level.[119]

That changed when domestic manufacturing was subjected to foreign competition. Some sectors suffered while others managed to specialize and compete in the world markets. At least by the 1980s, terms like "domestic manufacturing"[120] and "new exports"[121] had lost their meaning due to diversification of exports. Only food manufacturing, graphic industry and manufacture of construction goods could be defined as home market industries at that point. However, Aunesluoma adds that the term "domestic

[116] Aunesluoma 2011, 286; Pihkala 2001, 194–197
[117] Aunesluoma 2011, 221; Pohjola 1996, 111–112
[118] Aunesluoma 2011, 216–217; Paavonen 2008, 252–254
[119] Ibid., 11, 258; Kaukiainen 2006, 150–151; Hjerppe 1982, 408
[120] Translated from: "kotimarkkinateollisuus".
[121] Translated from: "uusvienti".

manufacturing" was replaced by concepts like "sensitive sectors"[122] or "labour intensive industry"[123] so the development might not have been that clear-cut.[124]

Evaluating the exact importance of trade integration on export structure is difficult, since one cannot simply assert what the counterfactual autarchic development would have entailed. Economic changes would have probably been similar, though occurring at a slower pace.[125] Aunesluoma thinks that had FINEFTA been discarded, exports into the West would have continued, but from a more handicapped situation. Exports of more highly refined products would have been more difficult whereas those of low quality such as wood pulp would have been more viable. It is interesting to note that Swedish forest companies ultimately and in spite of trade integration chose the latter option while Finnish firms invested heavily in new paper production, which led into fast development.[126] Additionally, Swedish textile companies invested in Finland at the end of 1960s due to lower labour costs, which was made possible not only by the FINEFTA trade agreement but also by the devaluation of Markka in 1967.[127]

Another important characteristic of the era was the emergence of intraindustry trade. Paavonen does not focus on the economic determinants for Finnish IIT himself, but he does refer to studies performed in the 1980s which have identified a vast set of explanatory factors such as income levels, small differences in size of market areas or high R&D expenditure. Aside from Soviet trade there was an increasing tendency for IIT to grow after 1960, whether with Sweden, Britain, Efta or EEC or EU. Trade with Sweden was especially of intraindustrial nature, and noticeably more than the total trade with Western countries. Paavonen thinks that Efta integration likely promoted this development, although the general trend is not as drastic when also including non-manufacturing SITC categories.[128]

I will not discuss research on intraindustry trade greatly, since explaining its magnitude in comparison with inter-industry trade is not the main topic of this thesis. Besides, there is ample research already on the topic. Yet determinants of IIT across industries cannot

[122] Translated from: "arat alat".
[123] Translated from: "työvoimavaltainen ala".
[124] Aunesluoma 2011, 289
[125] Paavonen 2008, 252–254
[126] Aunesluoma 2011, 213, 216. Aunesluoma believes this to be a form of Nordic division of labour and specialization, and a result of free trade integration.
[127] Ibid., 213–216
[128] Paavonen 2008, 260–261

be ignored insofar as they determined a substantial portion of Finnish trade structure, or so is presumed in many studies.[129] Parjanne probably has the most comprehensive study on IIT, but she considers only the year 1985. She found several NTT variables to be statistically significant with correct signs: relative advertising expenditure reflecting brand, average plant size reflecting scale advantage, and decreasing concentration ratio reflecting monopolistic competition.[130] While Parjanne's study shows that intraindustry trade in Finland can be explained with New Trade Theory, it does not actually control for factor endowments nor does it explain their relevance in a meaningful way.[131]

Jan Otto Andersson and Yrjänä Tolonen have an especially pertinent study concerning IIT for this thesis. They argue that it increased in Finland during 1960–1980 when the country was a net-importer but then ceased when Finland became, if it already was not on some industry, a net-exporter. According to the authors, this tendency indicates that this type of trade was not "real" intraindustry trade, but rather a cause of change in Finland's place in international division of labour. They assert that IIT would have increased in the absence of trade liberalization anyway since it grew in Finnish trade with West-Germany in the 1960s, before the EEC agreement.[132]

The authors' explanation for increasing trend of IIT is that Finland managed to leverage its position between Sweden and Soviet Union. Swedish trade flourished due to cultural proximity and low labour costs according to product cycle theory.[133] The authors also mention, perhaps referring to Linder's theory, that Sweden was also used as an expanded home market for highly income-elastic products. Trade with Soviet Union allowed Finland to specialize in products which were relatively technologically demanding. The extent of these exports grew in accordance with imports thanks to Eastern Trade's bilateral clearing system. However, these arguments are not tested, only suggested.[134]

The third part of previous research is comprised of Reino Hjerppe's and Pekka Parkkinen's input-output applications written in the 1970s. Indeed, both share a perspective close to the H–O model. However, their approach there differs from mine, since even if factor intensities are considered in this thesis, it remains a cross-industry

[129] See Erkkilä 1993; Parjanne 1992; Parjanne 1989; Andersson 1987 or Andersson & Tolonen, 1982.
[130] Parjanne 1992, 194–195
[131] Ibid., 82. GDP per capita is used as a proxy variable for factor compositions.
[132]Andersson & Tolonen 1982, 33, 35
[133] I must admit that I find their argument over cultural proximity slightly impressionistic. One could speculate that their Swedish-speaking background in Åbo Akademi has something to do with it.
[134] Ibid., 33, 35. They are explicitly based on product cycle and market area theories.

study that estimates different variables' impact on export structure. Parkkinen's approach is actually completely opposite since he studies how commodity structure of trade changed input structure and not the other way around.[135]

Reino Hjerppe's study on Finnish factor intensities and their efficiency during 1965–1970 is primarily focused on capital and labour whereas natural resources are only considered in discussing the results and human capital is mostly disregarded. It should be noted that his study is more of a theoretical exercise where alternative models for input-output analysis are estimated.[136] More specifically he constructed a model with 34 industries that maximizes private consumption, with alternative criteria to test whether the estimated situation in 1965 corresponded with 1970.[137]

Hjerppe generalized the situation leading to the 1970s thus: Finland specialized as Heckscher-Ohlin model implied by exporting goods of forest industries, which are characteristically relatively capital intensive processing industries at an advantage if there is an abundance of raw materials. The technological level of forest industries was also quite high, which leads Hjerppe to characterize Finland as a dual economy with a relatively developed export sector and a traditional domestic one. Hjerppe mentions natural resources as having been thought of an important determinant for Finnish exports and also suggests that it is possible that the long tradition of Finnish wood manufacturing has produced related know-how and technological and marketing skills to the extent that affects Finland's position in the international division of labour.[138]

Hjerppe concludes that it seemed that capital intensive production was not optimal and economic policy that propagated expansion of that kind of basic industry ought to be avoided unless that expansion was not targeted on a sector which had an existing comparative advantage.[139] This is reminiscent of Matti Pohjola's argument that the level of capital intensity of Finnish post-war economy was inefficiently high.[140] Hjerppe's model implied that pulp and paper production had expanded too much.[141] The basic, raw material-producing industries whose expansion was also criticized consisted of textile

[135] Parkkinen 1977, 3
[136] Hjerppe 1975, 130, 136–140
[137] Ibid., 1–6, 150–161
[138] Ibid., 159–161
[139] Ibid., 160
[140] See Pohjola 1996.
[141] Hjerppe 1975, 149–150. Also see Ibid., 160 for welfare-maximizing predictions which include growth in industries – some of which could be considered belonging in new exports.

industry and the basic manufactures of wood and metal industries. A better alternative in Hjerppe's mind would have been increasing production of industries with high value-added. At least in the case of textile exports, which eventually collapsed, Hjerppe's argument was far-sighted, although basic metal exports did not share the same fate.[142]

Parkkinen's licentiate thesis discusses input and natural resource structure of Finnish commodity exports in 1964–1975, the period which broadly reflects the changes driven by Efta integration.[143] This study is interesting since it does not only contain empirical findings, but it also tests Ricardian and H–O models, and to a lesser degree, scale advantage and new technology theories.[144] In other words, Parkkinen shares my appreciation for considering multiple models though his focus is more on testing them. Parkkinen concluded that the H–O model was not supported by comparisons of capital intensity between exports and imports. For 1970: out of 12 export market areas, there were only four in which the Leontief paradox did not hold.[145] However, with human capital and natural resources there was some evidence for H–O model's validity. Particularly renewable natural resource exports were distinctively intensive in Finnish commodity and service exports during 1970.[146]

The structure of commodity exports became more labour intensive in 1964–1975 while human capital intensity, measured by income level, decreased. Based on the H–O model, one should frame Finnish comparative advantage during 1964–1975 to be found in industries requiring low skills. Textile and assorted industries, containing a great deal of labour but not much physical nor human capital, increased their export shares rapidly. Parkkinen also argues that this was related to the devaluation of 1967 and trade liberalization. The former lowered Finnish labour costs while the latter was especially conducive to lowering trade barriers concerning textile and assorted industries. There was also a similar effect for resource intensive exports.[147]

Unlike H–O model, Ricardian theory was supported by the finding that commodity exports were more productive than imports except with Sweden and Soviet Union. That is, the Ricardian notion predicted the structure of trade correctly in ten market areas out

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[142] Hjerppe 1975, 168
[143] Parkkinen 1977, 3–5
[144] Ibid., 152
[145] Ibid., 49–50. Essentially the figures for imports suppose what the input structure would have been had hypothetical domestic production substituted imports.
[146] Ibid., 161–162, 165–166
[147] Ibid., 95, 152

of 12 – decidedly better than the H–O model.[148] Tests pertaining to scale advantage and technology theories are less certain.[149] Concerning novel technologies, Finland imported goods reflective of human capital from technologically advanced countries at least relative to its exports. On scale advantage, Parkkinen mostly notes that Finland had a tendency to export forest products to large countries characterized by scale advantage and imported non-renewable resources therefrom.[150]

While Parkkinen and Hjerppe analysed, if not early, then at least the middle post-war period, Kajaste studied sectoral specialization for the late post-war era of the 1980s. Using different proxies for comparative advantage he notes that the hypothesis that "strongly" competitive fields should grow did not hold in the 1980s. Only a third of these increased their standing in production and exports. It is noteworthy that the share of forest exports in both EEC trade and elsewhere decreased, even when the last tariff barriers concerning forest products were finally lifted in the 1980s. The EEC agreement seems to have created more diversification since it increased metal engineering and chemical exports alongside those of weakly competitive fields. While this might reflect a shift in comparative advantage, Kajaste was also clearly aware of new developments in international trade theory as he also refers to the possibility that specialization might have been also determined by economies of scale, technology, and product differentiation.[151]

By the latter half of 1980s, the aforementioned "weak fields" of business, designated beforehand by previous studies, tended to reflect specialization in labour intensive industries, and to some extent industries with low factor intensities across the board.[152] Finland was not especially capital intensive or skill intensive. On the other hand, Finland's dependence on skill intensity increased after the early 1980s when the country had been even more labour intensive and less skill intensive. Capital intensive industries with low R&D intensity were less at a comparative advantage in the late 1980s while capital intensive industries with high R&D intensity were marginally better off. The loss of comparative advantage in labour intensive industries was a general European phenomenon that affected South European countries alongside Finland and Austria. Yet

[148] Parkkinen 1977, 137–138, 141
[149] Ibid., 121, 131, 142. Scale advantage and technology countries were assigned, not measured, on a country level by Parkkinen. Finland was neither. Additionally, Parkkinen's sample size is quite low.
[150] Ibid., 142–150
[151] Kajaste 1991, 481–482
[152] "Weak" fields include consumption goods industries whereas industries with low factor intensities are mostly related to machines used in forest industry, mining, agriculture etc. and production of wool, electric cables and flooring. See Ibid., 483–487, 491.

Sweden, for example, was more specialized than Finland in industries related to capital, research and education and the country's exports were not labour intensive.[153]

There are also a few international cross-country Heckscher-Ohlin studies which have also examined Finnish trade patterns. Robert Feenstra and Gregory Clark calculated upper and lower bounds for efficiencies of land and labour for India relative to Finland for the years 1910 and 1990 with the conclusion that Finnish labour has become more productive than land and vice versa in the Indian case. However as noted by Joel Mokyr, they do not address human capital and there is no tangible attempt to explain what happened and one could still view the results as an example of the Leontief paradox.[154]

Hellvin and Torstensson tested the H–O model in the case of Finnish and Swedish trade with Eastern Europe during 1985. While communist economies were characterized by administrative pricing and a lack of market competition, they claim that the general hypothesis of factor endowments determining trade patterns can still be tested. Finland and Sweden were found to be more abundant in human and physical capital than the Soviet Union, but Finland was paradoxically a net importer of physical capital intensive goods and an exporter of human capital, though the latter variable was statistically non-significant.[155] The authors believe that the result might be due to politics associated with Eastern Trade. Furthermore, they mention that it tended to be more capital intensive than what the H–O model predicts because the Soviet preference for labour theory of value underrates capital. Therefore, one can treat the unpredicted trade pattern as a symptom of either H–O model's weakness or Eastern Trade's distortionary effects.[156]

Although the chapter so far has incorporated both economic historical and economic studies in discussing studies of countries other than Finland I will focus on just economic historic studies, since they reflect the empirical approach adopted in this thesis more closely. Naturally, there are numerous empirical applications of trade models within economics that focus on other countries. Robert Baldwin for example studied Heckscher-Ohlin factors in conjunction with unionization, scale advantage and monopolistic competition concerning U.S. trade structure in 1971, well before the general formulation

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[153] Kajaste 1991, 484–488

[154] Clark & Feenstra 2003, 302–311; Mokyr 2003, 316–317, 320

[155] It is written in the text that Finland was a net exporter of physical capital against theoretical predictions which must be a writing typo since the regression table and the rest of the writing imply otherwise.

[156] Hellvin & Torstensson 1991, 380, 383–387. One might criticize the study for assuming that Finland and Sweden share the same factor intensities as those obtained from US data.

of NTT.[157] Yet I do not discuss these studies here, since that has already been done in more depth elsewhere.[158] Furthermore, since they are similar in approach with economic historical trade studies, there is not much sense in repeating the same intuition.

It has been noted that Ricardian empirics tended to be quite rare, because comparative advantage is difficult to measure. Indeed, a real study of comparative advantage should test productivity growth across both countries and industries: sectoral productivity growth has no effect on trade if it coincides in every country nor would general growth since it does not change relative competitiveness between industries.[159] Observed correlation with trade and sectoral productivity growth could be biased by omitted variables and not relate to anything real comparative advantage then.

There are some historical studies relying on a Ricardian intuition such as those regarding the British trade prior to the First World War and productivity of British manufacturing in the long-term.[160] However, the Ricardian approach is too simplistic for the Finnish context in 1956–1989. Neither labour productivity nor total factor productivity, at least in its standard formulation, explicitly show the different impacts of forest resources, human capital or scale advantage that one might suppose are explanatory.[161] Additionally, these studies may confuse comparative with absolute advantage.

In comparison, there is a great deal of historical trade research relying on the Heckscher-Ohlin framework. Estevadeordal's article from 1997 has already been mentioned. Although the main focus there is on trade policy in 1913, Estevadeordal estimates a cross-country model with different factor endowments: skilled labour, unskilled labour, agricultural lands, mineral resources and total capital stock. Additionally, distance to markets was included, since the point was to account for trade barriers. The model itself is not based on examinations of industrial structure however, so its applicability is limited here. Although Estevadeordal's net trade regressions are mostly statistically significant, particularly labour variables tended to be less significant than the others.[162] However as

[157] Baldwin 1971
[158] See Deardorff 1984 for a review of studies concerning the post-war U.S. with tests of Ricardian, H–O and technology theories and NTT insights to a lesser degree. For testing trade theories see Leamer 1994.
[159] Dollar & Wolff 1993, 144
[160] See for example Allen 1979, and the discussion between Temin 1997 and Crafts & Harley 2000. See Broadberry 1998 considering British productivity although the focus there is not on trade patterns.
[161] Total factor productivity in fact absorbs the impact of all of these.
[162] Estevadeordal 1997, 89–90, 97–101

already noted, in a later paper written with Taylor, Estevadeordal's model performed quite badly for the pre-1914 period apart from resource intensity related to minerals.[163]

There are also cross-sectional regression analyses of the H–O model concerning Great Britain: Crafts and Thomas studied British specialization in 1910–1935, which was followed by the dissertation by Brian Varian regarding late-Victorian exports. Crafts and Thomas concluded that the H–O model, modified to account for human capital in addition to capital and unskilled labour, was an explanatory one.[164] Varian likewise included human capital, measured through industry wages, as a determinant in regression analysis.[165] Indeed, human capital and natural resources have been described as the two "third factor" solutions to the Leontief paradox.[166] The two studies here highlight that cross-industry factor endowment regressions can be explanatory, but that one needs to account for more than just labour and capital. When considering the Finnish factor endowments, natural resources are of special interest. While Varian did not find natural resources to be a statistically significant determinant of British trade in the late 1800s,[167] Wright's article on factor content of U.S. trade for 1879–1940 is quite interesting.

Wright asserts that U.S manufacturing exports were primarily intensive in non-renewable resources and increasingly so from 1880 to 1920. While capital intensity of exports was clearly higher than that of imports until 1940, there seems to be no evidence for *growing* capital intensity in the period when U.S. industrial production was heading for world domination. The same applies to human capital: higher level in exports relative to imports but a slightly decreasing trend. Conversely the largest difference in favour of U.S. exports can be seen in non-renewable natural resources.[168]

Wright's article is important for this thesis due to its finding that the fact that resource intensity is the single determinant of U.S. trade that is consistently both statistically and historically significant. This was mirrored by Estevadeordal's and Taylor's finding that factor content theory works best when it comes to resource endowments,[169] and by Parkkinen in Finland as discussed previously.[170] This could reflect the fact that the H–O

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[163] Estevadeordal & Taylor 2002, 383–388
[164] Crafts & Thomas 1986, 629, 633
[165] Varian 2017, 127
[166] Wright 1990, 654
[167] Varian 2017, 121–122
[168] Wright 1990, 651, 656–658
[169] Estevadeordal & Taylor 2002, 391–392
[170] See Parkkinen 1977.

model assumes that factors do not move across borders, which is sensible when it comes to natural resources, but perhaps not when it comes to labour and capital.

On the other hand, Wright maintains that resources were not a separate factor, but associated with capital and technology. According to him, capital intensity should not be rejected as a characteristic of U.S. manufacturing, but interpreted as rising through "specialization in an industrial technology in which capital was complementary to natural resources" rather than abundance of capital.[171] Additionally the availability of fuel and raw materials were linked to organizational innovations, like the moving assembly line. Technological innovations were not irrelevant, but they were specific to the U.S. resource environment of the time. Indeed, the importance of natural resources was less due to geological endowment itself and more due to efficiency in exploiting it.[172]

Besides standard trade models, there are also demand and neo-technological theories, which I have mentioned previously. I have not discussed them in detail since they are not often mentioned in the literature with comparison to the standard trade models. Wright's H–O article does include mentions of both Linder's market area and Vernon's product cycle theories, although he proceeds to argue that they are not relevant to the U.S. context and that supply-side factors ought to be considered instead. On the other hand, at least the so-called neo-technological approach, which stresses R&D intensity and managerial practices and science-based production processes, is not mutually exclusive with H–O factors. Applications of NTT in historical trade studies are also not common, although there are a few economic historical studies concerning IIT at least.[173]

2.4 Choosing between Trade Models

> These models are only tools, each of which is appropriate in some circumstances and inappropriate in others. Empirical enterprises should therefore not attempt to test the validity of the theories. Instead, empirical work might identify the circumstances under which each of the tools is most appropriate, or measure the 'amount' of trade that is due to each of the sources. Neither of these tasks has been accomplished or often even attempted.[174]

[171] Wright 1990, 660
[172] Ibid., 651, 661
[173] Ibid., 654–655. Neo-technological theory is not applicable to the U.S. in Wright's opinion since U.S. exports were not appreciated by European tastes and their novelty was due to "technical specifications or quality". See Varian 2017, 129–137 or Petersson 1987 for historical IIT studies.
[174] Leamer 1994, 69

Edward Leamer's quote, while otherwise insightful, errs in separating contextual validity from quantifying the importance of determinants. Even if the latter line of inquiry is my primary interest, one needs to choose the correct variables according to some framework, some model. If there are various major and minor models of foreign trade, and possible combinations such as the Chamberlin-Heckscher-Ohlin model, one needs to "identify the circumstances" in order to determine which one is the most appropriate. It is useful to consider what Rodrik recommends when choosing between economic models:

> 1. Verifying critical assumptions of a model to see how well they reflect the setting in question.
>
> 2. Verifying that the mechanisms posited in the model are, in fact, operating.
>
> 3. Verifying that the direct implications of the model are borne out.
>
> 4. Verifying whether the incidental implications, those that the model generates as a by-product, are broadly consistent with observed outcomes.[175]

One can interpret these diagnostic questions from a validity perspective: while economic models ought to be internally valid in the sense that they are consistent in their mathematic, theoretical setting, their external validity, i.e. their representation of the real-world conditions at hand, can be questioned. Rodrik asserts that external validity is contingent on the setting. On the other hand, there is no scientific method per se for determining external validity related to assumptions, mechanisms and predicted outcomes, only subjective reasoning.[176]

Verification of competing trade models according to Rodrik's four questions, albeit necessary, is of magnitude requiring its own graduate thesis. For example, testing critical assumptions is time-consuming since one would not only need to evaluate whether a given model's conclusions change drastically if these assumptions are altered but also in testing whether they are in place. However, some rationales for choosing models can be considered. On the other hand, one has to emphasize that the approach here is empirical. A choice of one model as a primary framework does not preclude taking into account different determinants. Indeed, certain characteristics that are not explicitly considered by any model here such as trade liberalization and Eastern Trade have to be discussed.

[175] Rodrik 2015, 94
[176] Ibid., 112

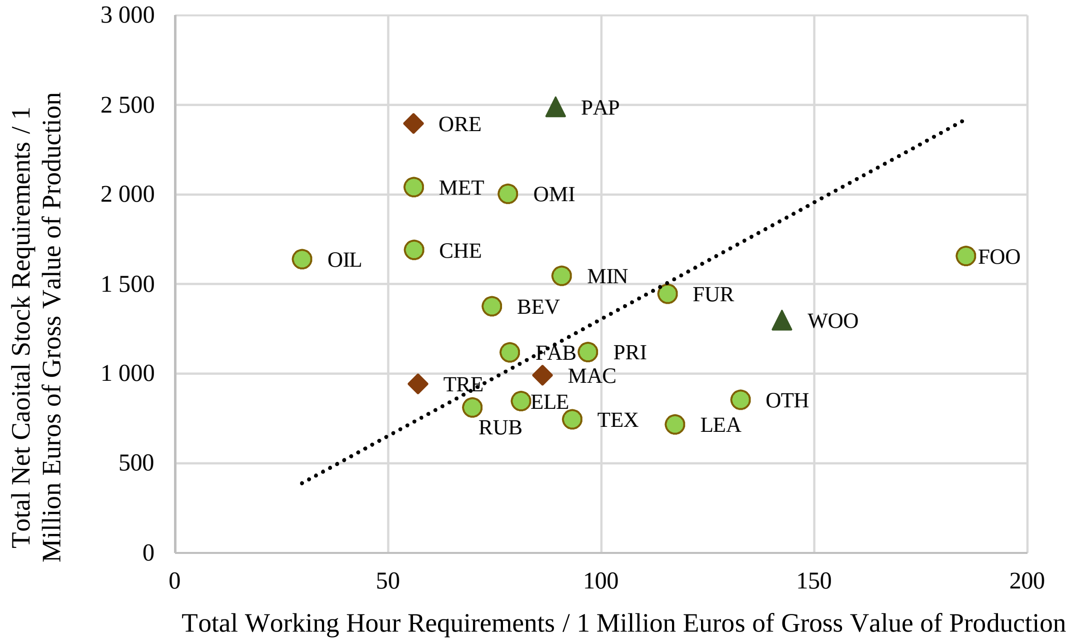
On the basis of previous studies, one can draw some generalizations on the most important determinants of trade. In particular, resource intensity is something that cannot be sidelined. First, Finnish economic history has canonized the importance of forest resources on wood and paper exports. Secondly, raw materials have been found to be statistically significant, indeed more so than other factors of production, in a number of studies.[177] Thirdly, as Romalis points out, many capital intensive industries are also raw material intensive which means that omitting the latter will overestimate the importance of capital as a determinant of trade, especially when considering poor countries that mostly refine raw materials into exports.[178] Forestry-dependent Finland of the 1950s and 1960s could be characterized along those lines. Conversely one could argue that resources can distort the H–O model, yet I would point out that theoretical consistency of an imperfect model ought not to constrain us here. Since this thesis is primarily an empirical, not a theoretical study, resources have to be explicitly considered. Another third-factor addition to the H–O model is human capital. According to Parkkinen it may have had some relevance although exports became less intensive with regards to it over 1964–1975.[179]

It seems evident that the need for a third-factor solution should be inspected. Since testing the Leontief paradox in post-war Finland requires a thesis of its own, I merely imitate Kauppila's *ad hoc* approach for 1928 in studying factor intensities of manufacturing industries. Chart 1. details the situation in 1959, prior to large-scale intraindustry trade and trade integration, when H–O model should have been more applicable.[180]

For now, I will forego the calculations behind the scatterplot – they are described in chapter 3.1 – and instead note that under the basic intuition of the two-factor H–O model countries should be either exporters of capital and importers of labour, or vice versa. As Kauppila puts it regarding 1928 "Finland exported commodities that absorbed more capital and less labour on average, than would have been required for the production of the goods it found cheaper to import".[181] This implies that export industries should have been collectively situated on the upper left-hand side of a scatterplot – such as the one here: Chart 1. – that signifies high capital intensity and low labour intensity, or a high capital/labour ratio, and importer industries should have been located on the lower right-

[177] Estevadeordal & Taylor 2002; Wright 1990; Parkkinen 1977
[178] Romalis 2004, 79
[179] Parkkinen 1977, 42, 163
[180] Kauppila 2007, 123–126
[181] Ibid., 123

Chart 1. Total Working Hour and Total Net Capital Requirements (€) per 1 Million Euros of Gross Output in Manufacturing and Mining during 1959



Notes: Both capital and labour are measured with total factor requirements defined as the number of working hours or net capital stock required to produce one million euros worth of output both directly and indirectly through the use of inputs. Dark green triangles refer to industries where value-added of exports relative to gross value of production exceeded 30%, brown squares to 10% – both being ad hoc thresholds for export industries – and light green circles otherwise signifying home market industries. The use of gross value of production as a denominator follows the logic of input-output calculations. Axis units in thousands. See the appendices for the industrial abbreviation.

Source: The author's own estimates; Statistics Finland, Input–Output Tables 1959; see the appendices on labour and capital.

hand side with low capital intensity and high labour intensity. Kauppila concluded that the notion that Finnish exports were capital intensive was confounded by woodworking exports which had a slightly lower capital/labour ratio than the average, whereas paper industry was characterized by high capital intensity.[182]

The same situation applied in 1959 as woodworking industry clearly more labour intensive less capital intensive than paper industry. However, while metal ore mining was similar to paper industry in this regard exports of transport equipment and machinery exports were not conclusively either capital or labour intensive. Export industries and domestic manufacturing did not differ clearly according to capital and labour intensity.[183] While this exercise is by no means a formal test, Chart 1. can be interpreted as a blow to the validity of the two-factor model, even if Kauppila found some qualified evidence in favour of H–O model concerning the interwar export structure.[184] And while capital

[182] Kauppila 2007, 124–125
[183] Furthermore, the scatterplot highlights that capital and labour do not have an inverse relationship, in which case industries would form into a relatively straight line from upper-left to lower-right.
[184] Ibid., 125

intensity was certainly a characteristic of paper manufacturing, other factors need to be examined in order to understand what gave impetus to other exports.

Yet the two-factor H–O model does give good indications on the topic. Parkkinen for example notes that exports, especially of textiles and assorted goods, became more labour intensive after the devaluation of 1967 and trade integration at least up to 1975. Since textiles were a key industry in new exports, labour intensity should be studied. Physical capital is more problematic due to, as argued by Pohjola, excessive capital fundamentalism, but capital intensity may have still been important.[185]

In conclusion, a four-factor Heckscher-Ohlin model, for all its deficiencies, presents a natural starting point in search of export structure's determinants. Yet it is not sufficient alone, as it can be criticized from two points of view: intraindustry trade and productivity differences. Pihkala has stated that export diversification was driven by growth in intraindustry trade, which can be observed from Table 1.[186] Statistical artefact or not, IIT implies that New Trade Theory's variables, such as product differentiation and scale advantage, should complement the four-factor model. Aunesluoma and Paavonen both claim that scale advantage became more important in the integrationist period.[187] On the other hand, Ricardian theory, recently back in fashion, that emphasizes productivity or technology can be complemented with Heckscher-Ohlin framework as well. Such a model, with constant returns to scale, can account for IIT as well according to Davis.[188]

Many of the models mentioned here lack an empirical test, which makes the choice between them more difficult. For example, Davis does not show empirically whether his model is predictive, nor is it apparent how to measure technology based on it.[189] Indeed, there is not much empirical evidence on whether technology was important or not, although Parkkinen offers limited proof that trade pattern was determined by productivity.[190]

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[185] Pohjola 1996; Parkkinen 1977, 98, 163

[186] Pihkala 1988, 84. However, the rate of IIT was still low in 1960 apart from trade with Sweden and it was still on a lower level than in other Nordic countries during the 1980s.

[187] Aunesluoma 2011, 154; Paavonen 2008, 260

[188] See Davis 1995.

[189] Ibid.

[190] Parkkinen 1977, 137–138, 141. The problem there is that Finnish export sectors having a higher productivity than import, or hypothetical import-substituting in exact terms, sectors does not necessarily account for relative productivity differences or comparative advantage in a meaningful way

Table 1. Grubel-Lloyd Indices for Intraindustry Trade in Manufacturing 1959–1989

	1959	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
FOO	55.9	73.7	82.8	97.0	86.2	76.9	86.9
BEV	14.5	30.7	83.5	66.0	73.3	82.1	92.2
TEX	18.8	54.9	83.0	94.2	94.0	95.4	64.9
LEA	13.8	53.7	84.4	91.9	90.2	84.8	71.3
WOF	3.3	12.6	11.4	9.2	16.0	23.6	35.9
PAP	1.1	3.6	3.6	6.2	6.6	7.6	9.9
GRA	27.7	42.5	80.0	78.2	82.7	98.0	85.9
CHE	20.3	30.4	34.4	69.7	66.3	72.9	67.6
OIL	0.7	1.1	20.9	71.1	61.3	67.6	48.1
RUB	5.9	19.0	49.0	61.6	76.9	82.1	64.2
MIN	74.3	66.7	61.9	99.0	86.5	89.6	94.5
MET	34.8	64.2	58.9	99.9	93.5	82.4	86.6
MFM	52.3	34.7	60.3	79.2	93.2	90.0	81.5
ELE	34.7	45.3	56.9	77.1	78.8	79.9	80.0
TRE	71.6	55.3	70.3	76.1	95.9	93.0	75.5
OTH	8.9	23.8	31.1	66.8	64.2	79.6	47.4
Median	19.5	38.6	59.6	76.6	80.8	82.1	73.4

Notes: A score of 100 refers to complete intraindustry trade whereas 0 refers to complete inter-industry trade. G-L indices were multiplied by 100 for easier perusal.

Source: The author's own estimates; Statistics Finland, Input-Output Tables 1959–1989.

The question then is whether one should consider factors pertaining to NTT or Ricardian notions. Whose assumptions correspond more aptly to Finland in 1956–1989? Consider for instance returns on scale. One can consider this to be an *a priori* critical assumption since it is the main difference between the conventional models and NTT. A Heckscher-Ohlin-Ricardo model is based on constant returns whereas as Chamberlin-Heckscher-Ohlin model is based on increasing returns. Measuring whether returns on scale were constant or increasing, or even decreasing, is largely out of the scope here. There is limited proof concerning the presence of increasing returns as Paul Hansen and Stephen Knowles have estimated the returns on scale with labour, capital and human capital inputs, following endogenous growth theory, for 1960-1985 with eleven OECD countries including Finland and observe increasing returns to scale.[191] It has been also suggested that paper and metal engineering industries had increasing returns to scale.[192]

While this gives evidence in favours of NTT, it also presents something of a conundrum: the lack of IIT in the era when paper exports were the most dominant form of trade as observed in Table 1. There is a possible game theoretical reason for this: pulp and paper companies' fear of retaliation. For example, the sales association Converta, representing

[191] See Hansen & Knowles 1998.
[192] Niemeläinen 2000, 281; Larjavaara 1978, 123

Finnish paper and board converters, entertained an idea of a marketing network in Sweden during the mid-1970s. But as the Vice-President of G.A Serlachius Oy put it, there was a "'peaceful coexistence'" between Swedish and Finnish companies that might end if Converta would "'go and mess your neighbour's affairs'".[193] Exporting to Sweden carried the risk of reprisals. In a sense, low levels of IIT might generally reflect high levels of cartelization. Of course, as seen in Table 18. customs barriers probably impeded paper imports to Finland during the primacy of forest exports to some degree, prior to free trade integration. Kaukiainen adds that the "demise of customs duties was almost contemporary with a big decrease in ocean freights", and it stands to reason that both developments should have reduced the cost disadvantage of imports and increased IIT.[194]

Indeed, another argument for the relevance of New Trade Theory is its direct implication of IIT. It is not too much of a logical stretch to argue that, while the forest sector probably depended on extensive forest resources, the observed levels of IIT meant that something else caused export growth in other industries. Of course, there are competing models here as well. There is Davis's model that explains IIT with technological differences, Falvey's neo–H–O model which explains it with capital-driven product quality and C–H–O model with horizontal product differentiation and increasing returns to scale. Again, if returns to scale were actually increasing in the time period, the C–H–O model might be the most appropriate option. Yet it and Falvey's model differ critically also in their assumptions of the nature of product differentiation, in whether it is vertical and quality-driven or horizontal and feature-driven.[195]

Falvey's neo–H–O model can be essentially summarized thusly: vertical intra-industry trade, pertaining to quality instead of attributes, will occur assuming that quality is determined by capital intensity.[196] Intra-industry trade is measured with Grubel–Lloyd index where 1.0 refers to total intra-industry trade and 0.0 to total inter-industry trade. Vertical differentiation is usually measured with unit price dispersion where a value exceeding +- 15% threshold is assumed to reflect vertical intra-industry trade. For neo–H–O model to be relevant here an industry would have to have a high G–L index score,

[193] Jensen-Eriksen 2017, 7
[194] See Kaukiainen 2006, 161–163. For a theoretical treatise on these effects see Eaton & Kortum 2002, 1751–1754, 1768–1771, 1774–1775.
[195] See Varian 2017, 140 or Greenaway, Hine & Milner 1995, 1508–1509 on measuring differentiation.
[196] Varian 2017, 109

a high rate of capital intensity and a unit price dispersion over +15. This score should be positive since Falvey assumes that capital is used to produce high quality commodities.

The results can be viewed in the appendix Table A 24. The only industry that fulfils the conditions above is forestry in 1980. Generally speaking, there seems to be little evidence of Falvey's theory's applicability. For example, electrotechnical industry has a high score of unit price dispersion in 1989 but it was not a capital intensive industry. Considering that the late post-war period was more affected by intraindustry trade than the early post-war period, Falvey's model probably lacks relevance in the earlier period as well.

If it is conversely accepted that IIT is caused by technological differences as suggested by Davis' model – the one considered a theoretical curiosity by Helpman – one could adapt a combination of Ricardian and H–O characteristics along the lines of Harrigan. Harrigan's trade model, which is not actually tested on any trade variables, rests on assumptions of free trade, constant returns to scale and competitive market-clearing.[197] The approach there cannot be adopted here straightforwardly since the author attempts to model technology differences by benchmarking sectoral technologies relative to a given country.[198] Since this thesis is not a cross-country study, this approach is unfeasible.

However, E. Young Song and Chan-Huyn Sohn argue in an empirical paper that in trade between developed countries the negative relationship between IIT and productivity differences is larger than that its negative association with factor endowment differences.[199] Since IIT was increasing throughout the post-war period, this would imply that productivity differences were not probably not growing. Therefore, one can speculate that technology in the guise of productivity would not be relevant in the post-war period.

Then there is the neo-Ricardian model family originating from the work of Eaton and Kortum. While particularly the Costinot, Donaldson and Komunjer model has some alluring characteristics, namely its link to Ricardian idea of comparative advantage and its focus on innate productivity differences that can be separated from exporter-to-importer or industry-importer trade characteristics, the model has some drawbacks. Although its definition of comparative advantage includes country-industry specific factors like infrastructure, institutions and climate, the focus is still the Ricardian one on labour, when it is apparent that there are other factors of interest concerning the Finnish

[197] Harrigan 1997, 447
[198] Ibid., 478
[199] Song & Sohn 2012, 469–471, 477–478. The dataset covers the years 1976–2001.

post-war context. During the period of interest, forest resources were the backbone of forest exports, high investment ratio was pervasive and human capital was growing in importance in the whole economy. This model does not account for these facets explicitly.[200]

Furthermore, the issue there is with the parameter θ of intraindustry heterogeneity related to technological knowledge, or the "elasticity with which increases in observed productivity levels, *ceteris paribus*, lead to increased exports".[201] The parameter is obtained by estimating exporter-industry fixed effects with estimates of different magnitude by using measures such as R&D expenditure or total factor productivity. In the absence of such data for Finland and its trade partners, θ of some magnitude selected beforehand could be used to capture exporter-importer fixed effects, and to calculate "revealed measures of productivity".[202] While the authors have a preferred estimate for 1997, it is dubious to believe that it would hold for the entirety of 1956–1989 in Finland. It is not clear what magnitude should be chosen then, especially since the results could be unpredictably biased by that decision. Therefore, one must decree that, while perhaps useful for modern exercises, this model is too narrow theoretically and too uncertain in its methodology to be adapted in the Finnish post-war context.[203]

There are also reasons to believe that Linder's market expansion and Vernon's product cycle theories are not entirely useful models. While Pihkala maintains that Linder's theory is better suited than the H–O model for Swedish-Finnish trade of 1960s he wonders whether demand preferences would have really been that different between the countries decade before, or whether the difference between Swedish and French demand was so large relative to Finland at the time of intraindustry trade to constitute for a reason to trade with former but not with the latter. Vernon's theory lost credibility for two reasons. First, when economic convergence of the U.S.A, Western European and some Eastern Asian countries did happen there were no drastic changes in trade structure which was contrary to the model's predictions. The model also predicted that home market advantages of large companies would support exports in their home countries, but production based on

[200] Costinot, Donaldson & Komunjer 2012, 582–583, 595
[201] Ibid., 607
[202] Ibid., 601–602
[203] Additionally, the parameter θ is assumed to be identical in all industries and countries which seems unrealistic. See Ibid., 582–583, 595–598

U.S. development was increasingly relocated abroad and sometimes even offshored to companies' foreign subsidiaries.[204]

In conclusion, with there being limited support for increasing returns to scale and the clear implication of intraindustry trade, it seems that the C–H–O model is the relevant foundation for my empirical approach. All that being said, one should not overemphasize the link between theory and regression framework too much. Leamer for example openly questions whether cross-industry regressions are even valid accounts of H–O theory and is also quite critical of empiric applications of New Trade Theory.[205] But as Wright asserts concerning H–O regression analysis of his own:

> On no account should the coefficients be viewed as structural estimates within a Heckscher-Ohlin framework – – they are best considered as descriptive summaries of trade patterns in a multi-factor setting, a way of pointing out areas of distinctive strength and tracking changes over time.[206]

The approach adopted in this thesis is and cannot be more than just that – a descriptive survey of Finnish trade patterns that accounts for magnitude of and changes in multiple factors over 1956–1989. And while theory is needed for guidance in locating the relevant factors, the approach should not be constrained into a theoretical straightjacket, Pihkala's Scylla, either. Since all models, and particularly trade models, are false by definition, one need not disregard important factors in an empirical exercise simply because they are not accounted by theoretical models.

Rodrik points out something that is relevant here: not all models' assumptions are explicit and not all of those are uncritical. One such assumption of many models is that the institutional framework includes property rights, contract enforcement and rule of law. Although one could characterize post-war Finland in this manner, it must be acknowledged that possible institutional features are ignored by the trade models here. Such characteristics consist of export cartels and Eastern Trade for instance. It is also true that free trade was not among the qualities of international trade initially, which also necessitates closer inspection on how industries were protected in Finland. Lastly, one might also wonder if the development of new exports might have been determined by

[204] Pihkala 2007, 39; Pihkala 1988, 81. Protectionism of the 1950s probably affected IIT though.
[205] Leamer 1994, 78, 84–85
[206] Wright 1990, 658

government activities which I will review primarily through the share of state-owned companies' gross output across industries.[207]

Trade models often assume that the country in question operated under perfect competition, which did not characterize the Finnish economy during the period here. Finland, defined as a coordinated market economy, did not ban cartels opting instead for oversight and interfering only in the most harmful of cases. The immediate post-war period was heavily cartelized because war-time regulation of the economy was practically left in the hands of commerce with the effect that cooperation from production to sales and acquisitions between companies intensified. Finnish legislation failed to resolve these curtailments of competition. Although there was increasing tendency towards economic liberalization in the 1980s, legislation on competition was not reformed wholly until 1988.[208] The institutional framework did eventually change however and in 1992 cartel register was finished, partly due to the negotiations to join the European Union.[209]

Niklas Jensen-Eriksen has emphasized that the stricter, post-war cartel legislation did not actually lead to decartelization, at least in the case of the pulp and paper industry in Nordic countries. Instead, pulp and paper cartels began to operate informally under the guises of club meetings, research institutes and committees for example. He suggests that such a development was possible in other industries as well, since the incentives for profit and stability did not disappear in the post-war era.[210]

Export cartels had the practical benefit of allowing small producers to access otherwise risky international markets. For example, Finnish paper producers effectively operated as a single company through their representative sales association: Finnpap.[211] The general opinion of the early post-war period on export cartels was downright positive. The committee report on cartels of 1952 maintained that export cartels should not be targeted by cartel legislation since their activity benefited the whole country.[212] As Jensen-Eriksen writes "cartels could promote economic stability and growth and make companies from small countries stronger players in international trade and negotiations".[213]

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[207] Rodrik 2015, 96–97
[208] Jensen-Eriksen 2017, 13; Fellman 2010, 156
[209] Ibid., 141–145
[210] Jensen-Eriksen 2017, 6–8. Sales associations were sustained through telecommunications, personal contacts and networks of trust. See also Eloranta & Ojala 2005, 170.
[211] Eloranta & Ojala 2005, 170–171. See also Heikkinen 2000.
[212] Fellman 2010, 147
[213] Jensen-Eriksen 2017, 4

However, it may be equally the case that cartels allowed certain companies to produce products of poorer quality in the absence of direct company-consumer relationship and they impeded growth of novel ideas and companies.[214] Innovation and technological progress may have been curtailed through passive satisfaction of the companies, whose export quotas were decided collectively in the sales association, meaning that a given firm had to only adjust production to match its quota.[215]

The theoretical question of how cartels affected Finnish trade structure is uncertain. Song and Sohn suggest that at least Ricardian rationales for trade work in a context where each industry is a duopoly with one domestic and one foreign firm, which should reflect a market controlled by export cartels.[216] Parjanne writes that it is difficult to draw clear conclusions from oligopolistic theories, but it been suggested that competition between oligopolistic companies can be a cause of trade, even with identical commodities.[217]

In conclusion, I would argue that international export cartels could have affected Finnish export structure through fears of reprisal and price-setting. An export industry would not have necessarily developed if the commodity market was already controlled by an international cartel. On the other hand, since international cartels operated, to the best of my knowledge, in the capitalistic world, it is possible that Finnish industries were able to channel their exports to a location where cartels of the Free World had no reach.

Indeed, a peculiarity to Finnish foreign trade of the time was trade with the Soviet Union and other communist countries. Another violation of perfect competition, the so-called Eastern Trade was centrally organized and operated through a clearing system. As one proof of its lack of a market mechanism was the fact that the prices and therefore the probability gained tended to be higher than with Western countries. Finnish companies had access to the market system – a source of price information that their Soviet counterparts were disbarred from using even if they tried to negotiate lower prices. The central budget covered possible losses, so Soviet operators could not evaluate whether the price negotiations were successful. As a result, there was a systematic bias in favour of Finnish exporters.[218]

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[214] Kuisma 1999, 80; Heikkinen 2000, 479–480
[215] Eloranta & Ojala 2005, 171
[216] Song & Sohn 2012, 466
[217] Parjanne 1992, 11–13
[218] Laurila 1995, 99–103

As with cartels, the profitability of Eastern Trade has been thought to have had its downsides. In protecting uncompetitive industries, it "in the longer run distorted the structure of production".[219] Another downside was that the trade systematically disfavoured small companies due to the size of Soviet orders. On the other hand, Eastern Trade has been thought of as a "springboard" for certain industries such as shipbuilding, which could grow in a protected environment before moving into Western markets. There were other pros including smaller transaction costs, countercyclicality and cons such as costs of bureaucracy and currency issues. Industries engaging in Eastern Trade tended to be more labour intensive than others and tended to have lower unit costs because of low marketing costs and economies of scale.[220]

The considered literature therefore suggests that Eastern Trade did not operate under perfect competition nor was it a close approximation of it, calling into question whether the standard trade models can be used to analyse growth in those exports that depended on it. Eastern Trade can also be viewed as a form of international protectionism as Paavonen argues.[221] At any rate, it should not be omitted here.

I will not discuss in detail how international trade policy began to shift from interwar protectionism back to free trade that had characterized the decades prior to 1914, since one can consult Aunesluoma's and Paavonen's research on this point. Efta and EEC trade agreements did create new patterns of trade, even if the development did not happen overnight since the reductions in customs barriers were gradual.[222] While it is not possible here to examine how trade liberalization opened new markets to Finnish exporters, the reduction in Finnish protectionism can be inspected. Changes in tariff rates reveal which industries were highly protected and at which pace protectionism receded in each industry. Since an increasing amount of exports was directed to signatory countries of Efta and EEC from what had been described as domestic manufacturing, these industries evidently adjusted to international competition.[223] One could speculate on this point that early protectionism might have enabled some fields of business to develop "in peace" to reach that level of competitiveness. Although I will at times refer to this possibility, I will not dwell on ascertaining the possible merits of this infant industries argument.

[219] Laurila 1995, 102
[220] Ibid., 99–103, 107
[221] Paavonen 2008, 285
[222] Kaukiainen 2006, 150–151
[223] Paavonen 2008, 11, 98; Kaukiainen 2006, 163

Finally, it is possible that some export industries would not have developed to the same extent without public investment. This interpretation is not prevalent in the economic or economic historical literature reviewed in this thesis, but Dahmén mentioned the possibility that the state could support domestic manufacturing in a variety of ways in order to increase its internationalisation, although he regarded this point as uncertain. Matti Huomo supports this notion by mentioning that there was public interest in developing new exports of chemical and metal industries in the 1960s.[224]

Yet what was the channel of this public interest? Kuisma himself argues that state-owned companies were important for economic development.[225] State-owned forest companies at least received capital through parliamentary decisions. Then again Dahmén later on stated that state-owned companies did not influence development since for all intents and purposes they behaved as private companies would, though initially they were important concerning basic and metal industries.[226] Kuisma himself refers to Outokumpu where he argues that while a private company would have merely utilized the mine to acquire raw materials, only the state was prepared to establish a whole production process with forward linkages to metal, chemical and paper industries, in the name of national interest.[227] Modern-day Kemira too was established in 1920 as a state-initiative to provide fertilizers in order to modernize agriculture.[228] Additionally the state company, Gutzeit, defied the European Chemical Cartel when it established a chlorine factory in 1935, which perhaps demonstrates that a state company was more resistant or less fearful of cartel reprisals than a private one.[229]

It is therefore possible that a high rate of state-owned companies might have been conducive to the development of export industries. Yet the obvious problem in Kuisma's interpretation is its implicit denial of the counterfactual that these industries would have developed on their own but proving this is not easy either. Considering the cold-war entanglements related to Neste Oil at least, it is unlikely that a private company could have expanded in the manner that a state-backed one could in that context.[230]

[224] Huomo 1986, 67–68
[225] See Kuisma 2016.
[226] Dahmén 1984, 24; Dahmén 1963, 35, 83
[227] Kuisma 2016, 197–198
[228] Ibid., 129
[229] Ibid., 210–214. The European Chemical Cartel did retaliate, but by establishing another chlorine plant in Finland, which actually increased the size of the chemical industry even more.
[230] Ibid., 207–208

It is not straightforward to determine if this was the only channel of state activities that affected Finnish export structure. Indeed, the relative scope of state-owned companies' activities across industries is more of experimental exploration on whether positive benefits may have existed. The lacking availability of industry-level data and time constraints limit examination of other policy-related variables. Alongside state-owned companies, I have only included a brief review of innovations involving public funding.

3. Methodology Used in this Thesis

While it is customary to discuss the sources and conceptual issues concerning the data, I deviate from this practice due to the sheer size of that discussion. This chapter is mostly methodological whereas data-related discussion is consigned to appendix chapter 6.2. Here the basics of input-output (I–O) methodology utilized to obtain both the estimates of value-added of exports and factor intensities are reviewed. The need to use the former variable instead of gross exports is also discussed before addressing regression model specifications and potential pitfalls there. Admittedly most of the chapter is devoted to discussing econometric methods rather than quantitative tables even if the latter are utilized to great deal in the empirical section of this thesis. This arises from the simple fact that tables usually require fewer assumptions and computations than econometrics.

3.1 On the Use of Input-Output Methodology

> As one example of the opportunities of economics' new methods is the so-called input-output study.[231]

> Input-output analysis has a lot to offer economic history. Its virtues are in its operational simplicity and the high level of disaggregating it makes possible in the analysis of any issue.[232]

There are two underlying, but related, methodological points in this thesis: the need to use value-added instead of gross figures in exports and the importance of appreciating both direct and indirect factor intensities. Indeed, unlike standard analyses on foreign trade, this thesis relies on value-added figures calculated by the author.[233] The issue with gross exports is that their values does not only reflect domestic activities, but also the value of imported raw-materials and intermediate products used as inputs in export production. This is not a frivolous point. Even in 1956 the bias caused by imported inputs raises total export value by 15.5% and this gap widens over time.

Secondly, industries are not separate entities, and they had at times significant indirect connections to other industries. While direct factor intensity, the use of a factor in the industry itself, can be easily quantified by weighing input measures by output – by measuring i.e. labour input as working hours per one million 2017 euros worth of

[231]Jalava, Eloranta & Ojala 2007, 14. Translated from: "Yhtenä esimerkkinä taloustieteen uusien menetelmien mahdollisuuksista on niin sanottu panos-tuotostutkimus."
[232] Kauppila 2007, 26
[233] The figures were originally calculated by yours truly for Haaparanta et al. 2017.

production – indirect factor intensities require similar calculations as value-added of exports. Therefore, I will summarise the I–O approach used to calculate these figures.[234]

Direct and indirect uses are calculated with input-output tables pioneered especially by Leontief, who also applied them to testing trade theory as already mentioned. Leontief, who published the first modern input-output tables for the U.S. in 1936, emphasized that economics should be based on observable structural relationships instead of unobservable equilibrium theories of neoclassical economics.[235] As a result, input-output approach is atheoretical, though it rests on a few assumptions concerning economic activities. In particular, it is assumed that a product is only produced with one production method and that a production method can only be used to produce one type of a product that is characteristic of that production. Input-output calculations assume constant returns to scale. This is admittedly contradictory on my part since the C–H–O model assumes increasing returns to scale but the need to account for import content of exports and factor intensities allows for no other research strategy.[236]

Despite this limited unrealism, input-output models are still the best available method of untangling total factor or value-added requirements of industries. The input coefficients, which reflect the production method of an industry through its use of other industries' inputs, is derived from an input-output table, an example of which is Table 2.

Table 2. An Example of an Input–Output Table

		Inputs						End Products					
		Production					Sum of Inputs	Consumption	Capital Formation	Exports	Imports	Sum of End Products	
Production	1	x_{11}	.	x_{1j}	.	x_{1n}	$x_{1.}$	y_{11}	y_{12}	y_{13}	$-y_{14}$	y_{15}	x_1
	.	.		.		.	.	.	.	.	.	.	.
	i	x_{i1}	.	x_{ij}	.	x_{in}	$x_{i.}$	y_{i1}	y_{i2}	y_{i3}	$-y_{i4}$	y_{i5}	x_j
	.	.		.		.	.	.	.	.	.	.	.
	n	x_{n1}	.	x_{nj}	.	x_{nn}	$x_{n.}$	y_{n1}	y_{n2}	y_{n3}	$-y_{n4}$	y_{n5}	x_n
Sum of Inputs		$x_{.1}$	.	$x_{.j}$	.	$x_{.n}$	$x_{..}$						
Imported inputs		$m_{.1}$	.	$m_{.j}$	.	$m_{.n}$	$m_{..}$						
Wages	1	z_{11}	.	z_{1j}	.	z_{1n}							$z_{1.}$
Operating Surplus	2	z_{21}	.	z_{2j}	.	z_{2n}							$z_{2.}$
Taxes less subsidies	3	z_{31}	.	z_{3j}	.	z_{3n}							$z_{3.}$
Sum of Value-added		$z_{.1}$	.	$z_{.j}$	.	$z_{.n}$							$z_{..}$
Total		x_1	.	x_j	.	x_n		$y_{.1}$	$y_{.2}$	$y_{.3}$	$-y_{.4}$	$y_{..}$	

Source: Modified from Forssell 1985, Table 4.

[234] For a review of the input-output approach and related studies in Finland see Forssell 1985. For their use in economic history see Kauppila 2007, 71–75.
[235] Kauppila 2007, 43–44
[236] Forssell 1970, 18–22

The input coefficients for each industry-pair are defined as:

$$\frac{x_{ij}}{x_j} = a_{ij}$$

The input coefficient a_{ij} tells us how much production inputs from industry i is needed to produce one product of industry j. As a result, one can compose the matrix A from all the input coefficients. In the case of value-added of exports, we start with the following equation:[237]

$$X = A * x + e$$

Where x reflects a vector of total production, e the vector of a final use category, in this case gross exports, and A the matrix of input coefficients. Note that in the following all of these are matrices, not vectors – that is, the information is in rows and columns instead of only columns or rows. Since the input coefficients essentially express how much raw-materials or intermediates from different industries are used in an industry, $A * x$ conveys the total amount of inputs. The remaining part of total production is in final use. However, the problem is that while A can be composed of only domestic inputs, even without considering imports, we do not know if a domestic input's producer would have imported inputs of its own. And the same issue applies with that secondary input's input and so on. Wassily Leontief solved this veritable Gordian knot of endless input chains with the Leontief inverse:

$$(I - A)^{-1}$$

Leontief inverse matrix is the inverse of the subtraction of the identity matrix, a diagonal matrix with only unit values, from the input coefficient matrix. It includes all the direct and indirect inputs that are needed to satisfy the demand of a final use category, such as exports. However, an equation of that kind would still not tell us anything about value-added. We need to add a third term:

$$DVA = v * (I - A)^{-1} * e$$

This is the final equation for the domestic value-added of exports. The term v is the diagonal matrix containing ratios of value-added relative to total production. Its multiplication with the Leontief inverse corresponds with value-added levels needed to

[237] The following is based on Ali-Yrkkö et al. 2016, 42–44. The main difference is that my calculations here are based on only one country: Finland.

satisfy the demand of a final use category. Exports *e* is a diagonal matrix as well. Therefore, our result reflects the value-added that is needed to satisfy exports in the entire production chain, considering both direct and indirect contributions. In this manner, we can see how much, let's say, forestry contributed to the value-added of paper and paper product exports by locating the cell on row "Forestry" and column "Paper and paper products". These sums of sectoral value-added relative to total value-added of exports also form the basis of variables such as resource intensity and the share of infrastructure or of financial services used in this thesis.[238]

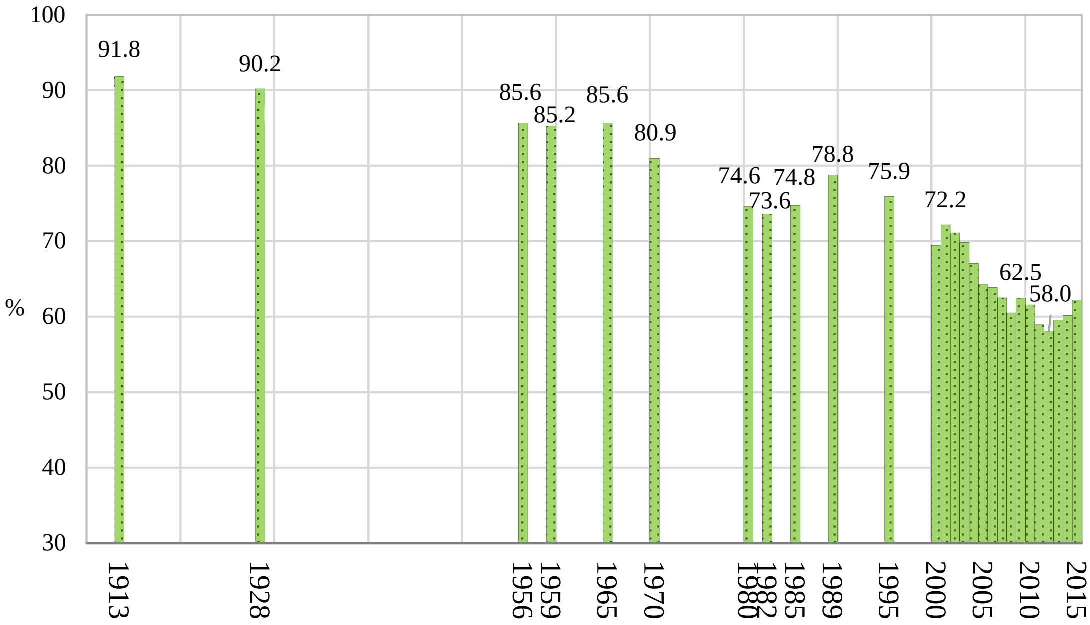
While using gross exports or its derivatives is commonplace, the need to use of domestic value-added content of exports instead can be proven succinctly. Consider Chart 2. Here we can observe a clear downward trend in the share of domestic value-added relative to gross exports in the 20th century. That difference is perhaps more intuitive to interpret as the rising share of imported inputs, or foreign value-added in gross exports.

Compared to the interwar period, production of exports in 1956–1965 was somewhat more dependent on imported inputs. Approximately 15% of gross value of exports embodied their value. By 1970 this ratio had increased to a fifth. The gap between the actual domestic benefit of exports and gross value widens after the 1970s. While there was a brief respite after 1982 – and even a clear reversal coming to 1989 – after the depression of the 1990s the relative use of imported inputs increased to an unprecedented scale. As a result, if one were to compare the domestic value-added of exports, relative to GDP, during 2015 to 1913 he or she would conclude that the ratio is virtually the same: 23%. Even with a clearly higher gross value of exports in 2015 and an impression of globalization of unseen scope, the export dependency of modern Finland is not different from the grand duchy of Finland of the first globalization period.

While Chart 2. illustrates that there have been interesting developments in domestic value-added of Finnish exports, the point here is not to examine the whys of it. I will only point out that potential causes for the general decline could be the decreasing importance

[238] There is an extensive literature in different ways of measuring domestic and foreign value-added content of exports. See Timmer et al. 2013 and Koopman et al. 2010 for example.

Chart 2. Domestic Value-added Content of Exports relative to Gross Exports in 1913–2015, %



Notes: The value-added data is the same as in Haaparanta et al 2017, but to ensure better compatibility throughout the period, the value-added of exports for 1928–1989 were recalculated as GDP shares: the sum of labour income, capital income and indirect taxes less subsidies. The data from 1995–2015 is not based on national input-output tables, but on international I–O tables which also account for the amount of Finnish inputs that are exported only to eventually return to Finland as imports. The estimate for 1913 was calculated on the assumption that a given industry's inputs embodied foreign inputs to the same extent as the main industry supplying those inputs did.

Source: The author's own estimates; Statistics Finland, Input–Output Tables 1956–1989; Haaparanta et al. 2017; Kauppila 2007.

of forest exports, which relied heavily on domestic forest resources, or lower trade barriers in the post-war period which may have enabled growth in imported inputs. It is also likely that the oil crises of the 1970s both increased the value of imported inputs and exports into the Soviet Union, which were relatively import-dependent.[239]

The real interest of mine is to point out that while gross values reflect the true economic effect of exports well enough in the first half of the 20th century, it leads to biased results in the post-war era. Even if the value of imported inputs was only 14% relative to gross exports in 1956, a cross-industry study like this thesis will overestimate the magnitude of metal industries' exports in comparison with forest industries, since the former tended to use imported inputs more than the latter. The same applies to all new exports. This is the rationale for using value-added of exports as the dependent variable in this thesis.[240]

The factor intensities for labour, capital and R&D expenditure are also calculated with similar input-output formulas as value-added of exports. Indirect factor intensities were

[239] Forssell 1986, 20–21
[240] Haaparanta et al. 2017, 37

calculated following the example of labour input formula of Statistics Finland's input-output studies concerning the 1980s:[241]

$$L = l * (I - A)^{-1}$$

Where l refers to direct labour input of working hours per one million 2017 euros worth of production and L to the demand for labour required to satisfy one million 2017 euros worth of production when all multiplier effects are accounted for. Hence, factor intensities are referred to also as factor requirements. Requirements related to capital stock and R&D expenditure are expressed in monetary terms but calculated in the same manner.

Note that output here refers to gross value of production, not value-added. Calculating factor coefficients by measuring them per some unit of gross output is the standard approach in input-output studies.[242] The total requirements for working hours for instance reflect the entire production process from start to finish in a given industry and its suppliers. Deardorff asserts that this is a conceptually proper way of measuring factor intensities in a comparison with using merely direct inputs.[243] Hence the same approach was adopted here.

It ought to be mentioned that labour, capital and R&D inputs therefore include the impact of their respective factor productivities. While, for example, labour intensity measured with direct or total working hour requirements is related to labour productivity, it should not be interpreted simply as its corollary. Low labour intensity of oil and petrol manufacturing does not necessarily mean that it was a highly productive industry, but rather that those exports' root causes lay somewhere else.

There are some conceptual issues with the using national input-output tables. For instance, it is possible that a Finnish company would produce raw-materials, export them for processing abroad and import them back for assembly. The Finnish value-added in these intermediate products is effectively assumed to be zero in this thesis. However, it is unlikely that the problem would distort historical figures meaningfully as even in modern times this ratio is negligible.[244] At any rate, fixing the bias would require historical,

[241] See for example Tilastotiedotus, KT 1985:4.
[242] See Eurostat 2008, 497–503 and Kauppila 2007.
[243] Deardorff 1984, 479–480
[244] I thank Saara Tamminen for pointing this out.

international input-output tables that do not exist. The method based on national data is the best one available for the foreseeable future.[245]

3.2 Methodology Concerning Determinants of Export Structure

> The tools of formal econometrics may be useful here, but tables and graphs can often be more persuasive.[246]

The standard method of empirical trade studies is the same as in empirical economics and economic history in general: regression analysis, or Ordinary Least Squares regression analysis in formal terms.[247] Due to the possibility that there are omitted variables, export cartels for instance, the approach here does not utilize OLS but fixed effects regression analysis. This is a major difference with the previous trade studies mentioned in this thesis, since industry characteristics which are assumed to be constant over time are controlled in the fixed effects approach. Time fixed effects, which control characteristics that vary over time but not by industry may also be included, but omitted variables which change both over time and across industries remain uncontrolled in both cases.

Yet as Leamer and Levinsohn point out, different trade models can apply for distinct industries: lumber trade might be better explained with H–O model whereas monopolistic competition model might be more applicable furniture exports.[248] Thus, it is important to consider the determinants of exports not only generally across industries as in fixed effects regression analysis, but also specifically by industries. Since the data here is based on input-output studies which cover only eight years and their level of aggregation is on the industry rather than on the product level, econometric analysis is an unfeasible approach for examining individual industries. As an alternative, quantitative tables are used instead. While simplistic in comparison with econometrics, this approach is more reliable when faced with a low number of observations.

Even the question of what kind of an export variable should be explained is less than certain. Since the link between comparative advantage and empirics is not clear, there are quite a few alternatives. Alan Deardorff himself prefers simply using net exports, since gross exports reflect intraindustry trade which is not determined by factor proportions model. Since I include both variables accounting for inter-industry and intraindustry trade

[245] Haaparanta et al. 2017, 130
[246] Leamer 1994, 67
[247] See Leamer 1994 for a review of empirical trade studies.
[248] Leamer & Levinsohn 1995, 1342. These two industries are combined in this thesis, however, due to potential issues caused by changes in classification in Statistics Finland’s data.

here, using value-added of exports as an explanatory variable is not an issue. The point here is to explain growth in industries' exports acknowledging that both H–O and NTT theories and their variables are working simultaneously.[249]

Net exports were deemed to be a less than satisfactory measure here, since utilizing value-added of exports tends to deflate the net exports values. In the context of the regression framework it ensures that variables have consistently negative signs, which removes one way of determining if a factor was important for export structure or not. Net exports will also tend to deflate the importance of new export industries due to high amount of imports from these industries, which is not desirable since explaining the emergence of these exports is one of the major topics of this thesis. Additionally, while a low rate of net exports could be interpreted as a lack of comparative advantage, it should be remembered that industrial groupings are always arbitrary to some extent, so it is possible net exports could be sizeable on a product level even if the same does not apply for industry level.

It is important to note here that while econometrics and the lure of statistical significance is hard to resist, "in economically oriented economic history method has regrettably often replaced source criticism".[250] Kauppila also maintains that reliability of data is always a potential issue in economic historical calculations.[251] For the sake of brevity, I have not included a detailed discussion related to the measures and proxies of explanatory variables in this section. Instead the conceptual and empirical discussion on explanatory variables can be found in appendix chapter 6.2. If one is uncertain on some point concerning the measures here, that is the section to be consulted.

As a starting point for the econometric approach, two regression equations were derived. The first is based on the four-factor H–O model and the second on the C–H–O model:

(1) $y = \alpha + \beta_1 labour + \beta_2 capital + \beta_3 wagerate + \beta_4 natural + \varepsilon$

(2) $y = \alpha + \beta_1 labour + \beta_2 capital + \beta_3 wagerate + \beta_3 natural + \beta_4 scale +$
$+ \beta_5 differentiation + \varepsilon$

Where y is value-added of exports, α the constant term, betas refer to slope coefficients of each explanatory variable and ε to the variance unexplained. In practice, the estimated models did not correspond with these theoretical starting points. While the advantage of

[249] Deardorff 1984, 487
[250] Ojala 2017, 453
[251] Kauppila 2007, 26

using a regression with more than one explanatory variable is that it estimates the effect of a single variable holding other variables constant, the interdependence between variables tends to make these specifications unstable. Labour productivity and average wage rate in particular tended to be correlated with the former absorbing most of the latter's effect. This necessitated dropping the average wage rate out of the specifications (1) and (2) with new specifications in the following form:

(3) $y = \alpha + \beta_1 labour + \beta_2 capital + \beta_3 natural + \varepsilon$

(4) $y = \alpha + \beta_1 labour + \beta_2 capital + \beta_3 natural + \beta_4 scale + \beta_5 differentiation + \varepsilon$

There are a variety of conceptual issues that can distort the results of econometric analyses. For example, a high number of variables can lead to "kitchen sink" regressions where data-mining is used to sort out the most explanatory variables without due consideration of their relevance. This problem can be avoided by including only variables that are theoretically legitimate – although I do depart from this approach in inspecting institutional characteristics that are unaccounted by trade models. The legitimacy of this choice arises from previous research however. On the other hand, the issue is accentuated due to multiple comparisons problem: variables can be measured in a number of different ways, some of which will be statistically significant by chance resulting from accidental data-mining. I do not see how this problem could be avoided in all certainty unless future studies take upon themselves to replicate the approach here.[252]

While increasing the number of variables unnecessarily is an issue, it is also harmful to disregard relevant ones. One such omitted variable here could be transport costs, which should be a determinant of trade at least in a two-country scenario.[253] However, supposing that exports' market area composition did not change by industry, reductions in transport costs in the post-war period should be captured by time fixed effects if transport and communications services are dropped.[254]

Additionally, it has been noted by Leamer and Levinsohn that unscaled exports of an industry will absorb the possible effect of an industry comprising a larger share of production than another industry. The authors state that this creates an omitted variable

[252] Leamer & Levinsohn 1995, 1378. See Gelman & Loken 2013 concerning multiple comparisons.
[253] Deardorff 1984, 470
[254] See Kaukiainen 2006 for a discussion related to transport costs.

bias if that scale effect is correlated with any explanatory variable. Yet since the authors do not suggest what these variables are I have disregarded the problem here.[255]

A related problem is that the level of aggregation might somehow bias the results by combining disparate product groups, which may be determined by different factors in the same industry grouping. Based on the disaggregation of the input-output tables of 1956 – see chapter 6.2 concerning this – the differences arising from aggregation are usually negligible, but in a few industries differences as large as 7% or 11% were found. The possibility of the bias has been noted in input-output studies, but for practical purposes one cannot do much about it.[256] This thesis' level of aggregation, of 30 or more industries, was necessitated by the levels found in existing input-output tables. At any rate, Kauppila considered this level as acceptable, though he noted that some characteristics may go unnoticed.[257] In other words, the level of aggregation and its bias in this thesis are at least not worse than in other similar studies.

While aggregating diverse products is a problem of its own, the division between manufacturing and service industries can be superficial in some cases. For instance, in 2015 half of the electrotechnical exports consisted of services, not commodities, even if one would usually interpret these figures as commodity exports. The ratios of services in manufacturing and forestry, agriculture and fishing were 18% and 16% respectively in 2015. Service exports were not quite so affected, though exports in trade mostly comprised of commodities.[258]

Therefore, merely reporting service exports on an industrial level will not give a clear account of the importance of services relative to commodities. It is feasible that the analysis in this thesis might not be able locate the right determinants of export structure correctly if commodity and service products have fundamentally different determinants. It is, of course, possible that historically the difference between commodity and service exports followed industrial categories. This point cannot be confirmed one way or another within the scope of this thesis. However, I must stress the fact that this thesis even considers exports of the tertiary sector as something of a novelty. Most economic

[255] Leamer & Levinsohn 1995, 1370
[256] See Blair & Miller 2009, 161 or Estevadeordal & Taylor 2002, 367.
[257] Kauppila 2007, 78
[258] Haaparanta et al. 2017, 55.

historical treatises focus on manufacturing industries and “services have generally been ignored by trade economists”.[259]

Aside from product-related issues, sectoral analyses will disregard firm characteristics that might be important determinants of trade. Trade in each industry could be, and indeed was, concentrated into the hands of few large export companies which makes this an important point. This is especially the case in small countries such as Finland. One could certainly argue that the rise and fall of electrotechnical industry was determined more by Nokia’s characteristics than by the average characteristics of the industry itself. In conclusion, there is ample evidence to suggest that firm and product level research would be more fruitful to discern different determinants of trade in value-added. However, the data requirements of such an exercise are formidable and out of the scope of this thesis and must therefore remain an area of further study.[260]

[259] Sapir & Winter 1994, 274
[260] Haaparanta et al. 2017, 56, 68

4. Analysis of Export Structure

In this chapter, the insights of trade models and previous research are applied in untangling the determinants of export structure. I begin by briefly reviewing how Finnish exports developed from the late 19th century to the late 20th century. After putting post-war exports into context, export industries are defined. Due to the possibility that trade models and determinants are industry-specific, I begin by inspecting factor intensities, New Trade Theory variables and institutional features across these industries. The chapter concludes by discussing the determinants of export structure in general in light of the results obtained through econometric fixed effects regressions.

4.1 Finnish Export Structure in the Long-term

> Finnish development has been dependent on how central export markets have had demand for Finnish products: have there been obstacles to trade – such as customs barriers or wars – and how well Finnish products have managed to compete with price or quality with rival countries.[261]

Before discussing the determinants of trade structure, it is worthwhile to review the general development of export industries in the long-run. This evolution is summarized in Chart 3. The period of this thesis, 1956–1989, is demarcated by black vertical lines. Note that the chart is not based on the same value-added of exports data as in the analysis soon to follow, but on gross value of exports inclusive of imported inputs. Thus, it overestimates the importance of new exports of metal, chemical and textile products to some extent, but the overall impression of greater diversification of export structure, which is main topic here, does not change.

It is apparent that Finnish export structure in the long duration has undergone significant changes. While exports were comprised of forest products in the first globalization period to a great extent, the dependence on these industries is in actuality more characteristic of the interwar period. Prior to the First World War, there were metal and textile exports Russia, but its eventual closure effectively brought exports from these industries to nil.[262]

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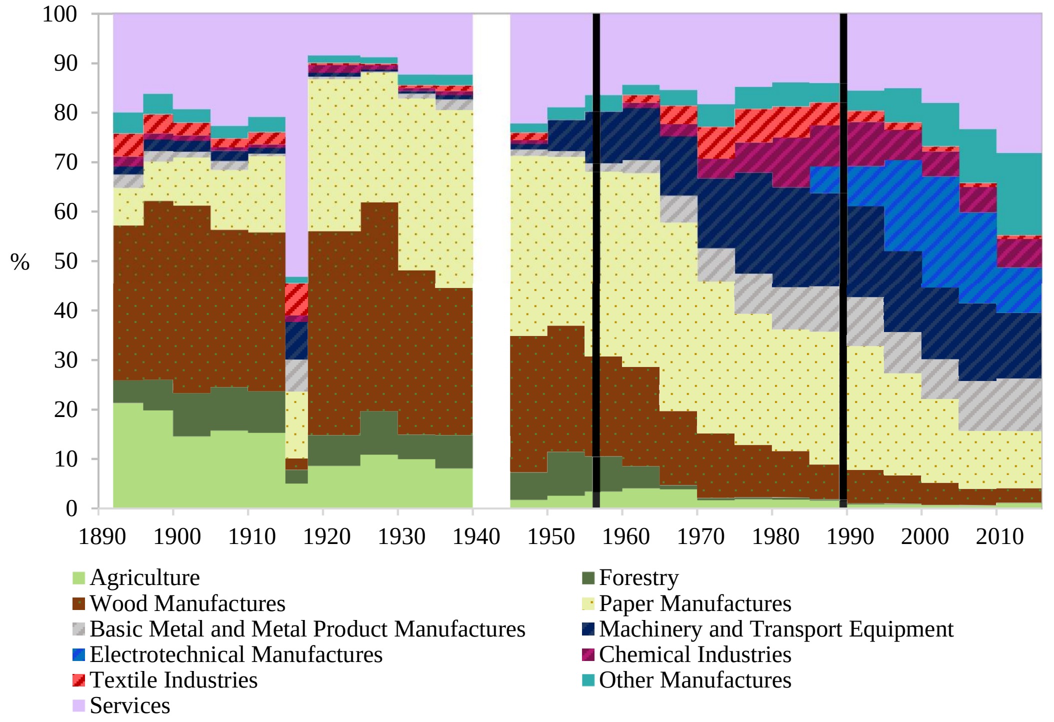
[261] Eloranta & Ojala 2018, 165. Translated from: "Suomen kehitys on riippunut siitä, miten keskeisillä vientimarkkinoilla on ollut kysyntää suomalaisille tuotteille: onko kaupankäynnissä ollut esteitä – kuten tullimuureja tai sotia – ja miten hyvin suomalaistuotteet ovat voineet kilpailla hinnalla tai laadulla kilpailijamaiden kanssa".

[262] On the other hand, these exports' success in the Russian markets had already been hampered by increases in Russian tariff rates before the First World War.

Chart 3. Export Structure of Finland in 1892–2016 in Gross Value, %



Notes: Percentages are measured in five-year averages. Note that the classification of commodities changes at several points in 1917, 1949, 1969, 2002 and 2008. While most discrepancies are small, chemical industries between 1969 and 2002 include also rubber, plastic and petroleum exports which are included in other manufactures from 2002 onward. The data on chemical and textile industries in the 1950s is not available. The service exports during 1892–1939 are estimates, and there is a classification change in 1949. Electrotechnical exports are included in exports of machinery and transport equipment prior to 1985. Forest exports are denoted in dotted pattern and new exports of metal, chemical and textile industries in striped pattern. Note that other manufactures and services do not have a pattern, since they are not included in what is "traditionally" understood as new exports of the post-war period.

Source: Haaparanta et al. 2017; Statistics Finland; Board of Customs.

While paper exports were also directed to Russian markets, companies managed to redirect their sales to Western Europe after the war. Service exports were to some extent based on Russian tourism, and during the Great War on payments gained from Russian civilians and Russian fortress constructions.[263]

After the regime change in Russia, the export structure became more uniformly based on forest resources. As Hjerppe puts it, the division of Finnish manufacturing into export industries and domestic manufacturing can be traced back to the interwar period.[264] Indeed, even the most marked development in export structure during the period was an internal shift in the internationally oriented forest sector: the structural change from wood to paper products in the 1930s. This was not meaningless, since the shift partly helped Finland to cope with the Great Depression.[265]

[263] Haaparanta et al. 2017, 32–33
[264] Hjerppe 1982, 408; Pihkala 1975, 19
[265] Haaparanta et al. 2017, 32–33

The export structure immediately after the Second World War did not differ significantly from that of the 1930s. While service exports' share of total exports was larger, this might be due to a change in statistical sources.[266] Agricultural exports were also more negligible than before the war, which is probably due to the need to ensure food security after the war. Yet Finnish manufacturing could still be characterized along the lines of export-oriented forest industries and domestic manufacturing, consisting of many industries, with only basic products and protected by tariffs from international competition.[267]

In the 1950s and clearly by the 1960s, export structure began to change. Exports of machinery and transport equipment grew to a larger scale than ever before in statistically recorded history. While metal industries' share of total exports was still small compared to that of forest industries at the time, the gap would decrease over time. By the late 1960s chemical and textile industries began to grow as well, though in a more limited scope.

However, as in the first globalization period, metal and textile exports were initially based not on Western European but on Eastern economies. The nature of the trade with the Soviet Union and its allies was qualitatively different, since it was based on a clearing-system which was state-directed even if private Finnish companies handled the negotiations, and it protected Finnish exports to the Soviet Union from foreign competition.[268] Since Eastern trade did not operate according to the logic of a market economy, it moderated economic shocks such as the oil crises of the 1970s. From a sectoral point of view, shipbuilding and machinery production used Eastern trade as a "springboard" for future Western trade.[269] Indeed, it has been suggested that war reparations to the Soviet Union were instrumental in the transformation of industrial structure, specifically with regards to metal industries, though the argument has been also described as a "myth".[270] Conversely, Inkeri Hirvensalo and Pekka Sutela remarked in 2017 that both Soviet and Swedish markets were drivers of export diversification.[271]

[266] The estimates on service trade during the interwar period was calculated by Lappalainen, whereas the post-war data is based on Finnish national accounts and balance of payments data. See Lappalainen 1997 and Airikkala et al. 1976.
[267] Kaukiainen 2006, 150–151; Paavonen 2008, 11, 258
[268] Ibid., 284–286
[269] Ibid., 309
[270] Heikkinen 2014, 92–93
[271] Hirvensalo & Sutela 2017, 183

Regardless of the increasing importance of new exports of chemical, metal and textile goods, paper industry remained the primary export industry until the 1980s.[272] However, its relative primacy lessened over time. This was even more accentuated in the case of other forest industries. Woodworking and forestry exports' share of total exports increased in the early 1950s on the account of the Korean boom but began to decrease noticeably afterwards. In a sense, this relates to the increasing level of value-added in forest industries – as in the 1930s – when woodworking and forestry gave room to paper industry. Indeed, in both woodworking and paper production there were significant structural shifts as production of pulp, veneer and cotton roll declined. Most of the pulp was processed now into paper and paper products.[273]

By the late 1980s, new exports had solidified their presence and Finnish manufacturing had reached a level of international competitiveness that was not simply based on price competitiveness, but on actual competitiveness.[274] According to Kaukiainen, Finland had ceased to be a provider of cheap labour in the global marketplace since its labour costs had risen and its exports were more highly refined than before.[275] However, while metal industries had managed to diversify their export markets by the late 1980s, the relatively unproductive textile industries had not. The problems in Eastern Trade, brought on by the collapse of oil prices in 1986, that culminated in the dissolution of the Soviet Union led to the collapse of textile exports, in parallel to closure of the Russian markets in the aftermath of the October Revolution.[276]

The discussion so far has focused on commodity exports, yet Chart 3 also illustrates that service exports have had a continuous presence in the Finnish export structure. While classification changes obfuscate the development of the immediate post-war period, there seems to have been a trend towards a lesser share of services in total exports – perhaps reflecting the resumption of world trade in commodities after the war. From the late 1950s to the late 1980s, the share of services in total exports remained fairly constant, though there was some growth there in the early 1970s.

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[272] This statement applies both in gross exports and in value-added exports. However, care should be taken in noting that it was, first, the combined total of metal exports that surpassed, secondly, paper exports and not paper and woodworking exports. The level of aggregation is obviously crucial here.
[273] Hjerppe 1982, 414–417
[274] Paavonen 2008, 309
[275] Kaukiainen 2006, 150–151 On the other hand, the relative value of high-technology goods in exports was still low: approximately 2.5% in the early 1970s and 6% after 1985. In the latter period the amount of high-tech imports was still twice as large as in exports.
[276] Laurila 1995, 48

Table 3. Domestic Value-added of Exports in Secondary Sector in Finland in 1959–1989, in Mill. of Euros and as Percent Shares of Total Value-added of Exports

	1959	%	1970	%	1980	%	1989	%
FOO	259.2	**7.3**	443.1	**5.8**	441.0	**3.3**	583.8	**3.2**
BEV	0.8	**0.0**	21.8	**0.3**	61.4	**0.5**	60.2	**0.3**
TEX	17.4	**0.5**	308.2	**4.0**	657.6	**4.9**	424.6	**2.3**
LEA	0.6	**0.0**	40.2	**0.5**	142.3	**1.1**	89.8	**0.5**
WOF	738.6	**20.7**	1 100.1	**14.3**	1 957.8	**14.7**	1 257.0	**6.8**
PAP	1 362.3	**38.1**	2 668.4	**34.7**	3 499.3	**26.2**	5 291.8	**28.8**
PRI	2.1	**0.1**	37.5	**0.5**	167.1	**1.2**	205.0	**1.1**
CHE	31.1	**0.9**	135.1	**1.8**	505.8	**3.8**	954.9	**5.2**
OIL	0.1	**0.0**	14.0	**0.2**	105.8	**0.8**	78.9	**0.4**
RUB	1.9	**0.1**	45.7	**0.6**	125.6	**0.9**	176.0	**1.0**
MIN	15.5	**0.4**	43.8	**0.6**	168.1	**1.3**	268.2	**1.5**
MET	42.9	**1.2**	300.2	**3.9**	634.4	**4.7**	1 127.5	**6.1**
MFM	161.3	**4.5**	488.6	**6.4**	1 265.4	**9.5**	2 322.0	**12.6**
ELE	28.7	**0.8**	146.2	**1.9**	517.4	**3.9**	1 199.4	**6.5**
TRE	174.4	**4.9**	396.2	**5.2**	572.6	**4.3**	1 163.1	**6.3**
OTH	2.8	**0.1**	42.8	**0.6**	71.1	**0.5**	63.2	**0.3**
Total	2 839.6	**79.5**	6 231.8	**81.1**	10 892.	**81.5**	15 265	**83.0**
Forest Exports	2 100.9	**58.8**	3 768.6	**49.0**	5 457.0	**40.8**	6 548.8	**35.6**
New Exports	458.4	**12.8**	1 874.3	**24.4**	4 526.9	**33.9**	7 536.0	**41.0**

Notes: Deflated with Statistics Finland’s export price index. Note that total refers to sum of manufacturing industries. New exports comprise of TEX, LEA, CHE, OIL, RUB, MET, MFM, ELE, TRE and forest exports of WOF and PAP.

Source: The author's own estimates; Statistics Finland, Input-Output Tables 1959–1989.

It is not a point of this thesis to compare gross exports to value-added of exports, but I have replicated the same value-added data as used in the rest of this thesis in Tables 3. – 5. The relatively high degree of value-added of exports found not only in forest industries (WOF and PAP), but also in foodstuff exports (FOO) which accounted for 7% percent of value-added of exports in 1959, is likely related to the importance of agricultural and forestry inputs in these industries.

Yet the general impression of rising share of new exports and of decreasing one of forest exports can be confirmed in Table 3. That is not to say that the value-added of forest exports did not increase. Moreover, Finnish forest industries also led to production of forest machinery which are classified in metal exports.[277] Some of the new export industries seem less remarkable after imported inputs are removed. Petrol refining (OIL)

[277] Hoffman 1988, 145

Table 4. Domestic Value-added of Exports in Primary Sector in 1959–1989, in Mill. of Euros and as Percent Shares of Total Value-added of Exports

	1959	%	1970	%	1980	%	1989	%
AGR	49.5	**1.4**	175.5	**2.3**	223.9	**1.7**	271.1	**1.5**
FOR	221.4	**6.2**	60.1	**0.8**	61.2	**0.5**	29.1	**0.2**
FIS	0.4	**0.0**	1.3	**0.0**	2.9	**0.0**	12.1	**0.1**
ORE	34.7	**1.0**	39.9	**0.5**	19.4	**0.1**	30.6	**0.2**
OMI	1.0	**0.0**	10.2	**0.1**	30.3	**0.2**	48.3	**0.3**
Total	307.0	**8.6**	287.1	**3.7**	337.6	**2.5**	391.2	**2.1**

Notes: Deflated with Statistics Finland's Export Price Index and measured in millions of 2017 euros. Note that total refers to the sum of Primary Sector, but percent shares are calculated relative to all exports.

Source: The author's own estimates; Statistics Finland, Input-Output Tables 1959–1989.

in particular accounted for 4–5% of Finnish gross exports in 1980–1985, but its value-added share of value-added does not even exceed a percent.[278] Conversely, metal industries which include basic metal industry (MET) and metal engineering industries (MFM, ELE and TRE) did constitute for a major part of exports in value-added terms.

Industries of primary sector were not meaningless either. Forestry (FOR) was a formidable export industry during the late 1950s although its importance decreased considerably afterwards. Agricultural exports' (AGR) relative importance conversely increased. It is worth pointing out that its small export share in 1959 may reflect the loss of agricultural land in Karelia to the Soviet Union.[279] Additionally, the industry's export share in 1985 was actually 3.2%, so its development was not of constant decline in the 1980s. Although agricultural exports were never very important in 1956–1989, their relative importance exceeded that of chemical exports (CHE) on 1970 and that of trade (TRD) in 1985, for example. However, as Pihkala notes that agriculture's share of gross exports declined after the middle of the 1970s due to global overproduction – this is the long-run trend even in value-added data.[280] At any rate, while fishing and mining activities are not important here, exports of agriculture and forestry warrant some study.

In the case of service exports, it should be noted that sales from tourism are not included in the export figures of the input-output tables that are the main data sources of this thesis. While tourism comprised approximately less than 10% of gross service exports in the 1950s, the ratio increased to 20-30% in the 1970s.[281] Therefore the total value-added of service exports is underestimated here. Based on Table 5. transport and communications

[278] Paavonen 2008, 277
[279] Pihkala 2001, 191. The loss of Karelia was apparently less of a problem for forestry although these products were increasingly imported. See Ahvenainen 1984, 412–413.
[280] Pihkala 2001, 258
[281] Airikkala et al. 1976, Appendix 2

(TRC) was the main export industry in services, though to lesser degree in the 1980s, which is probably related to Finland's high labour costs and the "great shipping crisis", associated with the expansion of Japanese shipbuilding, of the late post-war era.[282]

The trade industry was likewise important, which highlights that service exports were still related to commodity trade, though this could also reflect that data on these exports was easier to obtain. Exports of services proper, or financial (FIN), business and other real estate (BUS) and community, social and personal services (CSP) truly emerged in the 1980s, but even then, their combined value-added was less than 5% of all export industries. The slow emergence of BUS, the most important exporter of the three, is not surprising since professional expert services only began to develop in the 1960s.[283]

Since it is not practical to review the characteristics of every industry in the quantitative tables of the next section, I have resigned myself to merely studying industries that could be designated as exporters. Any threshold can be viewed as arbitrary here, not least due to arbitrariness of industrial classifications themselves. I have included only industries whose share of total value-added of exports exceeded 2.0% of the total at some point in 1956–1989. While it would be interesting to review if there were aspects shared by industries which were *not* exporters, in practice this would prove too cumbersome.

Table 5. Domestic Value-added of Exports in Tertiary Sector in 1959–1989, in Mill. of Euros and as Percent Shares of Total Value-added of Exports

	1959	**%**	**1970**	**%**	**1980**	**%**	**1989**	**%**
EGW	1.0	**0.0**	31.5	**0.4**	35.1	**0.3**	5.3	**0.0**
BUI	0.0	**0.0**	1.0	**0.0**	1.5	**0.0**	0.0	**0.0**
OCO	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**
TRD	9.5	**0.3**	140.4	**1.8**	274.5	**2.1**	232.7	**1.3**
TRC	364.4	**10.2**	891.2	**11.6**	1 185.7	**8.9**	1 661.0	**9.0**
FIN	23.4	**0.7**	37.3	**0.5**	145.8	**1.1**	133.5	**0.7**
DWE	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**	0.0	**0.0**
BUS	0.0	**0.0**	55.9	**0.7**	409.4	**3.1**	568.6	**3.1**
CSP	26.5	**0.7**	8.8	**0.1**	79.8	**0.6**	124.2	**0.7**
Total	424.8	**11.9**	1 166.2	**15.2**	2 131.7	**16.0**	2 725.3	**14.8**

Notes: Deflated with Statistics Finland's Export Price Index and measured in millions of 2017 euros. Note that total refers to the sum of Tertiary Sector, but percent shares are calculated relative to all exports. BUS and CSP have been scaled up for 1959 according to 1965 data and balance of payments data of Bank of Finland. The data for early post-war period is not necessarily as reliable as that concerning the 1980s when it comes to services or its exports. Note that sales obtained from tourism are not included here. EGW is often characterized as a manufacturing industry, but I have included it in tertiary sector due to its role in infrastructure.

Source: The author's own estimates; Statistics Finland, Input-Output Tables 1959–1989; Airikkala et al. 1976.

[282] Kaukiainen 2006, 154–155; Saarinen 2005; 34; Pihkala 2001, 260
[283] Pihkala 1982c, 465

4.2 Factor Intensities of Heckscher-Ohlin Model

> It seems that the comparative advantages, at least those that depend on resources and other natural endowments, have lost in importance compared with capital and know-how.[284]

In order to study possibly relevant factors that determined exports structure one should not only peruse determinants other than labour and capital, but also individual industries. I will not analyse in detail the development of each industry, however. I will also concentrate on total factor requirements, which reflect not only the direct use of a factor but also its indirect use through the industry's backward linkages to other industries. The root causes of changes in total factor use arise from changes in either the composition of input industries, their productivity or some mixture of both. Whether changes in factor intensities arose from one or another is largely beyond the scope of this thesis – one only has room here to signify levels and their changes.

In 1959, the most important export industries were woodworking and furniture and paper industries (WOF and PAP). In terms of direct labour inputs, paper exports were not labour intensive at all whereas woodworking exports were so on an average level. However, total working hour requirements reveal that WOF was the second highest user of labour in manufacturing industries through its linkages with forestry. This also explains also why the paper industry had a higher rate of total working hour requirements, close to the manufacturing median. One could therefore argue that paper industry in 1959 was more dependent on labour than what has been thought of before. Forest industries were in the aggregate, and in total terms, not unintensive in labour at least, which could be therefore asserted of Finnish exports of 1959 as well.

In the course of three decades labour intensity decreased in forest industries likely due to increases in labour productivity as in other industries, or i.e. due to higher output relative to labour input. This was a result of growth in investments which meant that less workers were required to produce each unit.[285] Yet PAP's total use of labour had fallen below the manufacturing median by 1970 suggesting that labour productivity in the industry's whole value chain was especially impactful. WOF also managed to decrease its labour intensity to the median level by 1980. Regardless, it seems that higher labour intensity of

[284] Kaukiainen 2006, 151
[285] See Jensen-Eriksen 2008, 125 concerning the investments after the 1970s and Heikkinen 2000, 267–270 for the investments of the early post-war period.

Table 6. Direct and Total Working Hour Requirements in 1959–1989, in 1 000 Hours

	1959		1970		1980		1989	
	Direct	**Total**	Direct	**Total**	Direct	**Total**	Direct	**Total**
AGR	208.6	**329.2**	127.5	**190.3**	85.9	**112.2**	60.5	**78.1**
FOR	139.7	**161.0**	48.7	**54.6**	26.0	**28.4**	19.4	**21.1**
FOO	15.9	**185.8**	11.3	**126.4**	9.5	**84.2**	7.4	**60.5**
TEX	63.6	**93.1**	40.2	**61.4**	32.1	**44.4**	24.6	**34.6**
WOF	52.9	**137.8**	32.7	**64.1**	19.4	**38.1**	13.6	**27.1**
PAP	20.1	**89.3**	11.7	**39.4**	7.8	**26.1**	5.7	**18.3**
CHE	19.4	**56.2**	15.3	**30.0**	7.7	**19.1**	7.7	**16.7**
MET	15.2	**56.2**	8.2	**27.7**	7.2	**22.4**	4.8	**13.6**
MFM	63.1	**83.3**	33.0	**45.2**	24.2	**37.1**	14.2	**22.5**
ELE	57.3	**81.5**	34.2	**48.8**	23.3	**32.8**	13.9	**20.9**
TRE	39.4	**56.9**	30.2	**45.4**	22.3	**35.3**	13.5	**22.2**
TRD	134.9	**146.1**	62.8	**76.7**	41.8	**55.2**	28.7	**36.2**
TRC	57.5	**78.5**	42.6	**57.2**	27.0	**39.2**	20.8	**29.4**
BUS	99.7	**144.9**	22.4	**40.5**	25.1	**40.2**	12.4	**20.3**
Median Manuf.	52.5	**86.3**	31.5	**47.1**	19.7	**37.5**	13.4	**22.7**
Median Tertiary	75.8	**112.2**	39.9	**58.8**	26.1	**40.2**	17.6	**27.7**

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1959–1989; Tiainen 1994; see the appendices for labour.

WOF in comparison with PAP, identified by Kauppila for the year 1928, was still more or less an accurate statement 60 years later.[286]

Considering that forest industries' direct use of labour was clearly lower than their total use, it is likely that the fall in labour intensity is related to developments in forestry (FOR). The industry was the source of inputs used in forest manufactures – and its own value-added of exports comprised 7.4% of the total in 1959 – so labour productivity there tended to make forest manufactures' value chain less dependent on labour. Since FOR's own export share almost disappeared after the 1950s, it seems that its exports were heavily dependent on labour. The same labour intensity can also be observed in agriculture (AGR) where the level of labour use declined, most likely related to emigration from rural areas,[287] but less markedly suggesting that its relatively favourable export development in 1980–1985 was still determined by labour intensity.

Backward linkages to agriculture were evidently important for foodstuff manufacturing (FOO), the most labour intensive manufacturing industry in 1959. During this time foodstuff exports were greater than those of transport equipment in value-added terms, so

[286] Kauppila 2007, 125
[287] Nummela & Ojala 2006, 74

this too reinforces the notion that Finnish exports were relatively labour intensive in 1959. Exports of transport equipment (TRE) and fabricated metal products and machinery (MFM) exports were also important in 1959. While TRE was clearly not labour intensive in either direct or total use, MFM was rather close to a median industry in manufacturing.

In the case of metal industries, it is rather interesting how stable the labour intensity of MFM, TRE and electrotechnical industry (ELE) was throughout 1970–1989, approximately at the level of manufacturing median. While TRE had been very unintensive in the use of labour in 1959, this was no longer the case compared to other industries in 1970. Basic metal industry (MET) was the only metal industry that had a clearly low rate of labour intensity. The same can be said for the chemical industry (CHE), but not for textile industries (CHE), which were relatively labour intensive – though the difference was not great in 1980. Foodstuff manufacturing (FOO) continued to be labour intensive, but its importance as an export industry declined.

Services were more labour intensive than manufacturing, but the difference in their respective medians had diminished by 1980. The same can broadly be stated regarding transportation and communications services (TRC). Conversely business and other real estate services (BUS) were not especially labour intensive with regards to other services, but they were so compared to manufacturing when the industry started exporting in 1970. By 1989 the industry had reached a similar, if a slightly lower, rate of labour intensity to manufacturing median. While retail and wholesale trade (TRD) was extremely labour intensive in 1959 one can witness how labour productivity brought on by the industry's rationalization decreased its labour input.[288]

If labour intensity was not a conclusive determinant of export structure, and specifically in the case of most metal industries, it is natural to consider capital along the lines of two-factor Heckscher-Ohlin model. It is interesting to note here that capital intensity did not change to the same extent as labour intensity did. This is in line with Pohjola's observation that the share of investments in GDP was fairly constant after the 1950s up to the 1990s.[289] However, changes in direct and indirect use of capital indicate that capital productivity of a median industry in manufacturing increased between 1959 and 1970 but

[288] Lastikka 1984, 30–32
[289] Pohjola 1996, 112

Table 7. Direct and Total Net Capital Stock Requirements in 1959–1989, in 1 000 Euros

	1959		**1970**		**1980**		**1989**	
	Direct	**Total**	Direct	**Total**	Direct	**Total**	Direct	**Total**
AGR	1 568.5	**2 757.4**	1 322.6	**2 259.9**	2 054.4	**2 971.0**	2 017.1	**2 903.2**
FOR	1 140.4	**1 374.4**	1 016.7	**1 132.6**	1 524.1	**1 604.1**	1 612.5	**1 699.7**
FOO	302.9	**1 965.3**	285.4	**1 866.1**	375.8	**2 612.2**	427.7	**2 751.8**
TEX	388.4	**809.2**	341.8	**711.4**	350.0	**719.7**	492.3	**986.5**
WOF	417.0	**1 467.2**	416.0	**1 212.4**	489.8	**1 518.5**	517.2	**1 542.9**
PAP	901.0	**2 806.8**	797.8	**2 033.7**	722.7	**2 191.3**	965.2	**2 362.3**
CHE	871.2	**1 839.9**	897.4	**1 629.7**	598.8	**1 416.8**	712.9	**1 499.8**
MET	499.1	**2 103.2**	562.1	**1 705.3**	638.3	**1 800.9**	577.6	**1 484.4**
MFM	593.2	**1 152.8**	414.0	**868.0**	432.5	**1 081.9**	390.9	**972.4**
ELE	284.0	**920.6**	324.0	**750.6**	433.7	**907.2**	403.0	**887.6**
TRE	693.8	**1 112.5**	571.9	**1 058.6**	667.1	**1 276.4**	622.0	**1 158.1**
TRD	1 761.0	**2 253.6**	1 123.9	**1 722.9**	1 069.0	**1 794.5**	1 136.2	**1 774.1**
TRC	1 586.9	**2 012.9**	1 817.0	**2 214.2**	1 695.2	**2 171.5**	1 430.0	**2 377.4**
BUS	2 857.4	**4 162.2**	1 918.7	**2 411.1**	1 906.1	**2 531.1**	1 638.4	**2 263.3**
Median Manuf.	546.1	**1 341.3**	551.4	**1 036.5**	433.1	**1 307.8**	569.7	**1 362.6**
Median Tertiary	2 035.3	**2 500.8**	1 409.3	**1 955.1**	1 069.0	**1 794.5**	1 136.2	**1 774.1**

Notes: In constant 2017 euros deflated by wholesale price index of engineering goods, including electrotechnical goods, for machinery and construction cost index for buildings and other capital. The net capital stock requirements reflect the amount of capital required to produce one million 2017 euros worth of production.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1959–1989; Tiainen 1994; see the appendices for capital.

declined to its initial level by 1980. Note here that net capital stock refers to not only machinery and transport equipment, but buildings and other construction as well.

PAP certainly was capital intensive in 1959 both in direct and total terms. The latter is due to the industry’s dependence on transportation services and energy industry’s inputs – PAP is estimated to have accounted 40–50% of Finnish electricity consumption – both of which were highly capital intensive.[290] PAP’s high direct use of capital intensity is a result of what Heikkinen has described as “an investment mania” in the decade following the Korean boom, which led to Finnish paper exports reaching Swedish levels in 1960.[291] The “mania” was partly encouraged by FAO’s predictions of rising global demand of pulp and paper, but also by the inability to decrease wages and stumpage prices due to domestic interest groups.[292] Thus investments remained the only venue for expansion.

PAP’s capital intensity declined between 1959 and 1970. Considering that its direct use did not change as much, it seems that the industry’s input providers became less capital

[290] Jensen–Eriksen 2007, 232–233; Hoffman 1988, 139
[291] Heikkinen 2000, 267–270
[292] Jensen-Eriksen 2007, 194–195

intensive. This could have been caused either by capital productivity or compositional shifts in input structure. After 1970, PAP's total capital requirements did not increase markedly whereas its declining direct requirements in 1959–1980 reflect underutilization of production capacity.[293] However, in the early 1980s the industry invested in new paper machines once more, as can be seen from its growth in direct capital use.[294]

Woodworking and furniture manufactures were less capital intensive than the paper industry, which corresponds with the situation in 1928 as identified by Kauppila.[295] On the other hand, when considering WOF's total use of capital, the entire production chain of woodworking was quite close to the manufacturing median. This probably reflects forestry's relatively high capital intensity.

Indeed, it is slightly surprising that primary sector's capital stock in general was so large relative to its gross output in comparison with manufacturing. This could, of course, reflect inefficient use of capital, but AGR underwent mechanization in the form of tractors and combine harvesters from the 1950s to the 1970s and Ojala and Ilkka Nummela argue that the industry went from labour intensive to a capital intensive one. A similar statement of labour-saving mechanization can be made of forestry. Indeed, capital intensity grew in both primary sector industries after 1970.[296]

WOF's capital intensity had increased as well after 1970. The industry's lower rate of capital intensity, at least in the early post-war period, related to forest companies tending to favour investments in PAP rather than in WOF due to its lack of efficiency-increasing technical innovations and lower global demand for its products.[297] Even after 1970, WOF's investment rate was curtailed by Bank of Finland and the Central Association of Finnish Forest Industries.[298] Yet its capital intensity was still higher than in many industries, such as MFM or TRE. This clearly illustrates that WOF was more mechanized than what had been the case in the interwar period. Its undergoing modernization was

[293] Hjerppe 1982, 419–421. PAP expanded excessively more than what the demand for its products would have necessitated. Since production capacity in the industry took a long time to construct, the expansion was intended to secure market shares in a forward-looking manner.
[294] Heikkinen 2000, 378–379. The invention of Thermo-Mechanical Pulp also increased the demand for energy, which should have increased total requirements here. See Jensen-Eriksen 2008, 130-131.
[295] Kauppila 2007, 124–126
[296] Nummela & Ojala 2006, 86–88; Pihkala 1982b, 405
[297] Ahvenainen 1984, 404
[298] Jensen-Eriksen 2008, 89. PAP avoided a similar fate due to its considerable economic influence.

exemplified by the automatization of sawmills during the 1960s and how furniture production moved from workshops to factories.[299]

What is perhaps most striking regarding capital intensity is its relative absence in metal engineering industries, although this has been noted in previous research.[300] ELE in particular was not capital intensive even when compared to other metal industries.[301] Its exports which truly emerged only in the 1980s seem unrelated to capital intensity. The same lack of capital intensity can be observed in MFM as well, although TRE's total capital use was approximately on the level of manufacturing median in 1970–1980. However, both industries tended to become less capital intensive in 1980–1989.

Unlike metal engineering industries, MET was clearly intensive in the use of capital. However, its total capital intensity declined during 1959–1970 and 1980–1989 as well. While the decline of the 1960s may simple reflect the rapid growth of the industry, the latter decrease was probably related to the field's overcapacity crisis related to Eastern Asian competition and decline in demand for its products due to new materials and environmental concerns.[302]

TEX had a low level of capital intensity in both total and direct terms in 1959–1989, though its capital intensity grew in the 1980s. However, Mika Maliranta sees this as partly resulting from the industry's rundown.[303] Since TEX comprised 4.0% of total value-added in exports already in 1970 and its export share declined to 2.3% in 1989, this indicates that capital intensity was likely unrelated to its exports. The foodstuff industry's high total capital intensity is reminiscent of Hjerppe's statement that it had developed into large-scale industry, but this is perhaps more on point with beverage and tobacco manufactures, not detailed here. However, its low direct capital use implies that it was not large-scale itself but had backward linkages to more capital intensive sectors.[304] At any rate, since FOO was gradually losing its status as an export industry, capital intensity may not have been an important determinant there.

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[299] Hoffman 1988, 150; Hjerppe 1982, 417
[300] Larjavaara 1978, 190
[301] On the other hand, this industry also includes production of instruments, previously categorized in other manufacturing, during 1980–1989. Instruments were most likely less capital intensive than other types of electrotechnical goods.
[302] Leiponen 1994, 21, 24
[303] Maliranta 1996, 110
[304] Hjerppe 1982, 410. The author does not differentiate food manufactures with beverage and tobacco industry here though.

Unlike consumption goods and metal engineering industries, CHE was a capital intensive industry as Maliranta notes.[305] It continued to be so throughout the period, even if at a lower rate, but one cannot simply state that its exports growth was driven solely by capital intensity. After all, its export share was relatively low prior to the 1980s: 0.9% in 1959 and 1.8% in 1970. Had capital intensity been the sole determinant of chemical exports, CHE might have expanded earlier. Still capital intensity probably had a role here.

In comparison with the relatively stable capital intensity in manufacturing – disregarding the decline observed in 1970 – capital intensity of services declined gradually in 1959–1980, which indicates that capital productivity possibly increased more in tertiary than in secondary sector. In the 1980s, the median in both did not change by much. Even so, exports in services were more capital intensive than in manufacturing. This seems to be the case in all three major service export industries: TRC, TRD and BUS. While BUS clearly decreased its use of capital, it was still roughly as capital intensive as PAP in 1989. One might speculate that services tend to have fewer employees per establishment and therefore there is more need for constructions there, or transport equipment in the case of TRC.

The traditional third-factor addition to the H–O model is human capital. While Wright maintained that wages can be used to infer skill requirements,[306] the possibility of a high rate of unionization wage rates warrants a more multifaceted approach. Additionally, it could be argued that this measure merely reflects the ability of productive industries to compensate their employees. The counterargument would be that employers are not willing do so unless labour is skilled enough. Secondly, it is possible that the share of women in the workforce could bias the wage rate downwards.[307] Thirdly, wage solidarity of the post-war period probably means that differences in average wage rate across industries are smaller than differences in true skill intensity.[308]

Due to these issues, which I discuss in more detail in the appendices, it is prudent to consider more than one measure. While I will begin with average hourly wages across industries, I have also included tables concerning the ratio of office workers to total employees and R&D intensity in this section. Although the concept of office worker is a

[305] Maliranta 1996, 71
[306] Wright 1990, 654
[307] This was apparently the case at least in apparel, shoe and partly in textile manufacturing. See Paavonen 2008, 309.
[308] See Paavonen 2008, 257 and Dahmén 1963, 44 concerning wage solidarity.

Table 8. Average Hourly Wage Rates in 1959–1989

	1959	**1965**	**1970**	**1980**	**1985**	**1989**
AGR	3.2	3.4	6.3	6.1	6.8	7.9
FOR	4.7	6.1	7.9	11.2	11.8	13.2
FOO	4.8	6.0	7.6	11.5	13.2	15.6
TEX	4.6	5.4	6.6	9.2	11.0	12.5
WOF	4.9	5.9	7.1	10.9	12.4	14.4
PAP	6.2	8.0	9.7	15.8	18.3	20.8
CHE	8.3	7.9	10.2	13.9	16.6	18.7
MET	5.9	7.8	10.3	14.4	16.5	18.5
MFM	6.1	7.6	9.6	13.0	15.1	17.4
ELE	5.1	7.1	9.3	12.6	14.7	16.8
TRE	8.8	7.9	10.4	13.6	15.6	17.0
TRD	4.6	6.5	7.6	11.3	12.4	14.8
TRC	5.7	7.6	10.2	12.7	14.4	16.4
BUS	7.8	7.4	10.0	14.9	16.3	19.0
Median Manufacturing	5.9	7.4	9.5	12.8	14.9	16.9
Median Tertiary	5.7	7.4	9.0	13.2	14.4	16.4

Notes: In constant 2017 euros deflated with Statistics Finland's Cost-of-Living index.

Source: The author's own estimates; Statistics Finland; Tiainen 1994; see the appendices for human capital.

crude measure for human capital in some respects,[309] the general increase in the relative amount of office workers in manufacturing still probably reflects a higher rate of human capital. Data concerning R&D expenditure is survey-based and only covers 1970–1989 which means that it is perhaps less reliable than the other measures for human capital. Furthermore, one might suppose that R&D intensity does not exactly measure the same thing as skill intensity, even if both are types of human capital.

Median wage rate in both manufacturing and services approximately tripled during 1959–1989. As Kaukiainen asserts, Finland had ceased to be a provider of cheap labour in international markets and implies that know-how was increasingly important. Pihkala also mentioned Finnish production shifter away from raw material and capital based production towards one characterized by knowledge and skill intensity in the 1980s.[310] He also argued that R&D inputs began to grow during this time. Especially the late 1980s was characterized by attempts to increase the R&D share of GDP. While this view is

309 See appendices concerning human capital measurement for a brief discussion on this point. Also note that Industrial Statistics, used as a data source here, do not cover enterprises with fewer than five employees.
310 Pihkala 2001, 306

supported by data on R&D intensity of Table 10. it should be noted that the share of high-tech products in commodity exports was only 5–6% in the 1980s.[311]

Taking the figures at face value, agriculture and forestry were low-wage industries as can be expected. The same can be stated of WOF, which is in concordance with its low ratio of office workers as can be observed in Table 9. Indeed, Jani Saarinen notes that WOF has been traditionally viewed as a low-tech industry.[312] While the industry trailed behind the wage rate of the manufacturing median, PAP had clearly higher wage rates than WOF, though the difference was not great prior to 1980, when employees of paper industry had the highest average wage rate in export industries detailed here.

This might reflect PAP's high degree of unionization and it has been suggested that investments there indirectly caused wage rates to rise – as the relative share of wages in production costs declined there was less of a reason to argue against trade unions attempt to raise them.[313] The industry's office worker ratio and R&D intensity were not especially different from the manufacturing median either which does not support the notion that the PAP utilized human capital to great extent.[314] Indeed, the CEO of Neste Oy, Uolevi Raade, is said to have remarked that "the forest industry's capacity for innovation stopped on the level of toilet paper".[315] While this relates to the early post-war period, Jensen-Eriksen is of the opinion that the industry's human capital intensity increased later on as he concludes that by the 1990s "the forest cluster's most high-class product may have still been a Finnish engineer specializing in wood-processing technology".[316]

Metal engineering industries' do not stand out here as their average wage rate was generally close to the median. MET conversely tended to have a higher wage rate than other metal industries especially in the 1980s, though not necessarily with regards to the share of office workers of R&D expenditure. However, Maliranta noted that the industry's workforce tended to be more educated than in the U.S. and West-German metal industry.[317] MET and PAP seem similar regarding this factor too.

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[311] Pihkala 2001, 306, 311
[312] Saarinen 2005, 30
[313] Jensen-Eriksen 2007, 195
[314] Lack of office workers could partly be explained by the sales association, FINNPAP, which removed the need for paper companies to employ marketing staff of their own.
[315] Ibid., 248–249
[316] Jensen-Eriksen 2008, 145–150, 189
[317] Maliranta 1996, 133

TRE seems to have been initially skill intensive, as its employees had the highest average wage rate in manufacturing in 1959, and it was characterized by a relatively high ratio of office workers in 1959–1970. ELE and MFM do not appear especially skill intensive when considering wage rates. On the other hand, a good deal of employees in ELE were office workers and the industry did have an extremely high rate of R&D intensity.[318] MFM also had a relatively high rate of R&D intensity, but to considerably lesser degree than ELE, and its office worker ratio remained above the median throughout 1959–1989. But the evidence there is not as overwhelming as compared to ELE. This is in line with Larjavaara's finding that skill intensity was not a determinant of metal engineering exports in the 1970s.[319] However, it could be that ELE and MFM became R&D intensive in the 1980s whereas TRE lost its edge in skill intensity for some reason.

Evidence for human capital intensity in CHE seems more certain as all three measures for it indicate that it was skill and R&D intensive. However, despite how the industry's average wage rate was consistently above the median it was not especially high in 1965 or 1980. Nevertheless they did increased during the 1980s when CHE's export share grew from 3.8% in 1980 to 5.2% in 1989. Moreover, the ratio of officer workers was exceptionally high in CHE, even more so than in ELE, indicating that skill intensity was a factor in chemical exports. The industry's R&D intensity was also high, which supports Hjerppe's statement that CHE was especially affected by technological progress.[320]

Consumption goods industries TEX and FOO tended to have low wages throughout the post-war period, which is not exactly a surprise. This certainly reinforces the notion these exports were based on low-cost, unskilled labour. Indeed, Swedish textile companies invested in Finland at the end of 1960s due to lower labour costs, before they increased to the extent that the Swedes began once more to offshore, but now to somewhere else than Finland.[321] Exports of TEX seem particularly unrelated to human capital as evidently TEX either could not or would not imitate other consumption goods industries' employment of office workers or level of R&D intensity. This could partly explain why the industry did not manage to compete in international markets after the 1980s. On the other hand, higher labours costs in FOO relative to TEX might explain why its export

[318] While instrument production is classified in electrotechnical production in the 1980s and not in other manufacturing industry, the office worker ratios of ELE without it are almost identical.
[319] Larjavaara 1978, 184–185. The exception here included wood-processing machinery which suggests that know-how related to forest industry played role, if small, here.
[320] Hjerppe 1982, 428
[321] Aunesluoma 2011, 215; Saarinen 2005, 29

share diminished over 1959–1989. At any rate, FOO's export performance seems largely unrelated to human capital. Low R&D intensity of consumption goods industries may also reflect the fact that most of their machinery and technology tended to be imported from abroad.[322]

There is more evidence for human capital intensity in services. Of course, the results here could be influenced by how services tended to employ a higher share of women in general and might have consequently had lower wages compared with more masculine manufacturing. TRC, generally the most important service industry, tended to have an average wage rate close to the manufacturing median whereas its R&D intensity was lower than in other industries. It seems that technical progress related to telecommunications and shipping did not translate to R&D expenditure in the industry.[323]

While TRD was mostly a low-wage industry, there is evidence that exports of BUS might have been driven by the use of skilled personnel as the industry had a higher wage rate than most manufacturing industries during 1980–1989 when its exports grew noticeably. Although its R&D intensity was not different from the manufacturing median, Lastikka noted that rapid technical development of the times was related to growth in ICT and leasing services, which should be related to business services.[324] Indeed the industry's R&D intensity was higher than in many manufacturing industries, but skill intensity may still have been the more pertinent type of human capital. Although the smaller exports of financial services are not detailed here, skill intensity was a feature of this industry too.

Table 9. The Ratio of Office Workers to Total Employment in 1959–1989, %

	1959	**1970**	**1980**	**1989**
FOO	15.4	18.8	23.9	25.0
TEX	11.3	14.2	16.3	19.2
WOF	10.8	12.3	15.7	23.5
PAP	14.1	19.6	23.5	26.2
CHE	24.2	32.3	37.6	47.0
MET	15.9	22.2	24.7	28.6
MFM	17.4	23.3	27.6	31.8
ELE	18.8	20.1	31.9	43.1
TRE	18.6	28.5	26.0	28.0
Median Manufacturing	15.9	20.0	24.3	27.1

Notes: The share of office workers also includes owners working in establishments.

Source: The author's own estimates; Industrial Statistics; see the appendices for human capital.

[322] Saarinen 2005, 28–29. This was a general feature of Finnish technology at the time though.
[323] Lastikka 1984, 38–40
[324] Ibid., 67–68

Table 10. Direct and Total R&D Expenditure Requirements in 1970–1989, in 1 000 Euros

	1970		1980		1989	
	Direct	Total	**Direct**	Total	**Direct**	Total
AGR	**0.0**	2.5	**0.0**	2.6	**0.3**	6.9
FOR	**0.0**	0.4	**0.1**	0.3	**0.5**	1.2
FOO	**1.1**	3.6	**1.5**	5.2	**4.9**	14.5
TEX	**0.6**	2.0	**1.3**	2.8	**4.1**	8.4
WOF	**1.6**	3.3	**1.2**	3.3	**4.6**	9.5
PAP	**4.7**	8.4	**2.6**	6.3	**5.3**	13.3
CHE	**17.0**	22.2	**10.1**	14.2	**35.0**	45.0
MET	**9.4**	20.1	**6.3**	13.0	**4.4**	12.0
MFM	**9.5**	13.7	**13.8**	19.7	**17.2**	25.7
ELE	**39.2**	45.1	**39.3**	44.7	**83.5**	94.3
TRE	**2.1**	7.0	**7.5**	13.3	**13.0**	22.6
TRD	**0.3**	1.4	**0.5**	2.3	**0.4**	3.2
TRC	**0.9**	2.2	**0.9**	2.5	**1.5**	5.5
BUS	**3.0**	4.6	**6.3**	8.1	**9.1**	12.5
Median Manufacturing	**2.4**	6.4	**2.9**	6.3	**10.2**	17.8
Median Tertiary	**0.9**	3.7	**0.9**	3.4	**1.5**	8.0

Notes: “0.0” are very small amounts of R&D expenditure. In constant 2017 euros deflated by Statistics Finland’s Wholesale Price Index. The R&D expenditure requirements reflect the amount of R&D expenditure required to produce one million 2017 euros worth of production. Total requirements could be biased by untrustworthiness of data on primary and tertiary sectors so direct requirements are preferable.

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1970–1989; see the appendices for human capital.

The final factor endowment in the four-factor H–O model is resource intensity. Natural resources is measured simply as the share of an industry’s value-added of exports that can be attributed to the primary sector: agriculture, hunting, fishing, forestry and mining. Note that I am referring only to domestic resources. Foreign resources might have been important for some industries, but the point here is to examine the importance of domestic factors, or the endowments provided by Finnish terrain.

The reliance on domestic natural resources declined over time. This transformation was not driven solely by export diversification away from forest industries since almost all industries shifted their production away from the use of natural resources. No export industry had a higher share of value-added of exports originating from primary sector in 1989 than in 1956. Even in agricultural exports, the share of primary sector inputs declined after 1965.

While forest manufacturing industries were reliant on forest resources throughout the post-war period, this tendency waned to great extent. In 1956, half of value-added in WOF’s exports and a third in PAP’s exports originated from natural resources. However, forest industries had a reversal of resource intensity during 1959–1965, which is probably

Table 11. The Share of Direct and Indirect Value-added Originating from Primary Sector in 1956–1989, %

	1956	1959	1965	1970	1980	1985	1989
AGR	81.5	83.0	81.5	78.2	74.2	76.3	72.3
FOR	97.6	96.5	97.6	96.1	97.3	96.3	96.1
FOO	52.1	45.6	51.8	50.4	51.1	54.1	45.7
TEX	2.0	1.3	1.8	1.1	1.0	1.1	1.1
WOF	47.5	43.5	45.7	39.3	35.9	35.8	30.2
PAP	32.5	27.5	32.7	27.4	22.7	20.9	20.8
CHE	7.4	7.0	5.8	4.4	3.5	3.7	2.7
MET	12.8	25.9	22.5	21.9	10.6	8.8	7.4
MFM	3.0	3.3	3.0	4.4	2.2	1.6	1.4
ELE	4.3	5.6	4.5	3.5	1.8	1.1	1.1
TRE	2.9	2.1	2.5	3.4	2.2	1.4	1.3
TRD	1.0	0.4	0.5	0.6	0.7	0.5	0.4
TRC	2.0	0.4	0.7	0.9	1.1	0.9	0.8
BUS	-	-	-	1.5	1.5	0.9	0.7
Median Manufacturing	6.4	6.3	5.7	4.4	3.8	3.5	2.9
Median Tertiary	1.3	0.6	0.9	1.5	1.5	1.1	0.9

Notes: "-" denotes that industry did not have any exports in that year and as such had no figure corresponding with resource intensity. Primary sector is defined as the industries of agriculture (AGR), forestry (FOR), fishing (FIS), metal ore mining (ORE) and other mining (OMI).

Source: The author's own estimates; Statistics Finland, Input–Output Tables 1956–1989; see the appendices for natural resources.

related to the programme to utilize forest resources to greater degree after the devaluation of 1957. Improved transportation also enabled easier access to resources. The decline in 1965–1970 corresponds with how the potential of these logging operations had been fully exploited and forest industries began to increase their level of refinement instead. Even sawmill production was curtailed primarily by lack of raw material by the 1980s and it is quite telling that Finland started to import raw wood from the Soviet Union.[325] Of course, the high investment ratio in PAP also meant that forest material was less needed.[326] Between 1956 and 1989 the share of primary products in WOF and PAP had fallen 17% and 12% respectively whereas forestry continued to be based on natural resources, which presumably had characterized its exports during the 1950s.[327]

Another very resource intensive industry was FOO, which reflects its backward linkages to agriculture. Indeed, one could characterize the industry simply as a refiner of agricultural goods. While foodstuff exports are not very important in the long-run

[325] Jensen-Eriksen 2007, 333; Ahvenainen 1984, 435
[326] Jensen-Eriksen 2008, 125
[327] Saarinen 2005, 30; Pihkala 2001, 255–256. The availability of forest resources was developed with silvicultural programmes though. See Pihkala 1982b, 402.

narrative of Finnish exports, its modest export performance in the early post-war period was likely determined partly by the availability of natural resources.

Yet comparing these exports' natural resource intensity to the manufacturing median illustrates that these industries were clearly outliers among the fields of business. The only metal industry that utilised domestic natural resources to great extent was MET. 13% of its exports were initially composed of primary sector inputs, but that ratio doubled to 26% in 1959. As Hjerppe notes, the industry was primarily a refiner of domestic mining products.[328] And indeed there were non-ferrous metal deposits such as copper in Finland, but by the 1980s these deposits had been depleted as well, which can be seen in MET's lower resource intensity during that time.[329] Metal engineering industries were not very dependent on natural resources as even ELE with its traditional cable production based on domestic copper, had only a negligible level of resource intensity in 1956.[330]

TEX was also among the industries that used natural resources the least during 1956–1989. CHE had a relatively "average" rate of natural resource use in the late 1950s, but one that decreased continuously. Therefore its development into an export industry by the 1980s was probably determined by other factors. This indicates that chemical production based on forest companies' inputs was not necessarily important in the grand scheme of things here. As expected, service industries were not dependent on resources either.

4.3 Variables of New Trade Theory

> The "gilded age" of applying neoclassical foreign trade theory broke with regards to Finland at the beginning of free trade integration with FINEFTA-agreement 1961 and free trade agreement with EEC 1973.[331]

The emergence of intraindustry trade was a blow to the validity of factor endowment model, or neoclassical foreign trade theory as Pihkala calls it. If factors of production of even a four-factor Heckscher-Ohlin model – labour, capital, human capital and natural resources – are incomplete explanations, variables of economies of scale and product differentiation might be explanatory instead. Since data is lacking on primary and tertiary sectors, I will mostly discuss manufacturing industries here. Services of a certain industry

[328] Hjerppe 1982, 421
[329] Paavonen 2008, 257
[330] Ibid., 275
[331] Pihkala 2007, 47

are often close substitutes of one another, but still different, so they could be automatically considered to be horizontally differentiated, but I will not study this point in further detail.

In the case of economies of scale, average plant size – here average establishment size – is a standard measure although it can also reflect product standardization. One should be mindful of the possibility that there are two forces at work here. First, there is product standardization that is an independent cause of exports, likely to increase net exports and to decrease IIT since it reflects homogenous products instead of differentiated ones. This perhaps corresponds with what Aunesluoma and Paavonen have described as scale advantage. Economies of scale along the lines of NTT is the second force. Here only the existence of economies of scale on some level is relevant for IIT to emerge. It is uncertain which level of average establishment size that would be, especially since Parjanne asserts that high levels of average plant size probably stand more for product standardization.[332]

Average establishment size almost tripled between 1952 and 1989 when considering the manufacturing median. Yet there was a wide disparity in scale advantage among industries. Most manufacturing industries did not have as large establishments as PAP, which operated on a large scale relative to the U.S. and Western European countries as well.[333] Indeed, since Heikki Niemeläinen asserted that increasing returns to scale were a characteristic of the industry it should be no surprise that PAP's establishments were on average over ten times as large as the median establishment in manufacturing.[334]

The investment programme of the early post-war period seems to have increased plant sizes in 1952–1965, though the largest increases in size happened in the 1980s. The increase in average establishment size therefore reflects its capability to rationalize its production. On the other hand, Finnish forest companies during this time were characterized by a "more of the same" attitude which led to larger and larger establishments that might have been more technically advanced but were still producing similar products.[335] This suggests that paper products were perhaps homogenous. In comparison with the paper industry, woodworking industry was conversely not a large-scale industry.

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[332] Parjanne 1992, 95
[333] Jensen-Eriksen 2007, 200–201; Maliranta 1996, 128–129
[334] Niemeläinen 2000, 281
[335] Jensen-Eriksen 2008, 126

Table 12. Average Establishment Size in 1952–1989

	1952	1959	1964	1972	1980	1986	1989
AGR	.	.	.	.	.	.	.
FOR	.	.	.	.	.	3.1	3.5
FOO	0.2	0.4	0.5	0.5	0.2	0.3	0.4
TEX	0.1	0.2	0.3	0.6	0.5	0.5	0.3
WOF	0.1	0.2	0.2	0.3	0.4	0.3	0.5
PAP	4.1	4.6	6.0	6.7	5.9	10.8	14.9
CHE	0.9	1.4	2.2	1.9	2.3	3.8	6.9
MET	2.4	1.7	2.5	4.1	4.6	5.9	11.1
MFM	0.3	0.3	0.5	0.5	0.5	0.7	0.8
ELE	0.7	0.7	1.0	1.6	1.2	1.4	1.5
TRE	0.3	0.3	0.4	1.0	1.1	1.8	1.7
TRD	0.1	.	0.1	0.1	0.1	0.2	0.2
TRC	0.1	.	.	.	.	0.7	0.9
BUS	0.1	.	0.1	1.6	1.1	0.6	0.7
Median Manufacturing	0.4	0.4	0.5	0.7	0.7	0.9	1.1

Notes: "." refers to a missing value. Measured as value-added in millions of 2017 euros, deflated by Statistics Finland's Wholesale Price Index, divided by the number of establishments. Several industries were dropped due to unreliability of data and possible systematic breaks in the series. The median of the tertiary sector is not included due to missing values arising from these issues.

Source: The author's own estimates, Statistics Finland; see the appendices for scale advantage.

This is not surprising. According to Ahvenainen, there were not many large sawmills in the 1960s despite modernization of old facilities.[336] Interestingly enough, the data for 1989 suggests that forestry might have been operating on a relatively large-scale at that point. In the early post-war period the primary sector had still been characterized by small establishments according to Dahmén.[337]

While MET operated on a smaller scale than PAP, its average establishment size was still high and had an increasing trend in 1959–1972 and 1980–1989. Product standardization and homogeneity unrelated to horizontal differentiation may have been features of this industry as well then. Larjavaara argued that increasing returns to scale were present in metal engineering industries, but the evidence here does not support this argument.[338] Of course, drawing on the argument that only a certain level of scale advantage is important to attain horizontal differentiation, it is also possible that MFM, TRE and ELE reached this threshold at some point. ELE in particular had larger establishments than the manufacturing median which is in line with Larjavaara's findings.[339] Establishments in

336 Ahvenainen 1984, 404
337 Dahmén 1963, 51–53
338 Larjavaara 1978, 123. His argument rests on the notion that these industries' net exports correlated with their home market shares, which is perhaps not the best evidence for increasing returns to scale anyway.
339 Ibid., 128

TRE also grew in size during the 1980s, though they were still relatively small compared to MET or PAP.

Conversely CHE's establishment size grew more strongly in the 1980s. Since its average establishment was relatively large compared to the median during 1959–1972, scale advantage might have been a determinant there. While beverage and tobacco industries – not detailed here – were characterized by large establishments, other consumption goods industries were not. The results here do not suggest that textile and foodstuff exports would have had scale advantage or economies of scale to the extent that made product differentiation possible. Indeed, Hjerppe's remark that foodstuff industry had transformed into a large-scale one seems unjustified.[340]

Similarly, there is not much evidence for scale advantage being a determinant of service export industries either – although this might arise from concrete lack of evidence as there is not much reliable data concerning TRC for example. Most services were operated from a large number of small enterprises. For example, while retail trade was rationalized from the 1960s, the larger establishment sizes are barely visible there.[341]

Product differentiation is another determinant of intraindustry trade, which can be measured through R&D intensity or marketing intensity. The R&D data is essentially the same as that used in previous section, but it is classified here according to product groups, not industries. Industries can and do have expenditure devoted to research in products outside their own characteristic product line. For example, the high level of R&D intensity in rubber and plastic goods – not detailed here – during 1985 can be explained with R&D expenditure that largely originated from CHE. Product groups have been weighted according to industry size though.

Product differentiation can be also studied with innovation data. Admittedly the number of innovations does not account for all research activities, but it is perhaps conceptually closer to the notion of horizontal differentiation. R&D expenditure can theoretically simply reflect a large company investing huge amount of funds into increasing the quality of a single commodity or a single breakthrough. Innovations are defined here as specific inventions, or *products*.[342] However, eight cross-sections, the years accounted for input-

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[340] Hjerppe 1982, 410.
[341] Lastikka 1984, 30–31
[342] Saarinen 2005, 59. See Ibid., 67–72 for a more comprehensive definition of an innovation and additionally the collection methods concerning the number of inventions.

Table 13. Direct R&D Expenditure Requirements across Product Groups in 1970–1989, in 1 000 Euros

	1970	1980	1982	1985	1989
AGR	0.3	0.4	0.5	0.9	0.9
FOR	0.7	0.6	1.0	0.9	1.6
FOO	1.1	1.9	2.3	3.0	3.9
TEX	1.0	1.6	1.8	1.7	3.0
WOF	1.2	1.2	2.2	2.0	2.3
PAP	6.7	4.0	4.6	5.2	7.5
CHE	19.3	14.9	19.4	10.9	32.0
MET	8.1	6.2	7.2	7.2	6.9
MFM	9.2	13.2	13.8	18.9	20.2
ELE	36.5	51.8	63.9	74.4	93.7
TRE	1.9	4.8	5.2	12.1	9.0
TRD	0.4	0.1	0.1	0.0	0.1
TRC	1.0	1.0	1.0	1.2	3.1
BUS	2.2	0.9	2.0	2.5	3.5
Median Manufacturing	5.1	4.3	5.0	8.5	9.7
Median Tertiary	0.7	0.4	0.5	0.9	0.9

Notes: In constant 2017 euros deflated with Statistics Finland's Wholesale Price Index. While R&D expenditure is calculated according to product groups it is scaled according to industry size, or gross value of production. Total requirements that also cover backward linkages are disregarded, since in the case of product differentiation only the end product's qualities matter.

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1970–1989; Vuori 1994; see the appendices for product differentiation.

output tables, are used in the regression analysis soon to follow. There is a degree of arbitrariness about this approach. A year might have had more or fewer innovations released in comparison with years just prior or after it. Therefore, aggregate sums over 1945–1998 reported by Saarinen are included in this descriptive section whereas the data used in regression analysis is in appendix Table A 15.

Similarly to scale advantage, horizontal product differentiation is difficult to identify due to possible non-linearity. High levels of R&D expenditure might refer more to technological rather than horizontal differentiation. In technological differentiation "one or more attributes of a particular product will be changed technically and it will become a new, different product".[343] This type of differentiation is more related to product cycle and technological gap theories mentioned in previous sections, whereas horizontal differentiation relates to NTT.[344] Therefore special care should be taken in interpreting these figures. For this reason I have included proxies for industrial concentration in this section, which should be negatively associated with horizontal differentiation.

[343] Parjanne 1992, 28
[344] Ibid., 27–28, 46

Table 14. The Number of Innovations according to Product Class in 1945–1998

	1945–66	**1967–84**	**1985–98**	**C4-index**
Foodstuffs	4	2	81	28.7
Textiles, clothing	4	7	17	25.0
Wood products	47	51	34	11.4
Pulp & paper products	10	9	53	30.6
Oil & chemicals, + pharmaceuticals	46	81	145	19.1
Non-metallic mineral products	10	23	27	20.0
Basic & fabricated metal products	56	68	109	21.9
Machinery and equipment	222	335	321	14.0
Electrical, electronics	72	108	169	30.6
Instruments	41	137	160	16.6
Transport equipment	68	101	44	26.3
Electricity, gas & water supply	10	39	19	23.5
Software	0	40	221	12.6
Others	2	0	48	21.7
Total	592	1001	1456	21.6

Notes: Total C4-index refers to the average index score. The index is the share of the four largest innovatory firms in a given industry for the entire period.

Source: Saarinen 2005, Table 5.2.

In addition to R&D intensity, we may also consider marketing intensity although the data for it is rather deficient. There is only one cross-section, for 1985, and total requirements cannot be reliably interpreted due to lack of figures for primary and tertiary sectors. Additionally, one would assume that technologically differentiated products would require some advertising as well. There is also the issue that joint sales companies, or export cartels, effectively operated as marketing divisions for their host industries. Thus, it is not surprising that paper companies had such a low rate of marketing intensity as most of this was likely classified in figures for trade industry.[345]

Both series for R&D intensity and the number of innovations, based on Tables 13. and 14., indicate that forest products were not especially differentiated, this is despite there being forest-based research centres in Finland, founded jointly by several companies prior to the post-war period, such as Keskuslaboratorio Oy.[346] Indeed, Jensen-Eriksen maintained that forest industries' products were "highly standardized bulk products" where inventions were process-innovations which tended to be unobservable to the general public.[347] Paper industry was also not viewed as market-oriented by contemporary observers.[348]

[345] See Heikkinen 2000, 477–478 for a discussion related to paper companies' sales association: Finnpap.
[346] Saarinen 2005, 39
[347] Jensen-Eriksen 2008, 144; Jensen-Eriksen 2007, 30
[348] Jensen-Eriksen 2008, 126

However, there is conflicting evidence concerning whether paper or wood production was the more differentiated one. WOF has been traditionally regarded as a low-tech industry, which is supported by the product group data.[349] Yet in 1948–1984, its number of innovations outranked that of paper. Its innovations were also less concentrated than in PAP. Horizontal differentiation was more likely in the case of furniture production, which after all produces durable consumption goods, rather than in woodworking proper though, as can be seen from Table 17. detailing marketing intensity.

The highest R&D intensity across industries by far was in ELE and in a rising trend. The number of innovations in its product group was also very high in the post-war period. Yet the innovation activities there were evidently ran by large companies.[350] Additionally, electrotechnical goods and instruments tended to be characterized by innovations increasingly new to world markets, of relatively high complexity, and of an origin related to science and technology more so than other industries.[351] However, ELE did have a high ratio of marketing expenditure, but this might be related to advertising technologically advanced products. In the end, I would conclude that there is more evidence in favour of ELE's products being related to technological rather than horizontal differentiation.

Goods related to machinery also tended to be characterized by many innovations and, especially in the late 1980s, high R&D expenditure. Innovations in machinery tended to be of relatively low complexity and, prior to 1984, not novel in world markets. Furthermore, their development was usually prompted by price competition or threat of imitation rather than from scientific and technological advancement as in ELE.[352] Product innovations here were also among the less concentrated among fields of business, which is consistent with product differentiation.[353] Saarinen also mentions that fabricated metal products became more complex once new materials were introduced beginning in the 1980s.[354] The employment share of large establishments in MFM is close to the median, which at least does not prove that the interpretation of horizontal differentiation is false.

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[349] Saarinen 2005, 30

[350] Both Saarinen's C4 -ratio and the employment share of large establishments corroborate this interpretation. However, the C4 -ratio for instruments, which are included in this thesis' ELE during 1980–1989, indicates less concentration than in electrotechnical goods. Yet I would argue that the employment share measure for ELE is more consistent with high concentration in the industry.

[351] Ibid., 118, 156, 165

[352] Ibid., 118–119, 156, 165

[353] Note that fabricated metal products are included in Saarinen's data among basic metal products and not in machinery as in generally this thesis.

[354] Ibid., 33

Table 15. The Share of Employees in Large Establishments in Manufacturing in 1959–1989, %

	1959	1970	1980	1989
FOO	17.2	28.2	34.2	36.0
TEX	51.0	46.2	45.2	36.3
WOF	41.9	50.6	42.8	37.6
PAP	78.1	81.3	83.3	85.5
CHE	43.2	56.9	57.4	61.4
MET	73.6	84.7	86.1	78.3
MFM	54.0	57.0	52.1	44.6
ELE	58.9	70.2	73.4	67.4
TRE	58.3	47.7	76.1	74.5
Median Manufacturing	52.5	54.7	51.5	46.5

Notes: Large establishments are defined as having more than 200 employees. Note that shoe manufactures are classified in TEX, not in LEA, in 1959–1970.

Source: The author's own estimates; Statistics Finland, Statistical Yearbooks of Finland 1959–1989; see the appendices for monopolistic competition.

Furthermore, the figures indicate that its concentration declined in 1980–1989. The industry's marketing intensity was not very high, but not non-existent either.

All of this would imply that MFM was characterized by horizontal differentiation. Yet it is useful to remember that Dahmén criticized metal exports of their lack of so-called market-creating innovations in 1949–1962. Eastern Trade led to specialization of sorts, but only rarely were there Western markets for resulting products. This implies that the nature of product differentiation in metal industries was related to how the demands of Eastern Trade were satisfied. I will return to this point in later sections.[355]

The evidence for product differentiation in other metal industries is mixed. MET did have a higher than median manufacturing in R&D intensity prior to 1985, whereas this was the case in TRE only during that year, and both product groups tended to generate more innovations than e.g. forest industries. However, Table A 15. indicates that most innovations in Saarinen's data, seen in Table 14., were not actually basic metal products but rather fabricated metal products that are classified in MFM in this thesis. Additionally, the low levels of marketing intensity and a high level of concentration in MET indicate that there are no grounds to declare that its products would have been horizontally differentiated despite some evidence to the contrary.[356]

[355] Dahmén 1963, 36–37

[356] Saarinen 2005, 118–119, 156, 165. The evidence consists of the low complexity of its innovations, of not being novel in world markets and being prompted by demand-side reasons. Note though that these points in favour include both fabricated metal products and basic metal products.

Table 16. Share of Five Largest Exporters in Manufacturing in 1981–1989, %

	1981	1985	1989
Food, beverage and tobacco	60.7	65.3	57.8
Textile, clothing and leather	15.7	18.1	22.9
Wood	28.0	33.1	45.1
Paper and graphic	46.5	45.7	68.9
Chemical	58.6	66.7	56.7
Non-metallic mineral	49.4	59.6	53.5
Basic metal	92.2	93.6	89.5
Other metal industries	35.8	37.9	24.7
Other manufactures	31.4	44.4	49.7
Total manufacturing	21.3	23.5	28.0

Source: Board of Customs, OSF IA Foreign Trade 1981 Vol. 2, 1985 Vol. 2 & 1989 Vol. 2.

Notes: Measures are in gross value, not value-added of exports.

TRE was the most complex field of industry in 1948–66 in terms of innovations. Yet its innovations in 1967–1984 were clearly less complex than the general average, tended not to be new in world markets prior to 1985 and were usually prompted by demand-side reasons which are consistent with horizontal differentiation. TRE also utilized marketing to great extent in 1985, yet its high employment shares of large establishments imply that it was not characterized by horizontally differentiated products, although it was less concentrated before the 1980s. Based on Saarinen's measure of concentration of innovation activities one could say that TRE innovated more than what was average, but the ratio smooths differences across time periods.

These points indicate that transport equipment might have been technologically differentiated prior to 1967, but was horizontally differentiated afterwards, at least before the end of the century. That there was product differentiation in TRE is perhaps not surprising since even its initial exports related to special varieties such as icebreakers and car ferries which were complemented by passenger cars and oil-rigs in the 1970s.[357] Yet it is slightly surprising that its R&D expenditure was lower than in MET.[358]

CHE's product line embodied a high degree of R&D expenditure throughout 1970–1989 and especially in 1989. As already mentioned, the relatively low degree of the measure in 1985 most likely reflected that a great deal of its R&D expenditure was devoted to research in rubber and plastic products. In terms of innovations, chemical, oil and pharmaceutical products did not exactly stand out. Still, the number of innovations there

[357] Saarinen 2005, 34; Hjerppe 1982, 421–422
[358] Saarinen 2005, 118–119, 156, 165

Table 17. Direct and Total Marketing Expenditure Requirements in 1985, in 1 000 Euros

	Direct	**Total**
AGR	.	**2.5**
FOR	.	**0.2**
FOO	5.4	**10.1**
TEX	12.1	**15.7**
WOO	5.8	**7.8**
FUR	16.0	**19.6**
PAP	0.5	**2.6**
CHE	8.4	**10.9**
MET	0.0	**1.4**
MFM	6.1	**8.5**
ELE	18.2	**20.7**
TRE	21.0	**24.6**
TRD	.	**0.6**
TRA	.	**1.4**
COM	.	**0.6**
BUS	1.1	**2.0**
Median Manufacturing	5.4	**10.1**

Notes: In constant 2017 euros deflated with Statistics Finland's Wholesale Price Index. The marketing expenditure requirements reflect the amount of marketing expenditure required to produce one million 2017 euros worth of production. Industrial classification disaggregates WOF into WOO and FUR and TRC to TRA and COM here. "." denotes missing values. Tertiary median is not included due to missing values.

Source: The author's own estimates; Statistics Finland; Input-Output Table of 1985, Parjanne 1992; see the appendices for product differentiation.

was higher than in forest or textile products. On industrial concentration there is conflicting evidence as Saarinen's C4 index indicates less concentration and the employment share of large companies indicates more concentration apart from 1959.[359]

As for CHE's marketing intensity in 1985, it was higher than the median but not markedly so. Chemical innovations tended not to be novel in world markets prior 1985–1998 and they were predominantly developed because of demand-oriented reasons. In addition, all chemical inventions in 1945–1966 were of low complexity, though their rate of complexity increased to an average level in 1967–1984. In conclusion, there is some evidence that horizontal differentiation might have played a role in the industry's exports at least before the late 1980s when they possibly became technologically differentiated.[360]

Textile products were decidedly not differentiated according to neither R&D intensity nor the number of innovations. On both counts they were markedly lacking compared to other industries, even if the industry's exports were not concentrated as can be observed in Table 16. However, textile industries had a high rate of marketing expenditure in 1985.

[359] Saarinen's measure is perhaps biased by rubber and plastic production, which were evidently less concentrated over time, on this point.
[360] Saarinen 2005, 118–119, 156, 165

This makes sense since textiles and apparel would require marketing as consumption goods, whereas – explaining the lack of human capital intensity observed in the previous section – skilled personnel were not needed in actual production. It is also worth pointing out that the few innovations textile industries had, tended to be non-complex, not new to world markets and demand-oriented – all of which points towards horizontal differentiation.[361] While consumption goods might be generally thought of as differentiated, foodstuff products were not markedly so in neither measure even if Hjerppe stated that there was active product development in the industry.[362]

Finally, there is no strong evidence to suggest that exports of either primary or tertiary sectors would have been differentiated. Of course, one can argue that services are by their nature differentiated, but one cannot rule out that Finnish service exports would have been homogenous concerning either R&D or marketing. While the small increase in TRC products' R&D intensity in 1985–1989 probably reflects development in telecommunications technology as observed in Table 13. it seems that these inroads into the new technological frontiers were still marginal at the time. It is likely that the high number of software innovations of Table 14. reflect the 1990s more than the late 1980s. However, considering appendix Table A 15. it seems that the innovatory activities of BUS were quite formidable in 1985 and 1989. Its innovations accounted for 20% and 13% of total innovations in Finland in these years respectively. Whether this was more reflective of horizontal or technological differentiation is hard to say.

4.4 Institutional Circumstances

> The Finnish economy until the new era of globalization, the 1980s, was able to limit the competition in several ways. The paper and pulp companies formed strong domestic cartels in order to find joint export markets, and they were also active in international cartels. They received support from the government for their investments – – One important component of exports, those to the Soviet Union – – were always negotiated by high-level government officials.[363]

[361] Saarinen 2005, 118–119, 156, 165
[362] Hjerppe 1982, 424. The only exception in consumption goods' otherwise low R&D intensity is in BEV during 1989, which might explain the number of innovations in foodstuff products in 1985–1998.
[363] Hjerppe & Jalava 2006, 62

> Historian has the permission and actually also the obligation to set the assumptions of economics at stake, if it is important for the question at hand.[364]

In addition to reviewing the features of C–H–O model, I also stress that some of the institutional characteristics of post-war Finland should be studied – after all they were determinants of export structure according to Hjerppe.[365] Simply because they might not be accounted for trade models of economics does not mean that they were not important. Dismissing these factors would constitute for an undue overvaluation of C–H–O model over historical facts.

Perhaps the most important institutional quality with regards to structural transformation of Finnish industry was the decreasing protectionism of domestic manufacturing, which can be measured by tariff rates. Secondly, I review which industries might have had export cartels, though much is uncertain about this topic. Conversely in the case of Eastern Trade several positives and negatives have been suggested. I conclude by briefly examining whether changes in export structure might have been associated with state-owned companies.

Tariff rates do not constitute a perfect measure of protectionism as there are a variety of other methods to curtail international competition. However, they do reflect how customs barriers were lowered in Finland and the fact that many industries were given leeway in adjusting to free trade through slower removal of tariffs. One can utilize not only nominal tariff rates but also effective tariff rates. The former type is defined here as the value of collected customs duties relative to the value of imports. Effective rates of protection (EFP) is calculated with input-output tables as many other variables in this thesis. The algebra is detailed in the appendices. For now, the term should be understood as corresponding not with a product, as nominal tariff rates, but with the whole value-chain of that product. The input structure of an industry is once again pertinent. While an industry's end product might have had a low tariff rate, its inputs faced a different rate.

Effective rate of protection then is the "percentage addition made possible by the existence of the tariff to the value-added of the domestic industry".[366] I.e. while setting a

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[364] Jalava, Eloranta & Ojala 2007, 11. Translated from: "Historiantutkijalla on lupa ja oikeastaan myös velvollisuus asettaa taloustieteen olettamukset vaakalaudalle, mikäli se on kyseessä olevan tutkimuksen kannalta tärkeää".
[365] Hjerppe 1989, 169
[366] Kauppila 2007, 66

Table 18. Nominal and Effective Rates of Protection in 1934–1989, %

	1934		**1959**		**1970**		**1989**	
	Nom.	**Eff.**	Nom.	**Eff.**	Nom.	**Eff.**	Nom.	**Eff.**
AGR	94.2	**105.2**	45.2	**48.6**	10.7	**11.5**	6.5	**9.4**
FOR	7.3	**6.3**	0.0	**-2.6**	0.0	**-0.2**	0.0	**0.0**
FOO + BEV	174.9	**208.1**	.	**.**	.	**.**	.	**.**
FOO	.	**.**	118.0	**277.6**	25.8	**76.8**	4.2	**0.9**
BEV	.	**.**	141.0	**224.7**	60.9	**110.7**	9.0	**13.3**
TEX	24.9	**34.3**	24.4	**27.8**	4.9	**4.2**	5.0	**4.5**
WOO	35.1	**1.4**	5.8	**4.4**	0.0	**-0.4**	0.1	**0.1**
FUR	.	**.**	0.0	**-4.8**	0.0	**-1.4**	1.4	**1.8**
PAP	8.3	**-5.3**	9.2	**7.4**	3.7	**2.8**	0.3	**0.0**
CHE	7.8	**-0.3**	1.5	**-7.7**	0.6	**-0.2**	0.3	**0.1**
MET	.	**.**	7.1	**11.3**	1.2	**1.9**	0.1	**0.0**
MET + FAB	19.7	**21.9**	.	**.**	.	**.**	.	**.**
MFM	.	**.**	.	**.**	.	**.**	0.6	**0.3**
FAB	.	**.**	6.5	**6.9**	2.7	**3.9**	.	**.**
MAC	8.3	**6.4**	3.4	**0.8**	1.6	**1.1**	.	**.**
ELE	9.3	**8.8**	7.6	**8.0**	4.8	**5.6**	2.1	**1.6**
TRE	4.9	**2.4**	11.2	**9.8**	4.5	**3.4**	1.5	**0.7**
TRD	.	**-1.1**	.	**0.0**	.	**-0.1**	.	**0.0**
TRC	.	**-3.3**	.	**-2.0**	.	**-0.5**	.	**-0.1**
BUS	.	**-2.8**	.	**0.0**	.	**-0.2**	.	**0.0**

Notes: Note that Kauppila's tariff rates for 1934 are classified in a different manner as in 1959–1989 and suffer from some statistical unreliability. The industrial classifications of 1959–1989 also disaggregate WOF to (WOO and FUR) and MFM (FAB and MAC) when possible. The industrial classification used here is not identical to one in Tables A 17 or A 18.

Source: The author's own estimates; Statistics Finland; Board of Customs; Kauppila 2007, Table 26; See the appendices for tariff rates.

tariff on an end-product of an industry will increase its level of protection, a tariff on that industry's raw materials, or its any other input for that matter, will increase its production costs and decrease its value-added reducing its EFP.[367]

High effective rate of protection implies that the value-added of an industry is highly protected, which naturally also increases domestic prices and reduces consumer income, but this does not matter for exports. If the effective rate is lower than the nominal rate, industry's imported inputs had a higher tariff than its own products which means that the tariff policy did not protect the industry as well as it was designed to. Negative effective rates imply that the industry is in a sense taxed, or negatively protected. Usually however, effective rates would be higher than nominal ones since customs duties on raw materials were lower than for intermediate or finished goods.[368] Kauppila also thinks that high tariff rates for industries with low domestic output reflect fiscal purposes instead of

[367] Kauppila 2007, 66–67
[368] Balassa 1965, 579

protectionist ones, which is logical enough though one should not necessarily read too much into possible political motivations behind these rates.[369]

While the data for 1934 contains some possible errors, and its classification is not completely comparable to the one used here, it is still useful to inspect the parallels between the protectionist 1930s and the protectionist 1950s.[370] For instance, FOO was highly protected in 1934, but even more so in 1959 – a vestige of war-time prerogatives perhaps. Indeed, this logic perhaps explains the high customs barriers on agriculture, which was still relatively protected in 1989. TEX was similarly protected in 1934 and in 1959 although its effective rate of protection had decreased to some extent, reflecting that tariff policy increased its input costs more than in the 1930s.

With forest industries in 1934, the level of protection was greater, but lower EFP suggests that its value-chain was protected less than optimally. Yet by 1959 their value-added was actually protected to relatively great extent. Since woodworking and paper industries did not have a high degree of direct value-added, this must reflect that their input costs were not increased by tariff rates relative to their own end-product tariffs. As Kauppila mentions, the nominal tariff rates are hard to justify in forest industries in any other manner than in fiscal sense, since these products were mostly exported abroad.[371]

CHE was actually negatively protected in 1959. Kauppila suggests that the industry's raw materials had high tariff rates relative to end-products in 1934, but this problem seems to have accentuated by 1959.[372] It is possible that the lack of customs barriers and the negative protection of CHE slowed its development to an export industry to some extent. Paavonen did note that fertilizer production was shielded by customs barriers, but this seems to have been negligible when considering all chemical production.[373]

While the level of protection in metal industries was generally lower in 1959 than in 1934, the metal industries were definitively protected. TRE was shielded by customs barriers to greater degree in 1959 than in 1934 whereas MET and ELE, to lesser extent, were protected in effective terms in 1959. While MET seem to have been more protected in

[369] Kauppila 2007, 138–142
[370] Ibid., 138–139
[371] Ibid., 141
[372] Ibid., 140–141
[373] Ibid., 278

1930s, in ELE the effective rate of protection was virtually the same. Machinery production on the other hand was less protected in 1959 than in 1934.

The results do have some implications for trade structure. First, it is quite clear that protectionism did decrease over the post-war period, opening all industries up to international competition to a greater degree. However, the initial exports of FOO were certainly aided by customs barriers. The visible degree of protection in TEX after 1959 also most likely contributed to its exports, though the lower EFP there seems to indicate that tariff policy was sub-optimal in protecting its value-chain to a minor degree. The high customs barriers, a result of consumption goods receiving a slower timetable of tariff reductions, did not aid these industries in reaching U.S. level of labour productivity at any rate.[374] Early chemical exports were actually impeded to a minor degree by the Finnish tariff regime. At the very least, its eventual development into an export industry clearly occurred in the face of international competition.

The relatively high EFP in 1959 concerning MET and TRE suggests that the infant industry argument might be applicable here to some extent, although it should be noted that basic metal manufactures' level decreased substantially by 1970. Considering that the industry evidently reached the U.S. level of labour productivity in the 1980s,[375] tariff protection was perhaps not the most important factor here. Additionally, basic metal and fabricated metal products had high customs barriers already in 1934, yet the industry developed into an export industry relatively late, which implies that the infant industry argument is not at its strongest here.

Of course, the problem with the infant industries argument is always with the counterfactual that customs barriers could have equally impeded growth in productivity besides increasing input costs as well. Dahmén argues that particularly metal industries utilized their factors of production inefficiently due to customs barriers. In their absence specialized, large-scale manufacturing would have been more efficient in the use of labour and capital than separate small-scale production lines servicing domestic markets. He asserts that whereas protectionism allows for the fragmentation of manufacturing into these small-scale operations, lack of it would tend to rationalize industry into larger units

[374] Pihkala 2001, 203; Maliranta 1996, 86
[375] Ibid., 87, 96

resulting in lower costs and higher productivity. Indeed, Dahmén is implicitly stating here that scale advantage might have been partly a result of free trade integration.[376]

The evidence here is not conclusive then. The high export share of at least TRE during the early post-war period could certainly be attributed to customs barriers, yet perhaps Dahmén is right in arguing that this led to lower productivity. While ELE was one of the industries that Finland managed to provide customs barriers in exchange of EEC curtailing Finnish paper exports,[377] considering that ELE's exports remained relatively meagre before the 1980s, it is difficult to say whether it was international competition or barring it up that spurred the industry's exports in the post-war era.[378] While fabricated metal products were protected to some extent, machinery production was not. Since the latter was the more important component in MFM, the industry was unaided by protectionism. In conclusion, the data here does not indicate that some metal exports were not aided by Finnish protectionism in the 1950s at the very least.

Lastly, we may briefly study effective rates of protection of services. Negative rates on services reflect that inputs from manufacturing have higher prices because of tariff rates whereas services are not protected in the same manner as commodities.[379] At least TRC was clearly hampered by tariffs, but it is also generally the case that protectionism during the early post-war period clearly did not help the tertiary sector to develop either domestically or internationally. One can speculate that service exports might have developed more strongly if free trade would have existed. Of course, trade in services was not free of protectionism either as GATT's Uruguay Round in 1986–1994 included discussions over its liberalization.[380]

As mentioned earlier cartels were a characteristic of both the Finnish and international economy, the existence and effects of which are difficult to measure. Additionally, it is not conceptually clear what effect cartels would have on the C–H–O model used in this thesis. Though it has been suggested that it can be an independent cause of trade, based on empirical evidence fear of retaliation seems to have had the opposite effect.

[376] Dahmén 1963, 61–62
[377] Pihkala 2001, 214
[378] Larjavaara suggests the former, or lacking infant-industry protection, as the reason for slow growth in some product groups of ELE. See Larjavaara 1978, 145.
[379] Kauppila 2007, 141–142
[380] Pihkala 2001, 230, 282–283

Table 19. Propensity for Cartelisation in 1956–1989

	1956	1959	1965	1970	1980	1985	1989
AGR	3	3	3	3	3	3	3
FOR	2	3	3	3	3	3	3
FOO	2	2	2	2	2	2	2
TEX	2	2	2	2	2	1	2
WOF	2	1	3	3	2	3	3
PAP	4	4	4	4	4	4	4
CHE	2	3	3	2	3	2	2
MET	4	3	4	3	4	3	4
MFM	2	2	1	1	1	1	1
ELE	2	1	1	1	1	2	1
TRE	2	2	1	2	2	2	2
TRD	2	2	2	2	2	1	2
TRC	2	2	2	2	2	2	2
BUS	2	2	2	1	1	1	1

Notes: The variable for propensity for cartelisation is calculated first by checking if the industry exceeds the 1956 median in capital intensity, natural resource intensity, the employment share of large establishments, or if it was under the average of the number of innovations in 1956. The values reflect the number of conditions fulfilled with "4" as the maximum.

Source: The author's own estimates, Statistics Finland; SFINNO; see the appendices for sources regarding product differentiation, capital, natural resources and monopolistic competition.

Cartelisation across industries is measured here in the form of propensity for cartelisation. The measure considers several factors that have been named by Jensen-Eriksen as present in a cartelized industry. In other words, an industry like this "was a capital intensive field, where the barriers of entry were high, access to raw materials crucial, and the products relatively homogenous".[381] The measure here is crude and one should not infer too much about changes over time. The measure rests on the assumption that these factors truly motivated export cartels to form in industries and that companies were rational agents who responded to these conditions. In reality, none of this might have occurred. It is also important to remember that the effect of cartelization is uncertain – they might have allowed expanded production or impeded growth of novel ides and high-quality products.[382] The high propensity of cartelization might also reflect the existence of an international export cartel which obstructed the development of a domestic manufacturing field into an export industry.

It is clear that PAP had a propensity for cartelisation throughout the post-war decades. The same seems to apply in WOF, AGR and FOR as well to some extent. While this is partly explained by resource intensity, note that they shared other qualities as well. While

[381] Jensen-Eriksen 2017, 4
[382] Heikkinen 2000, 479–480; Kuisma 1999, 80

TEX did not apparently have any of the characteristics that motivated cartelisation there is some indication that CHE might have had export cartels. One can claim this in stronger terms regarding MET. Supposing that it was cartelized in the 1950s it is possible that it was doubly protected by both customs barriers and cartels. Cartelisation seems to have been unlikely in metal engineering industries and in service exports.

The results can be confirmed by inspecting Grubel-Lloyd indices in Table 1. as well. Considering the low scores of intraindustry trade in forest industries, it seems quite probable that they were shielded from imports by fears of retaliation. However, increasing G-L index scores imply that these perhaps fears lessened over time, though the increases in WOF could also simply reflect structural transformation of Finnish industry to a higher level of refinement. MET's growth prior to 1980 and the high degree of IIT there suggests that international cartels were either non-existant or not strong enough to impede its performance. CHE tended to have less-than-median scores of IIT, which perhaps suggests that these exports was partly dependent on Eastern Trade.

The third institutional factor considered in this thesis is the share of exports devoted to Eastern Trade as there is ample evidence to suggest that this kind of foreign trade was qualitatively very distinct from other exports. Profitability of Eastern Trade was higher than in Western Trade, but it potentially also functioned as a springboard to Western markets. Thus, Eastern Trade can be interpreted as a kind of protectionism. This interpretation is supported by the fact that the Soviet share of Finnish exports was shielded from international competition and the companies Neste Oy and Kemira Oy had a state monopoly on their respective fields concerning OIL and CHE.[383]

The share of Eastern Trade was not always stable and sometimes fluctuated dramatically. For example, the share of foodstuff exports going into communist trade partners doubled in 1959–1965 but declined noticeably during the next five years. The notion that Eastern Trade benefited Finnish exports due to long-term contracts, did not evidently translate to easily anticipated export shares, though at least partly the results here are affected by increasing trade to Western markets.[384] Pihkala writes that the oil crises and the subsequent depression in Western markets tended to increase metal and consumption goods exports to the East in the early 1980s.[385] Indeed, such a development can be seen

[383] Paavonen 2008, 285; Laurila 1995, 100
[384] Ibid.
[385] Pihkala 2001, 257–258

Table 20. The Share of Exports to Eastern Group in Commodity Gross Exports in 1956–1989, %

	1956	1959	1965	1970	1980	1982	1985	1989
AGR	2.9	0.3	12.6	5.8	5.0	4.7	14.8	4.7
FOR	16.6	10.9	8.1	0.9	13.6	0.0	8.8	6.0
FOO	16.0	18.6	37.8	25.7	40.4	48.6	45.4	21.6
TEX	5.0	4.4	21.0	12.7	21.7	35.2	32.3	19.9
WOF	16.6	5.8	2.3	2.5	4.5	12.8	3.9	3.5
PAP	17.6	15.3	17.4	16.0	21.8	22.3	17.0	11.8
CHE	71.4	50.8	26.6	44.4	33.4	36.8	30.4	19.7
MET	29.1	18.2	18.5	2.6	10.8	10.9	10.0	6.5
MFM	78.8	82.0	54.6	30.9	28.2	45.7	34.4	20.2
ELE	49.3	82.8	43.2	25.0	25.5	31.2	25.0	22.1
TRE	93.1	87.4	79.2	44.6	41.1	46.7	55.6	43.6
Total	27.3	23.6	21.1	16.9	20.5	29.2	24.2	16.6

Notes: Board of Customs does not have data on service exports. “East” refers to Albania, East Germany, Bulgaria, Hungary, Poland, Romania, Czechoslovakia, Soviet Union, North Korea, China, Mongolia and North Vietnam / Vietnam.

Source: The author's own estimates; Board of Customs; see the appendices for Eastern Trade.

in other industries as well relative to the year 1970, but only AGR, PAP and FOO had a higher rate of Eastern Trade 1956–1965 in comparison with 1980–1985. In purely sectoral terms, most export industries’ reliance on Eastern Trade declined after the 1950s.

The high ratio of Eastern Trade in total gross exports was quite high in the 1950s and 1960s. Note that the ratios here reflect not only exports to the Soviet Union, but also to other communist economies which were relatively important in the 1950s and the early 1960s although exports to Soviet Union were likewise relatively high in the 1950s.[386] In other words, Finland was quite dependent on Eastern Trade in the 1950s, but less so when free trade integration began. Soviet Union became an important trade partner once more by the early 1980s only to recede significantly at the end of the decade.

The idea that metal industries possibly used Eastern Trade as a springboard for Western markets seems to be consistent with the evidence. MFM and TRE were extremely reliant on Eastern Trade in the 1950s and still to considerable extent in the later decades as well. ELE tended to be reliant on trade with communist economies as well to noticeable extent initially, but once it became an export industry in 1985–1989 only a quarter or so of its exports were directed there. MET was primarily directed to Western markets after 1965 so one cannot make strong claims about its export performance being driven by Eastern

[386] Pihkala 2001, 248–250

Trade. As Paavonen noted, exports to the West were characterized by basic metal exports whereas those to the East tended consist of machinery and finer paper qualities.[387]

Interestingly enough, the notion that reductions in tariff rates during free trade integration forced textile exports to shift to Eastern Trade before the regime's collapse can be applied to FOO as well whose export share was declining in concordance with its rate of protection. CHE was also relatively focused on Eastern markets, particularly in 1956, but to lesser extent when it began to truly develop into an export industry. In comparison, the share of Eastern Trade in textile industries is surprisingly low considering that it is often noted that they effectively depended on it.

These figures suggest that TEX – shoe and leather exports are not included here – was less reliant on communist demand in comparison with most metal industries and on a comparable level to CHE, whose exports did not cease in the 1990s. It is curious that even PAP was more dependent on Eastern Trade than TEX until the year 1982. On the other hand, the figures do not dispute that these exports did shift to Eastern Trade in the 1980s, only that the relative level there was lower than what might be presumed.

It is indeed surprising that paper products were exported to such an extent to communist countries. While the level of 15–22% is clearly lower than in new exports, this is still higher than in lower-quality woodworking exports which were almost completely directed to Western markets – similarly to the first globalization period. Then again the Soviet Union was an exporter of sawn wood in its own right.[388] The high ratio of PAP might reflect that Finnish exports to KEVSOS countries tended to be composed of paper.[389] Additionally, paper exports to the Soviet Union had a higher level of refinement than those directed to the West when customs barriers over trading partners' own paper production were still upheld, and even during the "free trade" integration.[390]

It is difficult to draw general inferences here. It is probable that the development of new export industries, particularly in machinery and transport equipment, was clearly aided by Eastern Trade. This is perhaps the case in CHE though its reliance declined over time.

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[387] Paavonen 2008, 257
[388] Ahvenainen 1984, 405
[389] Pihkala 2001, 220–221. KEVSOS countries consisted of the small Eastern European socialist countries.
[390] Paavonen 2008, 290. See Heikkinen 2000, 384–388 for a discussion related to customs barriers against Finnish paper exports during the EEC negotiations and Jensen-Eriksen 2007, 103–104 concerning British protectionism against higher quality paper before the 1960s. Some of the paper qualities in Eastern Trade were rather old-fashioned though. See Heikkinen 2000, 462.

Table 21. The Share of State-Owned Companies' Gross Value of Production in Manufacturing in 1959–1985, %

	1959	1965	1970	1980	1985
FOO	0.4	0.3	0.2	0.2	0.2
TEX	0.6	0.5	0.4	4.8	4.3
WOF	15.3	11.4	9.0	8.1	8.4
PAP	28.1	27.7	24.2	23.4	21.7
CHE	33.1	39.6	44.1	50.6	52.6
MET	58.6	62.8	73.0	78.0	79.5
MFM	12.8	11.5	10.2	11.8	12.1
ELE	3.3	2.9	1.3	7.2	4.7
TRE	28.9	25.8	24.4	22.9	24.3
Median Manufacturing	8.3	7.1	6.1	7.6	7.1

Notes: The ratio includes both state-owned joint stock companies and other state-owned establishments. The Industrial Statistics of 1989 have no data on the nature of ownership.

Source: The author's own estimates; Statistics Finland, Industrial Statistics.

Still the springboard argument could apply. TEX initially did not rely on Eastern Trade consistently until the 1980s, which was also caused by the need to balance the high import value of oil in accordance with the clearing system of Eastern Trade.[391]

I cannot make strong judgments on whether state activities may have been a determinant of export structure either directly or indirectly within the scope of this thesis, but the data of Industrial Statistics can be used to locate the industries where state-owned companies' share of gross output was prevalent and state activities were perhaps conducive to growth.

What might be surprising is that forest industries, and particularly PAP, were state-owned to such extent. In 1959 almost a third of gross value of production there originated from these companies, but the trend in both industries was decreasing. At least state-ownership of WOF was a result of Finland's large swathes of forests and "national-economic considerations", as Ahvenainen puts it.[392] The industries where the state-owned companies' importance grew in time were CHE, MET and OIL, not shown here. TRE also had a clear, but relatively stable, rate of state-ownership, but this was not the case in other metal engineering industries. MFM did have a higher-than-median rate though.

Since Hoffman suggests that CHE's initial breakthrough in the 1940s and the 1950s rested on a few large companies that substituted imports, possible benefits of state-ownership in CHE cannot be denied.[393] The increasing trend of MET was related to Outokumpu, which

[391] Paavonen 2008, 291
[392] Ahvenainen 1984, 427
[393] Hoffman 1988, 150–151

Table 22. Share of Innovations Involving Public Funding across the Sectors

	1967–84	**1985–98**
Foodstuffs	0.0	28.9
Textiles	28.6	80.0
Wood products	17.6	65.8
Pulp & paper	55.6	57.9
Chemicals	2.5	59.5
Non-metallic mineral products	0.0	71.4
Metal products	10.3	67.3
Machinery and equipment	9.3	67.4
Electrical, electronics	10.2	78.8
Instruments	13.1	73.6
Transport equipment	5.0	60.9
Electricity, gas & water supply	5.1	64.3
Software	12.5	70.4
Total	9.7	66.3

Notes: The data for 1945–66 was excluded by Saarinen due to low level of innovations. Note that the industrial classification differs from the standard one used in this thesis.

Source: Saarinen 2005, Table 6.7.

refined non-ferrous metals into Western exports.[394] State-ownership became more pronounced in TEX too during the early 1980s when textile exports accounted for their largest share of exports in 1956–1989. On the other hand, the relatively high, if receding, state-ownership ratios in beverage and tobacco manufacturing, not shown here, indicates that the presence of government did not always translate to export performance.

At any rate, it seems that new exports developed at least partly due to the government's willingness to support these industries, which is in contrast with arguments that policy of state-ownership favoured traditional sectors and impeded development of new exports.[395]

Another possible channel of state involvement is the public funding of innovations. As seen in Table 22. there were clear sectoral differences in the relative share of public funding in 1967–1984. Interestingly enough, textile and forest industries were among the highest recipients of state support in that time. While the absolute number of innovations in TEX and PAP was low, Saarinen believes that this either illustrates attempts of solidifying recognized potential or internationalization of these industries.[396] This clearly failed in TEX, but it is possible that public funding may have been instrumental in raising the level of refinement in forest industries.

[394] Paavonen 2008, 257
[395] Jensen–Eriksen 2007, 206
[396] Saarinen 2005, 143. The number of innovations in textiles and pulp and paper products were seven and nine respectively during 1967–1984.

Metal industries, except for TRE, had some public funding in their innovations during 1967–1984, yet clearly the vast majority of them was developed without public assistance. This is even more pronounced in the case of innovations of CHE. However, considering that electrotechnical exports emerged in the late 1980s, it is likely that public funding was related to it in some manner. In conclusion, I am inclined to assert that public funding of innovations was not a strong determinant of export structure prior to the 1990s, other than perhaps in raising the value-added of forest exports and developing electrotechnical exports. Generally speaking, the rate of public funding of R&D during 1964–1984 was negligible compared to the end of the century, so it can be expected that its impact on export structure was stronger in 1985–1998.

4.5 Regression Analysis of Determinants Export Structure

> During the era of protectionism, 5/6 to 9/10 of Finnish exports consisted of forest products, the competitiveness of which was based on a comparative advantage, i.e. forest resources combined with cheap labour. During the period of economic integration – – new competitiveness is based on the so-called economies of scale – – [397]

As Paavonen's description illustrates, our initial hypothesis should be that the determinants of export structure changed. While running a regression for 1956–1989 would allow for a higher number of observations, it is also an established practice in econometric research to run comparative regressions for different time periods.[398] Since both historical literature and economic historical regression studies agree on this point, the post-war era was divided into two periods comprising 1956–1970 and 1980–1989. The point here is to compare how the determinants of either three-factor H–O or C–H–O models changed between the protectionist and FINEFTA period in comparison with the 1980s. At that time the free trade integration was largely concluded, at least in relative terms. While the early post-war period admittedly includes a regime change to FINEFTA, it was not immediate due to gradual tariff reductions in sensitive industries.[399]

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[397] Paavonen 2008, 326

[398] See Varian 2017 or Wright 1990 for example.

[399] Paavonen 2008, 320–323. A preliminary Chow test with labour intensity, machine-related capital intensity and resource intensity, corresponding with a three-factor H–O model, indicated that the periods were different at least when it came to labour and natural resources. There were no stark differences concerning machine intensity in this specification.

The regression analyses were run with the software Stata 15.[400] Unlike other economic historical analyses,[401] I utilize a log-log regression model where variables are transformed to natural logarithmic form. This is not necessary theoretically speaking, but it does allow for an easier interpretation of regression coefficients. In the model a one percent increase in an explanatory variable is associated with a percent change of magnitude given by β in the value-added of exports.[402] I must stress that while the slope coefficient effectively is the elasticity of value-added of exports with regards to certain supply-side features, this approach has nothing to do with studies related to elasticity of exports nor is there necessarily any sense in interpreting the impact of these features as either elastic, if β is more than 1.0, or inelastic, if β is less 1.0.

Another major difference with previous economic historical studies and my approach is that I use a fixed effects model, which holds constant the impact of industry characteristics which do not change over time. Wright, for example, utilized only cross-sections whereas Varian ran a pooled OLS, or a panel without fixed effects. Choice of a fixed effects model was primarily motivated by the need to control cartels at least, although there could be other time-invariant omitted variables as well. Due to the uncertainty of the correct trade model for Finland, holding these omitted variables constant is sensible in order not capture spurious correlation. In all specifications I utilize both heteroscedasticity and autocorrelation consistent standard errors as is usual in fixed effects studies.

Time fixed effects, which control time-variant changes that do not differ across industries, were also added in specifications of Table 26. I assume that they control at least the impact of free trade integration since it should have removed trade barriers in all industries alike. This remains uncertain though.[403] The same applies to devaluations of the Finnish markka, since increases in competitiveness should affect value-added of exports in all industries by the same amount, even if Pihkala states that the devaluation of 1957 was intended to expand and diversify forest industry whereas the one of 1967 was intended to strengthen new exports.[404]

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400 I thank Sakari Saaritsa for numerous comments regarding the econometric approach here.

401 Varian 2017, 120; Wright 1990, 659; Crafts & Thomas 1986, 631–632. Varian for example has chosen a linear-log specification whereas the other two articles do not use log-transformations.

402 Standardized z-scores are also often used as well, but I consider the log-log specification to be more intuitive than expressing effect sizes in standard deviations.

403 There is evidence that at least United Kingdom and Denmark increased their paper industries' customs barriers in EEC negotiations. See Jensen-Eriksen 2007, 357.

404 Pihkala 2001, 207–208. Devaluation would affect gross exports differently, since export industries utilized imported inputs, whose prices increase if markka depreciates, in varying degrees.

The correct way of interpreting regression results is not as self-evident as one might presume. Wright thinks that statistical significance is an appropriate measure for factors' importance, but R^2 values not so.[405] I should note that the R^2 ratios in the regression tables of this thesis are not exactly the same as in OLS regressions. They refer to "within" R^2 of the mean-deviated regression where the variation explained is that within industries.[406] Furthermore, there are no adjusted R^2 ratios in fixed effects models.

At any rate, goodness-of-fit is not vital here since the model here is not meant to be predictive, but I would criticize Wright's implicit dismissal of slope coefficients. As Ziliak and McCloskey assert, merely noting statistical significance answers the question of precision rather than the question "how much?" which is arguably the more interesting of the two.[407] This latter line of inquiry concerning historical significance can be answered with slope coefficients even if a variable lacks statistical significance.[408] In practice, I usually refer more to confidence intervals than slope coefficients, because they are more informative in showing possible magnitudes. Statistical non-significance is also reflected in intervals that are too wide as to make any judgment too uncertain. In order to gauge the importance of a variable its sign, statistical significance and its slope coefficient – or rather its 95% confidence intervals – should all be examined.

The control variables used in some specifications consist of share of Eastern Trade, effective rate of protection and additionally shares of women and trade union members relative to total workforce. The latter two are specific to regressions where average wage rate is included, since it is possible that they may bias the results in some manner – wage differences of women relative to men or trade union members relative to non-members might either decrease or increase wage rates irrespective of human capital. I should note that the data quality of the unionization measure is poor – more on that in appendix chapter 6.2 – but it should capture at least part of the impact of trade unions. Eastern Trade should be controlled since it did not operate under perfect competition. EFP is included to ensure that the results are not affected by changes in domestic protectionism.

[405] Wright 1990, 658–659
[406] See StataCorp 2017, 425 for the reference manual's explanation.
[407] See McCloskey & Ziliak 2008.
[408] That is not to say that statistical significance should be dismissed either. If a variable is non-significant, the estimate is so imprecise that one cannot draw any conclusions about the existence of an effect. I usually tend not to dismiss effect sizes if confidence intervals are only somewhat in the "wrong direction". Usually p-values larger than 0.200 are already too imprecise for meaningful interpretation.

A measure of propensity for cartelization cannot unfortunately be incorporated into the regressions since fixed effects models tend not to work well with fairly constant variables. Besides the variable is calculated based on other factors used here in the first place. State-ownership of companies was not controlled, since it is not apparent whether these companies' existence would distort trade models. Additionally, while state-owned companies might be connected to the initial growth of an export industry, I am not convinced that this association is linear and captured adequately by the regressions here. Since the variable has no observations from primary or tertiary sectors, the sample size also decreases substantially if it is included.

Note that since logarithmic transformations required for log-log model cannot be applied to zero values, variables that contain them in great deal such as Eastern Trade and the number of innovations remain untransformed. This was also the case in other control variables. In Eastern Trade the high number of zeroes mostly arises from the assumption that there were no service exports. While this is not absolutely true, I judged this to be an acceptable assumption as the majority of Eastern Trade remained on a commodity basis though there were service exports related to tourism and construction projects.[409]

It is important to note here that the regression tables where effective rate of protection and Eastern Trade are the dependent variables follow a level-log specification where β must be divided by hundred: β/100, before interpreting the slope coefficient as a percent change. Conversely, when value-added of exports is explained, the slope coefficient of the number of innovations must be calculated according to log-level specification where β*100 – the slope coefficients there are deceptively small in other words. In explaining Eastern Trade, the number of innovations follows a level-level model where one more innovation results in a unit change in Eastern Trade, which is a percent change since the latter variable is a share of total exports.

I should also add that the high level of capital intensity in the energy and waterworks industry (EGW) might distort the results somewhat, but whether it can be treated as an outlier is an open question. The industry did have exports to some degree, so it cannot be simply dropped from the data as I have done in the case of construction industries (BUI and OCO) and the ownership of dwellings (DWE). I assume that they were not

[409] See Hirvensalo & Sutela 2017, 280–284. Tourism exports are not included in this thesis due to lacking data in input-output tables and construction industries were dropped due to lack of exports.

characteristically export industries.[410] Additionally, in 1985 financial exports had a negative value, which was dropped.[411] I have included EGW in the regressions, but I will also comment if dropping it would have led to meaningfully different results and how.

Additionally, it must be noted that a major issue with the factors here is that many of them are correlated with each other, though not in perfect multicollinearity. For instance, labour intensity reflects changes not only in the use of unskilled labour but also of greatly increasing labour productivity, determined by technology, human capital and physical capital.[412] Based on Kokkinen's research technology is subsumed in physical capital, but it cannot be studied separately here anyway due to lacking data.[413] Changes in labour productivity should still be compared to other variables, as is done in Table 23.

Labour productivity was studied here instead of labour intensity, since it is conceptually more appropriate and changes in labour intensity are almost entirely explained by those in labour productivity. Machine intensity, or total capital requirements pertaining only to machinery and transport equipment, was also used instead of capital intensity due to its stronger conceptual link to productivity and technology. Admittedly, average wage rate could also reflect that export industries were able to compensate labour more so than in domestic manufacturing. Since unionization should be controlled here, I would expect that higher wages should be associated with skilled labour.

It is quite surprising that machine intensity was negatively associated with labour productivity. A one percent increase in machine intensity decreases labour productivity by approximately half a percent in most specifications. This might be a result of ineffectiveness of capital endowments identified by Pohjola.[414] Resource intensity was likewise negatively correlated with labour productivity in most specifications, which is perhaps less surprising as higher level of refinement reflects less use of raw materials. R&D intensity, on the other hand, was statistically significantly linked with labour productivity though its effect size was lower than in other variables, such as average wage rate in specifications (2) – (4) which had a high and strong association with labour productivity. This suggests that increases in skilled labour may have been a more

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[410] This should be evident based on lack of exports in these industries as seen in Table 5.

[411] Negative values are possible in financial exports if insurance claims paid by Finnish companies to foreign customers exceed the value of insurance claims paid to Finnish companies or denizens. This was the case in the late 1980s. See Pihkala 2001, 260.

[412] Jalava 2007, 27

[413] Kokkinen 2012, 190–191

[414] See Pohjola 1996.

important determinant for export structure than R&D expenditure, though the latter was also associated with labour productivity. Scale advantage was likewise positively related to labour productivity, as can be expected, but only to a relatively low degree.[415] The number of innovations is also statistically indicative – i.e. its p-value is less than 0.010 – in specification (4) where one more innovations increases labour productivity by 1.4%.

Table 23. Labour Productivity and its Determinants in 1956–1989 and 1970–1989

	1	**2**	**3**	**4**
Machine Intensity	-0.490** (0.192)	-0.743** (0.303)	-0.431*** (0.129)	-0.511*** (0.115)
Resource Intensity	-0.470*** (0.069)	-0.148 (0.159)	-0.014 (0.083)	0.044 (0.071)
R&D Intensity	0.265*** (0.043)			
Average Wage Rate		0.607** (0.288)	0.970*** (0.069)	0.955*** (0.311)
Scale Advantage			0.172* (0.084)	0.142 (0.085)
Number of Innovations			0.010 (0.008)	0.014* (0.007)
Intercept	8.090*** (2.6)	11.582*** (4.103)	6.689*** (1.744)	7.374*** (1.725)
Unionization	No	Yes	Yes	Yes
Women	No	Yes	Yes	Yes
Eastern Trade	No	No	Yes	Yes
EFP	No	No	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
Time Effects	No	No	No	Yes
R^2	.373	.612	.837	.871
Observations	135	182	132	132
Clusters (Industries)	27	27	24	24
	1970–1989	1956–1989	1956–1989	1956–1989

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is value-added per working hours in each industry. All variables are measured in natural logarithmic form except for the number of innovations and control variables. See the appendices for data sources.

[415] Maliranta has noted that large establishment size is correlated with labour productivity. See Maliranta 1996, 129.

Kokkinen has argued that physical and human capital had a symbiotic relationship in the 20th century. According to him, physical capital and technology gave impetus to growth in human capital in the first place, but human capital also intensified growth in physical capital as it made it possible to exploit new technology embodied in capital. Hjerppe too has argued that utilizing machinery requires a certain level of skilled labour.[416] However, human capital became more important in explaining physical capital than vice versa after 1944. While Kokkinen's approach differs from the one here to the extent that contrary results cannot support or discredit it, the findings in Table 23. imply that human capital was the motor of labour productivity in post-war period, which is on line with Kokkinen's description of the situation after 1944. Yet the negative association of physical capital, with human capital held constant, is still striking. These findings are robust to enlisting a full set of controls, including both time and industry fixed effects.[417]

Empirically speaking this means that the measures for human capital and labour intensity confound each other and should not be included in the regression specifications jointly. Therefore, only of them is included at a time. As mentioned before, I have separated the time period here to 1956–1970 and 1980–1989. Not only were these periods subject to different trade policy regimes but they may have been different in other ways too. The use of EFP does control possible impacts of domestic protectionism, but the impact of new trade opportunities on unbound European markets cannot be completely accounted for. I assume that time fixed effects capture at least part of this development alongside other post-war trends that swept over all industries in the same degree but for now, I will only focus on industry fixed effects in Tables 24. and 25. Time fixed effects regression specifications are inspected in Table 26.

Based on the literature reviewed in this thesis, it seems more probable that the three-factor H–O model is more explanatory for the earlier post-war period of 1956–1970 than for 1980–1989. Hence it is the starting point of our econometric inquiry in specification (1) of Table 24. The regression model indicates that during the early post-war period both labour and resource intensity declined markedly, though labour intensity to a greater degree. A one percent increase in labour intensity led to a decline of over 2% of value-added of exports whereas a similar increase in resource intensity resulted in a decline of

[416] Hjerppe 1982, 411
[417] Kokkinen 2012, 182, 190–191. Kokkinen argues that this shift was likely caused by war-time destruction of physical capital and increases in schooling.

Table 24. Determinants of Value-added of Exports in 1956–1970

	1	2	3	4	5	6
Labour Intensity	-2.383*** (0.652)	-2.789*** (0.828)	-2.517*** (0.512)	-2.327*** (0.510)		
Capital Intensity	1.065 (0.783)	2.181* (1.174)			0.247 (0.862)	
Machine Intensity			2.686*** (0.814)	2.358** (0.852)		1.585 (1.057)
Resource Intensity	-0.942** (0.396)	-1.241*** (0.392)	-1.407*** (0.378)	-1.728*** (0.352)	-1.080** (0.358)	-1.080*** (0.274)
Scale Advantage		0.360 (0.402)	0.286 (0.326)	0.231 (0.387)	0.431 (0.358)	0.341 (0.386)
Innovations		0.059 (0.079)	0.049 (0.067)	0.035 (0.073)	0.048 (0.085)	0.003 (0.061)
Average Wage Rate					3.397*** (0.898)	3.481*** (1.003)
Intercept	17.047** (6.217)	6.104 (11.993)	-1.095 (8.184)	1.658 (9.519)	-4.560 (12.464)	-24.313* (13.498)
Unionization	No	No	No	No	Yes	Yes
Women	No	No	No	No	Yes	Yes
Eastern Trade	No	No	No	Yes	No	Yes
EFP	No	No	No	Yes	No	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	No	No
R^2	.473	.655	.706	.695	.665	.719
Observations	101	81	81	62	81	62
Clusters (Industries)	27	23	23	22	23	22

* = p < .100, ** = p < .050, *** = p < .010

Notes: Dependent variable is domestic value-added of exports in millions of 2017 euros in natural logarithmic form. All variables are in natural logarithmic except for the number of innovations and control variables. Note that EFP only includes the years 1959–1970 which decreases the sample size in relevant specification. See appendices for further information and data sources.

-0.9%. However, it is generally more interesting to ask what determined something rather than what did not. Capital intensity did have a positive and strong association with exports in specification (1), but its effect is also imprecise with 95% confidence intervals ranging from -0.5% to 2.7%.

However, applying the C–H–O model by complementing the specification with scale advantage and the number of innovations, a proxy for product differentiation, in column (2) amplifies the regression coefficients of all three intensities to the extent that capital intensity becomes statistically indicative. In purely empirical terms, this implies that some of the variables in (1) encapsulated part of the effect of number of innovations and scale advantage. While capital intensity's effect nearly doubles in (2) switching to machine intensity in column (3) results in statistically significance with 95% confidence intervals of 1.0% and 4.4%. In other words, the model cannot disprove that a 1% increase in machine intensity would not have been associated with over a 4% increase of exports. This indicates that export structure was determined to significant extent by mechanization in the early post-war period. This supports Hjerppes' statements that Finnish exports were capital intensive with regards to natural resources.[418] Of course, this not rule out that this mechanization was on an unproductive scale. In fact Dahmén noted in 1963, decades before Pohjola, that the high investment ratio had downsides for the Finnish economy.[419]

While machine intensity is robust to controlling the share of Eastern Trade and EFP in specification (4) both capital intensity in specification (5) and machine intensity in specification (6) are not robust to including average wage rate in favour of labour intensity. Based on Table 23. and the fact that labour intensity captures a great deal of labour productivity's impact, imprecise correlations perhaps reflect that the negative association of machine intensity and labour productivity is now encapsulated in the two measures for capital. Yet in specification (6) machine intensity, despite being statistically non-significant, does have 95% confidence intervals of -0.6% and 3.8%. In other words, the model cannot disprove that a one percent increase in machine intensity would not have led to an increase of exports by over 3%. Additionally, if either EFP or the industry EGW were to be removed from the specification, machine intensity would be a statistically indicative variable.[420]

Based on specification (5) average wage rate is a stronger explanatory variable for value-added of exports across industries in 1956–1970 than machine intensity. This finding is robust to including the shares of female employees and union members. While the variable's effect size diminishes slightly by controlling for Eastern Trade and EFP it remains a large, positive and statistically significant variable for explaining export performance. While this could reflect that export industries were simply productive

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418 Hjerppe 1989, 162; Hjerppe 1975, 159–161
419 Dahmén 1963, 31–32
420 With 95% confidence intervals of -0.2% and 3.5% and a p-value of 0.074 if EFP is removed and confidence intervals of -0.4 % to 4.2% and a p-value of 0.096 in the case of dropping EGW.

enough to pay higher wages, controlling for the measures mentioned does suggest that the use of skilled personnel was a determinant of exports in 1956–1970.[421]

Although the point here is not to test trade models, it should be noted that the Heckscher-Ohlin variables are more explanatory than scale advantage or number of innovations. Neither variable was statistically significant though it cannot be disproven that number of innovations would have had an effect as large as 18.7% in (4). On the other hand an effect of -11.6% cannot be disproven either. Since Dahmén criticized Finland for its scarcity of market-creating products it is probably more believable that innovations or product differentiation were not determinants of exports during this time.[422]

Scale advantage has a smaller effect size, which increases when disregarding labour intensity and decreases when adding machine intensity. As seen in Table 23. this likely reflects its positive association with labour productivity in some manner. However, unlike in the case of machine intensity this probably reflects that omitting labour productivity had led into a positive bias. Of course, it could be argued that scale advantage should have a higher effect size since it is causing labour productivity, but this effect is drifting into labour intensity. However, neither scale advantage nor number of innovations seem to be useful measures here, which most likely reflects that the H–O model is an adequate one for export structure at least preceding the EEC agreement in 1973.

This was no longer the case in the 1980s as can be observed in Table 25. All of the three-factor H–O variables in column (1) have small effect sizes and only one of them, capital intensity, remains statistically significant and only at an indicative level at that. Labour intensity's loss of statistical significance perhaps reflects slower growth in labour productivity in the 1980s whereas the reduction in resource intensity is likely explained by the supposition that most of export diversification, when forest exports' relative importance decreased, occurred prior to the 1980s.[423]

Even capital intensity loses its significance, once scale advantage and intensity in R&D expenditure according to product groups are included in specification (2). Note that the Tables 24. and 25. are not identical due to using R&D intensity of product groups as a proxy for product differentiation instead of number of innovations. This change was

[421] Dropping EGW in specification (6) will also increase average wage rate's 95% confidence intervals to 1.8% and 5.8% with a p-value of 0.001.
[422] Dahmén 1963, 38
[423] Resource intensity becomes statistically significant and negative variable, at least at an indicative level, in specifications (1) – (3) if EGW is removed though. Its effect size only ranges from -0.3 to -0.6% though.

motivated by the likelihood that the former variable is a better proxy for product differentiation and it is weighted according to industry size.

Specification (2) stands for C–H–O model where even labour intensity now has a negative sign. Reduction in negative slope coefficient of capital is mostly due to adding scale advantage to the model, implying that the variable is capturing part of the negative association of capital and exports. Similarly, in column (2) of Table 24. capital intensity's positive association increases when scale advantage is added. At any rate, the poor standing of H–O variables in the 1980s is not improved by replacing capital intensity with

Table 25. Determinants of Value-added of Exports in 1980–1989

	1	**2**	**3**	**4**	**5**	**6**
Labour Intensity	0.170 (0.433)	-0.188 (0.305)	-0.216 (0.280)	-0.349 (0.276)		
Capital Intensity	-0.811* (0.444)	-0.168 (0.345)			-0.324 (0.408)	
Machine Intensity			-0.089 (0.294)	-0.095 (0.304)		-0.289 (0.418)
Resource Intensity	-0.380 (0.422)	-0.175 (0.307)	-0.176 (0.311)	-0.078 (0.296)	-0.096 (0.272)	-0.124 (0.309)
Scale Advantage		0.330 (0.206)	0.335 (0.206)	0.352 (0.211)	0.419 (0.289)	0.417 (0.296)
R&D Prod. Diff.		-0.072 (0.11)	-0.082 (0.106)	-0.068 (0.107)	-0.105 (0.125)	-0.111 (0.127)
Average Wage Rate					0.613 (0.591)	0.632 (0.605)
Intercept	15.844*** (4.743)	10.647*** (3.623)	9.787*** (3.203)	10.840*** (3.231)	8.662 (5.811)	7.794 (5.196)
Unionization	No	No	No	No	Yes	Yes
Women	No	No	No	No	Yes	Yes
Eastern Trade	No	No	No	Yes	No	Yes
EFP	No	No	No	Yes	No	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	No	No
R^2	.105	.272	.271	.294	.338	.340
Observations	107	92	92	92	70	70
Clusters (Industries)	27	24	24	24	24	24

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is domestic value-added of exports in millions of 2017 euros in log form. All variables are measured in natural logarithmic form except for control variables. See appendices for further information and data sources.

machine intensity in column (3) or by controlling for Eastern Trade and EFP in (4).

The only variable in specifications (1) – (4) that has a consistently positive sign is scale advantage even if its historical and statistical significance are not high. It is somewhat surprising that R&D intensity according to product groups has a negative sign and a small effect size considering that product differentiation should have emerged as a determinant of export structure during the 1980s.

Replacing labour intensity with average wage rate in specification (5) results in scale advantage's effect size increasing somewhat with 95% confidence intervals of -0.2% and 1.0%. While naively comparing statistical significances across regressions is not prudent,[424] I presume that part of scale advantage's effect on labour productivity is reduced if labour intensity is included, meaning that its impact on export structure through labour productivity is also diminished. Scale advantage may have become an important determinant of exports by this point as Aunesluoma and Paavonen assert. The other marked change is that average wage rate is the only H–O variable that is positively associated with exports, with 95% confidence intervals of -0.6% and 1.8% in column (5). This is undeniably muter than its impact in 1956–1970, but it is equally important to note that other factor intensities seem to be completely unrelated to exports.[425]

However, the regressions in Tables 24. and 25. omit those variables which do not vary across industries but do so over time. Time fixed effects control for these factors, which I assume include at least free trade integration and devaluation cycle. Since there could be other such omitted variables, one should not engage in too fanciful theories on why and where the differences in Table 26. arise from. The specifications here simply hold the general trends of the early and late post-war period fixed. The following results are robust to dropping the industry TRC from the data, which ensures that general reductions in transport costs are captured by time fixed effects.[426]

Holding the general trends in 1959–1970 fixed, the negative association of resource intensity emerges as the strongest one in the early post-war period, and as one that is also

[424] Omitting certain variables leads to biased slope coefficients, but since the model has more information in estimating them, the coefficients will tend to have smaller variance and higher level of statistical significance. See Feinstein & Thomas 2002, 304.

[425] Removing EGW would yield statistically indicative effect sizes of average wage in (6) with 95% confidence intervals of -0.1% and 1.8% and a p-value of 0.065. However, scale advantage's effect size diminishes to 95% confidence intervals of -0.2% and 0.5%.

[426] It should be noted that machine intensity in (6) is nudged into statistical non-significance. However, its effect size is hardly any different.

robust to a wide range of controls. This cannot be simply explained by forest industries reducing their forestry inputs. As can be seen in 11. PAP's use of primary sector inputs was relatively on the same level in 1959 as in 1970 and WOF's decline occurred in 1965–1970. It seems unlikely that its 95% confidence intervals of -2.0% to -0.8% in column (1) would be a result of only structural changes in woodworking and furniture exports. An effect size of that calibre must reflect the emergence of new export industries, less reliant on domestic natural resources.

Table 26. Determinants of Value-added of Exports in 1959–1970 and 1980–1989, with Time Fixed Effects

	1	**2**	**3**	**4**	**5**	**6**
Labour Intensity	-0.813 (0.975)	-0.844 (1.051)		-0.524 (0.547)		
Machine Intensity	1.217* (0.697)	1.715* (0.824)	1.615* (0.860)	0.140 (0.681)	-0.293 (0.432)	-0.690* (0.395)
Resource Intensity	-1.400*** (0.275)	-1.550*** (0.289)	-1.165*** (0.353)	-0.109 (0.286)	-0.106 (0.321)	-0.001 (0.284)
Scale Advantage		-0.136 (0.397)	-0.197 (0.370)	0.370 (0.268)	0.389 (0.283)	0.409 (0.316)
Innovations		0.015 (0.056)	-0.006 (0.045)			0.042* (0.023)
R&D Prod. Diff.				-0.075 (0.088)	0.134 (0.123)	
Average Wage Rate			1.444 (0.912)		0.979 (2.100)	2.093 (2.583)
Intercept	-1.171 (10.516)	-7.710 (12.479)	-20.325** (9.730)	9.671* (4.819)	7.466 (7.329)	8.592 (6.624)
Unionization	No	No	Yes	No	Yes	Yes
Women	No	No	Yes	No	Yes	Yes
Eastern Trade	Yes	Yes	Yes	Yes	Yes	Yes
EFP	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	.651	.756	.771	.322	.370	.402
Observations	79	62	62	92	70	70
Clusters (Industries)	27	22	22	24	24	24
Years	1959–70	1959–70	1959–70	1980–89	1980–89	1980–89

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is domestic value-added of exports in millions of 2017 euros in log form. Explanatory variables are measured in natural logarithmic form except for control variables and number of innovations. The years 1956 and 1982 are dropped from the regressions since EFP and Women variable do not cover these years respectively. See appendices for data sources.

This finding is in contrast to Parkkinen's conclusion that Finnish export structure in 1964–1975 was characterized by unskilled labour and forest resources. Naturally, one cannot simply say that Parkkinen was wrong since his study compares exports to imports and it differs from this thesis in its choice of period and of measures. It is not contradictory to say that renewable natural resources were not as imported to Finland as they were exported, but Parkkinen also argues that the devaluation of 1967 tended to increase the exports of these industries. True or not, that statement contradicts the evidence here.[427]

There is also some evidence to suggest that mechanization was a determinant of export structure in the early post-war era. For example, when controlling for scale advantage among other things in specification (2), machine intensity's 95% confidence intervals are 0.0% and 3.4%. While the model cannot prove that there would have been approximately zero correlation between exports and mechanization, it cannot disprove a very high positive impact either.

The major difference between Table 24. and specifications (1) – (3) in Table 26. is that labour intensity and average wage rate have lost their historical and statistical significance, though their signs remain the same. This implies, in my opinion, that what we observed previously mostly reflected general increase in Finnish labour productivity that was not specific to certain industries. That being said, in column (1) for example the regression model cannot disprove that a 1.0% decrease in labour intensity would not have led to an increase 2.8% in exports, which is very high. Yet a 1.2% decrease cannot be disproven either, which suggests that some industries perhaps specialized according to labour intensity and some did not. While Parkkinen suggested that Finnish exports were driven by unskilled labour around this period, we cannot prove this statement here.

The specification (3) is also imprecise with regards to average wage rate. Yet its 95% confidence intervals range between -0.5% and 3.3% meaning that the model cannot disprove a large, positive impact of skill intensity on export structure. Hjerppe speculated that know-how related to forest manufactures could be another comparative advantage of the early post-war period, and the results here do not disprove that view.[428]

Column (4) reinforces the notion that the underlying model of Finnish trade structure had shifted away from the H–O model by 1980–1989 as labour, capital and resource

[427] Parkkinen 1977, 95–98, 152
[428] Hjerppe 1975, 159–161

intensities have smaller regression coefficients that are statistically non-significant. Comparative advantage was very different between 1956–1970 and 1980–1989. Indeed, Kajaste noted that exports of capital intensive industries with low R&D declined in the 1980s. This is also in line with Pihkala's statement that capital intensity no longer determined the relationship between companies and world markets in the 1980s, yet his claim of know-how's importance is more questionable.[429]

Specification (5) reveals that average wage rate had become a very imprecise indicator for export structure with 95% confidence intervals of -3.4% and 5.3%. While one cannot claim that human capital would have not had a large positive association with exports, one cannot disprove the opposite either. This implies that skill intensity may have become increasingly divergent in the 1980s – some export industries utilized it greatly whereas others decidedly did not. Note that the specification already controls Eastern Trade and customs barriers so they cannot be the culprits here.

Based on the regression model, one finds no strong evidence that skill intensity had developed into a determinant of Finnish export structure in the 1980s. The same can be stated regarding R&D intensity as well.[430] On the other hand, a large, positive impact of skill intensity cannot be disproven either. Since such an effect can be refuted in the case of R&D intensity, human capital related to know-how rather than to high-tech research may have been more important. Pihkala wrote that inputs into R&D only began in the 1980s and the share of high-tech products in commodity exports only increased over 10% in the 1990s, suggesting that R&D is more characteristic of the 1990s and 2000s.[431]

However, since the office worker ratio is an imprecise factor as well, though its validity as a proxy for human capital in modern times can be questioned, this might be a moot point.[432] Kajaste argued that skill intensity was not a feature of export structure in the 1980s – although its importance increased towards the late 1980s – and the results here

[429] Pihkala 2001, 303; Kajaste 1991, 484–488

[430] Its 95% confidence intervals ranged from -0.5% to 0.1% with a p-value of 0.141 if variables concerning average wage rate, the share of women and unionization are removed in column (5).

[431] Pihkala 2001, 310–311

[432] See Yli-Pietilä et al. 1990, 4, 150–151. Of course, there is office worker data only concerning manufacturing industries, so a more comprehensive dataset might yield other results. 95% confidence intervals in the case of office worker ratio are -1.8% and 3.0% with a p-value of 0.634 if variables of average wage rate, share of women and unionization are removed in column (5).

cannot refute his argument. Still, Pihkala's and Kaukiainen's remarks that know-how was a Finnish comparative advantage in these times cannot be disproven either.[433]

On the other hand, Kajaste also stated that export structure was more driven in that period by other determinants such as scale advantage or product differentiation. As observed in Table 26. there is evidence that scale advantage may have evolved into an important rationale for export structure even when time fixed effects are included. First, its sign was negative in the columns (2) – (3) concerning the early post-war period, but flips to positive in specifications concerning the 1980s. Secondly, in column (5) there the regression model cannot disprove an effect of scale advantage being approximately -0.2% or as large as 1.0%. Quite a large impact cannot be disproven, though the evidence is not conclusive enough to absolutely prove Aunesluoma's and Paavonen's claims.

In specification (6) I utilize the innovation data of SFINNO and H-INNO as an alternative proxy for horizontal differentiation. It is noteworthy that the variable is statistically significant, albeit on an indicative level. Since the variable's association with exports is modelled in a log-level specification its 95% confidence intervals correspond with a percent change of -0.5% and 8.9% in exports if one more innovation is produced in the industry. The possible effect of horizontal differentiation might have been extremely large then. However, it is feasible that these innovatory activities may have been more reflective of technological differentiation. Although capital intensity becomes a statistically indicative factor in the same column, the variable is not very robust, so I hesitate to draw any conclusions here.

I have not included the results in the case that the EGW industry is dropped from the regressions of Table 26. but it should be noted that the results change significantly in some cases. In specifications (2) – (3) machine intensity's p-value declines below 0.050. In column (3) average wage rate becomes statistically indicative with 95% confidence intervals of -0.2% to 3.6%. In column (4) machine intensity has a coefficient of -0.6% and in (5) average wage rate has a one of -0.1 but neither is statistically significant. Lastly, the number of innovations is not robust to dropping EGW.

Due to the possibility that R&D differentiation and scale advantage might have a non-linear relationship with exports, I have included quadratic transformations for them in Table 27. High scale advantage might reflect product standardization instead of

433 Kaukiainen 2006, 151; Pihkala 2001, 306–307; Kajaste 1991, 484–488

economies of scale pertinent for NTT whereas high R&D intensity stands for technological differentiation instead of attribute-related horizontal differentiation. Concerning product differentiation this approach follows that of David Greenaway's and Chris Milner's whereas product standardization is based on Parjanne's arguments.[434]

There is little evidence for product standardization being a determinant of exports as its regression coefficient is consistently approximately zero. The fact that a lower level of scale advantage is not statistically significant in column (4) does not support the notion of the variable's importance, but it is possible that this simply results from a misspecification of scale advantage's functional form. It is also likely that high scale advantage, if capturing product standardization, will be negatively related with horizontal product differentiation, but running a regression without these variables does not result in different effect sizes or statistical significances concerning scale advantage variables.

The case of R&D intensity according to product groups is more revelatory. Both high and low levels of R&D product intensity are correlated with exports, but in very different manner. The squared variable, which stands for technological differentiation, is positive but its effect size is small. Lower levels of product intensity, which should correspond with horizontal product differentiation, are conversely negatively associated with exports. In specification (1) an increase of horizontal product differentiation by 1% tended to decrease exports by roughly the same degree, or with 95% confidence intervals of -1.7% and -0.1%. When considering average wage rate in (4) the negative association amplifies with 95% confidence intervals of -2.8% and -0.3%, arising probably from associations with labour productivity in some manner as well.

The findings here are clearly opposite to the hypothesis that NTT and horizontal product differentiation evolved into important rationales for export structure during the post-war period. It also explains why R&D product intensity tends to be statistically non-significant in previous tables: it includes two different effects. This is robust to including time effects in columns (2) and (4). While one can explain the statistical significance of technological differentiation, although its impact was small, with high-tech exports of the late 1980s such as electrotechnical goods, the finding that exports tended to be homogenous or standardized and not differentiated in the 1980s requires further research.

[434] Parjanne 1992 95; Greenaway & Milner 1984, 325. Parjanne, however, did not transform her measure for increasing returns to scale into a quadratic form.

Of course, one could also speculate that alternative measures for product differentiation such as marketing intensity might yield other results.[435]

Table 27. Determinants of Value-added of Exports in 1980–1989, Product R&D Intensity and Scale Advantage in Quadratic Form

	1	2	3	4
Labour Intensity	-0.153 (0.240)	-0.360 (0.597)		
Capital Intensity	-0.290 (0.315)	-0.201 (0.817)	-0.417 (0.377)	-0.577 (0.400)
Resource Intensity	-0.152 (0.287)	-0.035 (0.241)	-0.028 (0.246)	-0.124 (0.247)
Scale Advantage	0.241 (0.187)	0.258 (0.251)	0.315 (0.231)	0.277 (0.215)
Scale Advantage^2	0.031 (0.040)	0.031 (0.043)	0.033 (0.043)	0.035 (0.049)
R&D Prod. Diff.	-0.927** (0.376)	-0.934** (0.354)	-1.490** (0.605)	-1.546** (0.608)
R&D Prod. Diff.^{2}	0.052** (0.019)	0.052** (0.019)	0.083** (0.031)	0.086** (0.032)
Average Wage Rate			0.851* (0.429)	2.100 (2.554)
Intercept	15.313*** (3.378)	15.869** (6.311)	13.207** (8.570)	12.579* (7.323)
Unionization	No	No	Yes	Yes
Women	No	No	Yes	Yes
Eastern Trade	No	Yes	No	Yes
EFP	No	Yes	No	Yes
Industry Effects	Yes	Yes	Yes	Yes
Time Effects	No	Yes	No	Yes
R^2	.336	.381	.447	.471
Observations	92	92	70	70
Clusters (Industries)	24	24	24	24

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is domestic value-added of exports in millions of 2017 euros in log form. All variables are measured in natural logarithmic form except for the number of innovations and control variables. Also, note that the squared variables are in logarithmic form before the quadratic transformation. See appendices for further information and data sources.

[435] Capital intensity's negative effect size becomes larger in specifications (2) – (4) when EGW is removed to the extent that the variable becomes statistically significant or indicative. Product differentiation variables become even more statistically significant in all specifications.

In light of opinions that some industries were more protected than others, I will also discuss the association that these factors had with effective rate of protection. Additionally, the share of Eastern Trade might have had determinants of its own. While neither specifically relate to export structure, they are important points in understanding the differences between domestic manufacturing and internationally oriented industries. Eastern Trade has also very interesting implications considering product differentiation.

There is evidence that EFP was positively associated with labour intensity in 1959–1970 when protectionism began to recede. Industries with customs barriers tended to have a low rate of labour productivity and/or utilize labour to noticeable extent and in manner that is statistically significant in column (2) of Table 28. Still the possible impacts might have been small – a 10% increase in labour intensity was associated with a 0.4 to 4.5 unit increase in EFP. There is also some indication that these industries were not capital or machine intensive as can be seen from the variables' negative signs. The same can be stated regarding resource intensity, but its effect size is negligible. The results partly reflect that the tertiary sector had negative EFP and a high rate of capital intensity and a low rate of natural resource intensity.

Table 28. Determinants of Effective Rate of Protection in 1959–1970 and 1980–1989

	1	**2**	**3**	**4**
Labour Intensity	26.251* (13.551)	24.590** (10.073)	3.934 (3.208)	3.607 (3.001)
Capital Intensity	-21.000 (19.347)		-2.901 (2.814)	
Machine Intensity		-39.122 (26.348)		-2.084 (2.464)
Resource Intensity	-4.326 (5.478)	-0.211 (5.462)	-2.156 (2.541)	-2.194 (2.628)
Intercept	30.859 (154.486)	256.100 (253.838)	6.267 (20.835)	-4.211 (20.211)
Industry Effects	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No
R^2	.080	.126	.020	.018
Observations	79	79	108	108
Clusters (Industries)	27	27	27	27
	1959–70	1959–70	1980–89	1980–89

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is Effective Rate of Protection. Explanatory variables are measured in natural logarithmic form. See appendices for data sources.

By 1980–89 customs barriers had been lowered to the extent that the regression models in columns (3) – (4) are unable to differentiate any significant factors. Labour intensity still has a positive sign and one cannot refute the statement that customs barriers shielded labour intensive industries, but no general statements can be made one way or another. The evidence instead implies that EFP was no longer correlated with any factor intensity in the 1980s.

Table 29. Determinants of Share of Eastern Trade in 1956–1970 and 1980–1989

	1	**2**	**3**	**4**	**5**	**6**
Labour Intens.	8.512 (7.570)	3.050 (6.235)		18.647*** (2.915)		
Capital Intens.	-5.376 (12.245)		0.939 (9.863)		22.390*** (6.004)	25.276*** (6.306)
Machine Intens.		13.822 (9.069)		0.825 (5.691)		
Resource Intens.	1.834 (5.838)	3.002 (6.187)	3.535 (6.984)	-14.060*** (4.439)	-7.429 (5.719)	-8.709 (5.727)
Scale Advant.	-5.565 (6.725)	-6.479 (6.898)	-5.896 (5.945)	-2.896 (1.906)	-0.565 (1.978)	0.526 (1.984)
Innovations	1.406** (0.548)	1.280** (0.603)	1.478* (0.736)			
R&D Prod. Dif.				-2.119 (1.400)	-0.768 (1.279)	12.106* (5.891)
R&D Prod. Dif.^{2}						-0.774** (0.353)
Avg. Wage Rate			-11.000 (11.825)		-21.888*** (7.416)	-23.286*** (7.310)
Intercept	-5.434 (139.465)	-205.749* (118.066)	0.077 (155.204)	-144.126** (64.970)	-208.731*** (72.794)	-294.225*** (89.998)
Unionization	No	No	Yes	No	Yes	Yes
Women	No	No	Yes	No	No	No
Industry Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	No	No	No	No	No	No
R^2	.139	.157	.150	.317	.318	.337
Observations	81	81	81	92	92	92
Clusters (Industries)	23	23	23	24	24	24
	1956–70	1956–70	1956–70	1980–89	1980–89	1980–89

* = p < .10, ** = p < .05, *** = p < .01

Notes: Dependent variable is the share of Eastern Trade in an industry's total exports, both in gross value. Variables are measured in log form except for number of innovations. If "women" are included the year 1982 would be excluded. In that case average wage rate becomes statistically non-significant. However, it seems that this is caused by removing 1982 from the data. See the appendices for further information and data sources.

In Table 29. one can observe that Eastern Trade in the early post-war period was seemingly characterized by labour intensive industries as seen in columns (1) – (2), based on its positive sign. In specification (3), average wage rate's 95% confidence intervals range from -35.5 to 13.5, or -0.4% to 0.1%, which indicates that Eastern Trade utilized unskilled labour, but the association is not statistically significant either. However, it actually seems that Eastern Trade was more of a feature of export industries with a high degree of mechanization in 1956–1970, though this is not statistically significant. It is worth pointing out that resource intensity was not a determinant one way or another at the time – if exports of other than forest products would have been predominantly directed to Eastern Trade, one would expect to find statistical significance or a large effect size.

The only variable that is statistically significant here is the number of innovations as the model predicts that an industry's share of Eastern Trade will increase approximately by 1.3% when an innovation is produced there in column (2). The variable's 95% confidence intervals in there are 0.0% and 2.5%. This likely reflects the high number of innovations in metal industries. The finding here can be also stated in inverse: industries exporting primarily to the West were not characteristically innovative in 1956–1970.

In the 1980s, prior to the end of Eastern Trade, the situation was quite different. Labour intensity is now a highly statistically significant variable in predicting exports' dependence on Eastern Trade in specification (4) and the same can be said of average wage rate in column (5). Capital intensity is also a statistically significant and positive measure for Eastern Trade in (5), but since neither it nor machine intensity is robust to including labour intensity I would not draw strong conclusions here. Although Eastern Trade is arguably interesting in its general trend across all industries, and hence time fixed effects need not be controlled, I should note that labour intensity is robust to including time effects in specification (4). The negative relationships with scale advantage and R&D product intensity become statistically significant in that case. However, in column (5) average wage rate loses its significance with the same addition.[436]

The results here are different from Hellvin and Torstensen's characterizations of Finnish exports to Eastern Europe for 1985 where they concluded that Finland was a net exporter of human capital and a net importer of physical capital. Specification (5) indicates the complete opposite, but then again their perspective revolves around comparing exports to

[436] This is likely due to unionization being a surprisingly statistically significant explanatory factor with Eastern Trade after controlling time fixed effects.

imports whereas I am analysing features of Finnish industries. The results are not necessarily contradictory. It is possible that Finnish exports to Eastern Europe were more human capital intensive than imports from Eastern Europe – resulting in net exports of human capital – but that simultaneously the most skill intensive industries in Finland exported to the West rather than to the East – resulting in a negative sign of skill intensity

Horizontal differentiation seems initially unrelated to Eastern Trade in columns (4) – (5) and the same result would be observed if number of innovations would be used in its stead. Yet based on column (6), Eastern Trade tended to be horizontally differentiated in terms of R&D during the 1980s. By the same reasoning, the standardized homogenous exports were a feature of Western Trade. However, the 95% confidence intervals there correspond with changes of -0.0 to 0.2% so the association is relatively limited. While technological differentiation had a more marginal impact here, it seems to have been also more characteristic of Western Trade. While these findings are not robust to including time effects or labour intensity small associations cannot be overruled. I will return to this topic in the next section.[437]

In conclusion, industries exporting to communist countries were possibly mechanized and associated with innovatory activities in the early post-war period, but in the 1980s they were also characterized by increasing labour intensity as has been noted in previous research.[438] This suggests that Eastern Trade functioned as a form of protectionism applied to unproductive labour intensive industries after free trade integration had reduced their customs barriers. There is also some evidence that suggests that products of Eastern Trade were horizontally differentiated according to R&D.

It ought to be mentioned here that neither Eastern Trade, EFP nor the share of state-owned companies were statistically significant, robust variables in explaining export structure. Additionally, the share of infrastructure or of banking and financial inputs in value-added of exports were statistically non-significant variables. However, infrastructure has a relatively large effect size with confidence intervals of -0.8% to 2.1% in specification (5) of Table 26.

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[437] It should be noted that this finding rests on the assumption that there were no service exports to communist economies insofar as they were not included in commodity exports. Additionally, if Eastern Trade would be transformed into natural logarithmic form, log-log model's horizontal product differentiation' slope coefficient would correspond with an increase of 0.8%. While this result might be biased due to data imputations related to zeroes, it is possible that the level-log model's effect size of 0.2% is underestimated.

[438] See Paavonen 2008, 288 or Alho et al. 1986, 90.

5. Discussion and Conclusory Remarks

This chapter discusses the overall conclusions based on utilizing trade models and examining previous research through quantitative methods in locating the determinants of export structure. While the majority of the discussion here is devoted to addressing the econometric results of this thesis, inspecting industries' individual characteristics can be insightful as well. For this purpose, I have compiled information in quantitative tables of the previous section in Table 30. The results are also compared with previous research and venues for future research are suggested.

5.1 Development of Determinants and a Nordic Comparison

> From a researcher's point of view it would have undoubtedly been a pleasure to locate an "Open Sesame" type business idea or strategy – –[439]

In the earlier sections I criticised previous economic historical research as lacking in analysis of their diagnosis of the important determinants of Finnish export structure. Yet the results here are somewhat complex in light of previous research. The results of fixed effects regression analyses confirm some of its characterizations, find no evidence for others and temper the rest. That is to say, some arguments can be supported but only in a qualified way. The need to separate early and late post-war periods should be self-evident by now as there is evidence that different models apply to 1956–1970 and 1980–1989.

Before considering what the determinants of export structure as a whole were, it might be useful to review the determinants of individual export industries. Table 30. is only a general approximation of their noteworthy features. Deciding what constitutes noteworthiness is admittedly somewhat arbitrary on my part and is based on whether an industry "stood out" in the case of each determinant. Therefore, econometric analyses are preferable to measuring each determinant's impact as they pick more marginal and less observable differences across industries. On the other hand, institutional features of trade might be important only by the virtue that they existed and not by their trends. If that is the case, econometrics used here will not identify their significance. This summary table, based on quantitative tables of the previous section, is a workaround to this issue.

[439] Larjavaara 1978, 194. Translated from: "Tutkijan kannalta olisi epäilemättä ollut ilo löytää "sesam aukene"-tyyppinen toiminta-ajatus tai strategia – – ".

Table 30. Determinants of Export Structure in Export Industries in 1956–1989

	Heckscher-Ohlin	**New Trade Theory**	**Institutional**
Forest Industries			
Woodworking and Furniture	Labour **(E)** Capital Resource		Cartels State Companies **(E)**
Pulp, Paper and Paper Products	Capital Resource **(E)** Skill **(L)**	Scale	Cartels State Companies
Metal Industries			
Basic Metal	Capital Skill **(L)** Resource	Scale	Cartels State Companies
Machinery and Fabricated Metal Products	R&D	Differentiation (Horizontal)	Eastern Trade
Electrotechnical	R&D	Differentiation (Technological)	Public Funding of R&D
Transport Equipment	Skill **(E)**	Differentiation (Technological) **(E)** (Horizontal) **(L)**	Customs Barriers **(E)** Eastern Trade State Companies
Other Industries			
Chemical	Capital **(E)** Skill R&D	Scale Differentiation (Horizontal) **(E)** (Technological) **(L)**	Eastern Trade State Companies
Textile and Apparel	Labour	Differentiation (Horizontal) **(L)**	Customs Barriers **(E)** Eastern Trade **(L)**
Foodstuff Industries	Labour Capital Resource		Customs Barriers **(E)** Eastern Trade **(L)**
Services			
Wholesale and Retail Trade	Labour Capital		
Transport and Communications	Capital		
Business and Other Real Estate Services	Capital Skill	Differentiation (Horizontal) **(L)**	
Primary Sector			
Agriculture	Labour Capital Resource		Customs Barriers Cartels
Forestry	Labour **(E)** Capital **(L)** Resource	Scale **(L)** Differentiation (Vertical) **(L)**	Cartels

Notes: "**(E)**" refers to the determinant being important during the early post-war period of 1956–1970 and "**(L)**" during the late post-war period of 1980–1980. Note that R&D data only covers the year 1970 from the early post-war period.

First, it is evident that the traditional export sectors of forest, and also foodstuff, goods tended to be determined by factor intensities of the H–O model. This is somewhat reminiscent of Aunesluoma's point that raw materials and comparative advantage were important in the 19th century – the traditional export industries still operated in an old-world fashion during 1956–1970 at least.[440] Although they are difficult to measure, scale advantage and product differentiation were more apparent in the case of new exports. This was particularly the case in the 1980s when new exports had become more dominant.

While this does reinforce Paavonen's argument that most new export industries utilized scale advantage, the distinction is not clear-cut even in the 1980s.[441] For instance, MFM, ELE, CHE and TEX were all associated with some Heckscher–Ohlinian factors at some point. Secondly, PAP had a high rate of scale advantage as early as in 1956–1970 while metal engineering industries did not in the entire post-war period.

It is curious to note that the basic metal industry, which was a relatively noteworthy export industry even in the 1950s shared many characteristics with the paper industry. Both were resource-dependent industries that utilized capital to great deal which might reflect the notion of some observers that capital and natural resources are complementary.[442]. Both industries had increased their skill intensity coming to the 1990s, which is likely related to how the length of experience obtained in the same company was greater in Finnish PAP and MET compared to the U.S. in 1987.[443] Both industries were also characterized by state-owned companies and possibly cartels. The only difference between the two was that MET became even less dependent on domestic resources than PAP after 1970. It is also worth mentioning that according to Maliranta's calculations these two were the most internationally competitive industries in Finland in 1987.[444]

That both industries featured scale advantage and skill intensity may be explained by production strategies. Combining the production of parts can lead to branded articles where economies of scale are reached by using know-how in "combining 'hardware' and 'software'", as Larjavaara puts it.[445] He also notes that this seemed to be characteristic of

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[440] Aunesluoma 2011, 154
[441] Paavonen 2008, 263
[442] See Wright 1990 for example.
[443] Maliranta 1996, 135–137
[444] Ibid., 79–80. PAP's labour productivity was 6% higher than in the U.S whereas MET was lagging only 8% behind. In comparison, CHE/OIL, ELE and TEX had labour productivity levels of only roughly 65% of the U.S. level.
[445] Larjavaara 1978, 130

German metal industry of the period and based on Table 30. this may have been the case in Finnish not only in MET and PAP, but in CHE as well. Maliranta also refers to MET and PAP as being characterized by industry-specific know-how which is connected to forming industrial clusters, per Michael Porter's famous line of thinking.[446]

Aija Leiponen has also described MET as following the strategy of the so-called newly industrializing countries: a state-directed import-substituting production that uses imports of novel technology. Although she mentions that technical change was an aspect of the industry and there were attempts to improve relevant education and research, R&D intensity was never an especially prevalent characteristic of MET. This at least highlights another similarity of MET, PAP and CHE – a high rate of state-ownership. While the emergence of forest exports was probably unrelated to public assistance, the same statement cannot be made so certainly regarding chemical and basic metal exports.[447]

While woodworking exports were labour intensive in contrast with paper exports, it had a higher rate of capital intensity than metal industries throughout the post-war period. Nor was it relatively labour intensive in the 1980s. This reflects that the industry was capable of structural transformation, though admittedly its labour force seems to have been unskilled based on the industry's low wage rates. Yet one cannot observe a structural change of this kind in foodstuff exports, for example, where the only major difference between the early and the late post-war periods was that the industry switched its reliance from customs barriers to Eastern Trade.

Metal industries have often been linked with Eastern Trade in previous research. This seems to be an accurate statement as it appears to be most shared feature among the metal engineering industries.[448] This is not surprising considering that metal engineering industries were linked with war reparations to the Soviet Union. Conversely basic metal industry was not dependent on Eastern Trade, and in fact its exports were also unrelated to war reparations, which consisted of machinery, ships and cables. The last product explains the high share of Eastern Trade in electrotechnical exports.[449]

While the war reparations can be considered as a positive demand shock for these industries, the development was not necessarily positive in all respects. For instance, the

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[446] Maliranta 1996, 95; Larjavaara 1978, 130
[447] Leiponen 1994, 22–24
[448] Coincidentally the Eastern Trade of Yugoslavia or Austria was also characterized by metal exports. See Hirvensalo & Sutela 2017, 196, 199.
[449] Ibid., 146. War reparations also included wood-processing products though.

need to pay for the reparations was so pressing that some small shipyards were established inland.[450] They were consequently uncompetitive and had difficulties in exporting to anywhere else than to the Soviet Union. Exports of transport equipment were decidedly affected by geopolitics. Finnish shipyards might not have been competitive in Western markets during the 1950s, but the Soviet Union did not have many alternative sources either as most of the competitive Western shipyards were in NATO countries which curtailed such exports to the East for obvious reasons.[451]

As mentioned earlier, horizontal differentiation in TRE might be a natural consequence of its exports including icebreakers, car ferries, oil-rigs and passenger cars. Saarinen also describes that the industry did not manage to compete well in global markets and its companies "specialized in a few products and often only served selected customers".[452] These commodities included elevators, luxury cruisers, LNG tankers and an assortment of harbour equipment. Dahmén also noted in the case of early post-war period that due to demands of Eastern Trade there was some product specialization in metal industries but they were not usually of the kind that could be marketed to Western markets as well.[453] In the late post-war period this had changed since both Western and Eastern metal exports were specialized, but only in a few products.[454]

The lack of competitiveness in Western markets apparently characterized all metal engineering industries.[455] Indeed, Eastern Trade was the only noteworthy determinant of MFM in 1956–1965. Both it and TRE continued to depend on Eastern Trade throughout 1956–1989, but electrotechnical exports' emergence in 1985–1989 seems more related to R&D, and its public finding possibly, or product differentiation of technological nature. R&D intensity did become a feature of MFM during the 1980s as well. There is no data on R&D intensity before the year 1970, but it was likely not an export determinant in the early post-war period, because R&D expenditure of metal engineering industries in Finland was lower than in other Nordic countries, particularly Sweden, in 1973–1975.[456]

The chemical industry was reliant on human capital, either viewed through skill or R&D intensity, but it also tended to have a wide variety of determinants. Scale advantage and

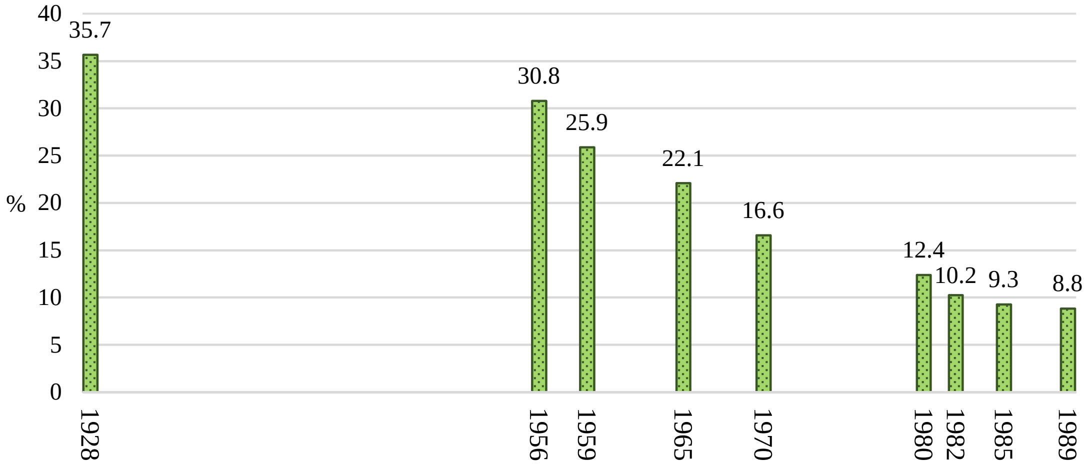
[450] Hirvensalo & Sutela 2017, 152
[451] Ibid., 147
[452] Saarinen 2005, 34
[453] Dahmén 1963, 36–37
[454] Saarinen 2005, 34; Dahmén 1984, 21; Hjerppe 1982, 421–422
[455] Hirvensalo & Sutela 2017, 147
[456] Larjavaara 1978, 152–153

product differentiation may have been expected on the basis of previous research on intraindustry trade, but it is surprising that Eastern Trade and state-ownership were associated with chemical industry to such extent. One cannot rule out that its development would not have occurred in the absence of these characteristics. As noted by previous research, the labour intensive textile industries became more dependent on Eastern Trade in the 1980s. Yet the extent of this dependence was generally either on the level of or lower than for chemical exports. This suggests that the plummeting of textile exports was perhaps more related to high labour costs and lack of competitiveness than the dissolution of the Soviet Union.

While data concerning the variables of New Trade Theory and institutional features, particularly scale advantage, is admittedly lacking when it comes to primary or tertiary sectors, Heckscher–Ohlinian factor intensities seem to be especially explanatory concerning service exports. Capital intensity was a factor in all three major service export industries whereas TRD was also characterized by labour and BUS by skill intensity. However, BUS was also characterized by a high rate of innovations during its growth in the 1980s, though its R&D intensity was not great. Due to this reason I have included horizontal differentiation as a characteristic of the industry, but it is also possible that innovatory activities are more reflective of the skilled personnel in BUS. Skill intensity was also a feature of financial services which grew to some degree in the 1980s. This indicates that know-how was tied into Finland's transformation to a service economy, even if that impact was only limited in the 1980s from an export-perspective. It is also evident that the tertiary sector's development was curtailed by customs barriers due to increasing their input costs.

Conversely, agricultural exports were decidedly protected by customs barriers even in 1989. Propensity to cartelization was also a feature of both agriculture and forestry, as was the strong dependence on resources, as can be expected. However, forestry tended to shift away from labour intensity towards capital intensity after the 1950s, and towards scale advantage in the 1980s, though the data is lacking here. There is also some evidence to suggest that product quality or vertical differentiation in the line of Falvey's model might be applicable there. Yet scale advantage and product quality cannot be considered to have been very important, since forestry exports were only important during the 1950s. That being said forestry's structural transformation most likely affected the labour and capital intensities of woodworking and paper exports.

Chart 4. The Share of Domestic Value-added of Exports originating from Forestry Products, %



Notes: Includes the value-added of forestry inputs in both forestry itself and in other industries through backward linkages.

Source: The author's own estimates; Statistics Finland; Input–Output Tables 1956–1989; Kauppila 2007.

The manner of discussing the entire post-war export structure from the late 1940s to the 1990s as a straightforward narrative – i.e. described with a single trade model – can lead to somewhat imprecise statements, even if they are true in broad terms. Kaukiainen for example stated that natural resources became less relevant over time. This is true, but most of the decline there seems to have taken place prior to the 1980s.

That is not to say that forest resources were meaningless for export structure at least in 1956. Eloranta and Ojala have suggested, based on Finland's small share of global paper exports, that Finnish forest exports were not very important internationally.[457] In truth, Finnish forest exports accounted for high shares of global commodity exports of their respective product groups at certain points in time.[458] Although the international importance of Finnish forest industries is not equivalent for their standing among other export industries in Finland, in 1956 almost a third of Finnish value-added of exports originated directly or indirectly from forestry as seen in Chart 4.

Yet the tremendous and clear decline in the value-added of exports accrued by forestry products after 1956 proves that resource intensity ceased to be a determinant of exports. This is in stark contrast with Markku Kuisma's rather impressionistic statement on how Finland and forests are "bound by fate":[459]

[457] Eloranta & Ojala 2018, 163
[458] In terms of physical volume Finnish sawn softwood exports accounted for 13% and exports of wood pulp for 17% of the commodities' global exports in 1953–1954. See Yates 1959, 119–120. While Finland's share of global wood pulp exports declined in 1961–1991, Finland's paper and cardboard exports comprised approximately 15% of global exports in that commodity group during the same era. See Pihkala 2001, 257.
[459] Kuisma 2008, 16. "Bound by fate" is a loose translation of "kohtalonyhteys".

Finland lives on forest, is in forest and is forest.[460]

The term “forest fundamentalism” is apt in this context. Even in more mild-mannered recent research by Pertti Haapala and Christopher Lloyd one can find declarations stating that “the rapid industrialization of the 20th century was largely based on a single raw material”.[461] Ahti Karjalainen’s quote from 1953 in the introduction of this thesis was certainly an accurate description of the times he lived in, but that even the historical research of 2018 seems to have a misguided interpretation of the importance of forest resources is bewildering.[462] The data suggests that the reliance on forests declined demonstrably in both forest industries and new exports. Indeed, how could it have been any other way as Finland transitioned into a modern economy? The livelihood of modern Finland is found not in forests but in other factors.

Kaukiainen stated that capital and know-how became important determinants of trade, which is also supported by Hjerppe’s description in 1982 of structural transformation of Finnish manufacturing – implying that she is specifically describing the development prior the 1980s. Hjerppe asserts that lower trade barriers tended to encourage capital intensification and mechanization of production alongside improvements in know-how. Skilled workers were more in demand owing to diversified production processes that required more technological skills.[463]

Based on the econometric approach of this thesis, both factors may have been important in the early post-war period, though there is solid evidence only for capital intensity. Capital, and specifically the kind related to mechanization, as Hjerppe correctly characterizes, was an important determinant of export structure in 1956–1970. Indeed, Pohjola notes that the capital intensification of the Finnish economy was already underway in the 1950s. Although Pohjola makes a persuasive case for the inefficient of Finnish capital fundamentalism, it is perhaps not surprising that high levels of mechanization were correlated with export structure. Yet one might speculate, that by the 1980s, the inefficiently high level of capital with its lower marginal productivity was no longer sufficient enough to compete in global markets resulting in lack of statistical significance for capital intensity and negative signs. The only specification where time

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460 Kuisma 2008, 16. Translated from: “Suomi elää metsästä, on metsässä ja on metsä”.
461 Haapala & Lloyd 2018, 26
462 Karjalainen 1953, 24
463 Kaukiainen 2006, 150–151; Hjerppe 1982, 410–411

effects are included and capital intensity is on a statistically indicative level is column (6) of Table 26. but its sign is negative there as well.[464]

The results concerning human capital are less certain that what might have been hoped for. Based on Hjerppe's remark that manufacturing required skilled personnel in increasing numbers leading to the 1980s, the early post-war period should have been characterized by skill intensity. Indeed, a regression with both time and industry fixed effects cannot rule out an impact as large as 3.3% on exports when average wage rate increases by 1% concerning 1956–1970. Although the same specification cannot disprove a negative relationship, this does seem to indicate that human capital might have been a cause of export structure in 1956–1970.

Since skill intensity interacted with machine intensity in some manner, the impact might be distorted somehow. The exact manner of how the variables interacted with each other is not studied here, other than by remarking that average wage rate and R&D intensity were positively associated with labour productivity whereas machine intensity was not. This indicates that capital intensification may have indeed been on an inefficient scale. It should be noted that R&D intensity's possible effect on export structure is mostly transmitted through labour productivity. While chemical and metal exports tended to have high levels of R&D activities, econometric analysis could not identify a positive relationship with R&D and export structure in the 1980s.

This is consistent with Hjerppe and Jalava's statement that Finland was lagging behind the Western European level of R&D in the late 1980s.[465] Pohjola also mentions that manufacturing's R&D expenditure relative to its value-added was only roughly half of Swedish level in 1989.[466] On the other hand, Maliranta claims that Finnish R&D intensity was high in 1990 in an international comparison, but this seems to have been unrelated to export structure.[467] It could be speculated that skilled personnel and know-how, specifically mentioned by previous research, were more important than R&D expenditure for export structure. On the other hand, skill intensity's effect size is wildly imprecise for the 1980s when time fixed effects are included. Neither strong positive or negative associations cannot be ruled out for the late post-war period then.

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[464] Pohjola 1996, 111–113
[465] Hjerppe & Jalava 2006, 59
[466] Pohjola 1996, 53
[467] Maliranta 1996, 153

This impreciseness might be partly related to the fact that Finnish manufacturing employees tended to have less job-experience on average in comparison with the U.S.A and Japan during the late 1980s. While PAP and MET had personnel with a considerable length of experience in the same company that was also the case in textile and foodstuff industries. The potential in skill intensity was perhaps neglected in some industries while utilized in others leading to the large impreciseness witnessed before. The full explanation of why skill intensity's effect size changed as it did cannot be fully answered here.[468]

The reason why R&D intensity was evidently unrelated to exports is more easily explained. Dahmén himself stated that new knowledge in Finland tended to be more related to "engineers and other practical, inter alia organisatory, working in production" rather than inventions and science.[469] Finnish technological policy favoured engineer-dependent process-innovations at the expense of marketing, management and R&D. Economic nationalism unfavoured foreign-owned companies which impeded spread of technology. Since public funding of innovations also seems unrelated to exports as seen in Table 22. it is perhaps no wonder that R&D intensity was not a determinant of Finnish export structure in 1956–1989. Of course, the establishment of Tekes in 1983 and other R&D related policies of the 1980s may have borne fruit afterwards.[470]

Labour intensity was also not a determinant of export structure once time fixed effects were included concerning 1956–1970. This is perhaps a good reminder that there is a difference between saying where Finland's place in the international division of labour was and what determined Finnish export structure. Kaukiainen argues that Finland ceased to be a country of low-cost labour and this seems to be the case in regressions when industry-invariant but time-variant features are not controlled for.[471] There we see a clear indication that Finnish export industries had high rates of labour productivity and average wage rates in 1956–1970. Yet controlling for general trends over time also implies that this development happened in all industries equally, even if skill intensity may have had some effect at that point. In fact, it has been suggested that the move away from unskilled, cheap labour was an all-European phenomenon even if other countries tended to have a significantly higher rate of labour productivity than Finland.

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468 Maliranta 1996, 135–137

469 Dahmén 1984, 19. Translated from: "insinöörien ja muu käytännön mm. organisatorinen, työskentely tuotantotoiminnassa".

470 Aunesluoma 2011, 292–293; Pohjola 1996, 54–57

471 Kaukiainen 2006, 151

Table 31. Aggregate Labour Productivity of Certain European Countries (100 = U.S.A.), %

	1956	**1959**	**1965**	**1970**	**1980**	**1985**	**1989**
Finland	44.6	45.5	49.3	58.4	73.0	74.9	81.5
Sweden	75.4	75.1	84.3	95.4	101.8	95.7	95.1
Germany	55.5	60.0	69.1	80.2	99.0	100.4	105.6
United Kingdom	61.3	62.2	64.2	71.2	78.5	83.3	84.3
France	56.0	58.1	67.7	82.1	101.4	109.1	112.7

Source: The Conference Board Total Economy Database™, March 2018

After this general trend is accounted for, the estimates for labour intensity are imprecise. For example, in specification (4) of Table 26. the 95% confidence intervals of labour intensity are -1.7% and 0.6%. Not much can be said of the possible impact of the variable. Perhaps the association would be more precise had Eastern Trade not supported labour intensive industries, although the variable should be controlled in the regressions.[472]

Since skill intensity's effect size is lower in 1980–1989 than in 1956–1970, the dependency on low-cost labour seems to have been stronger in the 1980s. This suggests that the protection provided by Eastern Trade noted by Laurila was perhaps an unintended consequence of free trade integration. Uncompetitive labour-intensive industries and effective rate of protection had a positive and statistically significant association in 1956–1970. The fall of customs barriers, gradual or not, perhaps motivated these industries to depend on trade with communist countries, which was easier to satisfy than trade with Western markets for a variety of reasons. This seems to have been especially the case in textile and foodstuff industries and probably distorted the structural transformation of Finnish economy. Uncompetitive industries might have died out faster as in other Nordic countries had Eastern Trade not existed – but more on that later.[473]

Although it was not apparent which theory or study Aunesluoma and Paavonen were referring to when they stressed the importance of scale advantage, their view is somewhat validated by the finding that scale advantage had a positive association with exports, though not on a statistically significant level, in 1980–1989. Of course, its regression coefficient was smaller than what H–O model's factor intensities tended to be, so scale advantage's impact on export structure was not tremendous. Yet only it and number of innovations had a positive association with value-added of exports in 1980–1989 suggesting that there had been a structural change in determinants of the Finnish trade pattern. However, including time fixed effects tempers the notion of scale advantage's

[472] Laurila 1995, 101
[473] Ibid., 99–102

superiority. While that econometric specification suggests that scale advantage's impact could be 1.0% per a 1% increase, it cannot rule out a -0.2% decrease either. At the very least, scale advantage did not have a substantial negative effect on export structure whereas in 1959–1970 its sign had still been negative.

Considering that previous literature has identified several reasons why product differentiation, the second New Trade Theory variable, could have been important, it was curious that the variable seemed largely unrelated to export structure. Although number of innovations had positive association with exports in the 1980s, it was not robust and might have been related to technological differentiation that is not related to NTT. Due to the possibility that the structural form of the regressions was misspecified, both low and high levels of R&D intensity according product groups were inspected. The result was that low levels of R&D, reflecting horizontal product differentiation, were negatively associated with exports implying that Finnish export products were actually homogenous.

What can explain this surprising finding? It could be that inclusion of marketing intensity would result in a positive sign of horizontal differentiation with exports. On the other hand, one might speculate that the C–H–O model is in fact not the correct approximation of the late post-war export structure, and that a model that includes increasing returns to scale – without product differentiation – might be more accurate.[474] Then again, it has been thought that large countries tend to be at comparative advantage in industries with increasing returns to scale. This does not exactly provide evidence for scale advantage being an independent determinant of trade in a small open economy like Finland. However, it has been also suggested that the argument is not relevant once free trade creates shared global markets, a development which European trade integration was part of. Additionally, there is still a rationale for trade between countries of the same size, which is consistent with how Finnish IIT was a feature of trade with Nordic countries.[475]

There are also reasons for intraindustry trade in homogenous products including border trade, re-export trade, cyclical trade – think of how agricultural trade depends on seasons – and strategic trade pertaining to Brander's model where a binational duopoly exports to each one's market.[476] I am not sure how much stock one should put to these rationales.

[474] For a discussion of models of increasing returns to scale, see Helpman 1984. It is important to note here that the nature of economies of scale can differ by being national or international and external or internal.
[475] Pihkala 2001, 297; Deardorff 1984, 510–511; Helpman 1984, 344
[476] Deardorff 1984, 506–507

Border trade would at least make sense in the case of intraindustry trade with Sweden whereas Brander's model may be explanatory in industries with export cartels.

Yet it has been suggested that country size makes all the difference here. Jacques Drèze argued "that a larger total market will be needed to permit producers in particular product lines to exhaust the benefits of economies of scale".[477] This leads into a market segmentation where large countries specialize in differentiated products and small countries in homogenized products.[478] Perhaps this was Finland's position in the new international marketplace of the 1980s: a country producing only standardized, general goods. Larjavaara was quite sceptical in 1978 whether this theory, more suitable to small labour intensive countries, could be applied to Finnish metal exports. According to him they were differentiated products, but Larjavaara admitted that the notion might still apply in other exports, most of which were composed of bulk commodities.[479]

A further examination indicated that homogenous goods were specifically a feature of Western Trade. Since exports to communist economies were characterized by low marketing costs and high profitability,[480] one might presume that they were relatively homogenous as well, but this seems to have not been case. Horizontal differentiation by R&D – i.e. products characterized by R&D but not on an extremely high level – seems to have been a feature of Eastern Trade even if the estimated effect size was not large. Therefore, Drèze's argument might still hold since metal exports, the focus of Larjavaara's study, were exported into the East. Indeed, it has been noted that metal and paper qualities of Eastern Trade were more refined than those exported into the West. This should partly explain the geographical difference in horizontal differentiation.[481]

The relationship between innovations, R&D intensity of product groups and Eastern Trade warrants some discussion, although it is obscured by the inability to distinguish between technological, vertical and horizontal differentiation. In 1956–1970 innovations had a positive association with Eastern Trade, but not one that can be proven regarding all exports. In the 1980s the opposite was the case. It seems that during this time Western Trade was characterized by technological differentiation, though only mildly, and homogenous products whereas horizontal differentiation was a feature in Eastern Trade.

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[477] Deardorff 1984, 511
[478] Ibid., 511
[479] Larjavaara 1978, 121–122
[480] Laurila 1995, 100–101
[481] Paavonen 2008, 257

Reconciling these observations is not straightforward. They may even simply rise from using different data sources. If that possibility is assumed away, one might speculate that changes in both the diversification and the technological level of Finnish exports might be the key here. In 1956–1970 Eastern Trade provided a market for metal engineering industries which were also the most innovatory industries at the time based on H-INNO data. Eastern Trade may have been important in raising the technological level of these exports. In the 1980s the number of export industries had grown, and innovating was no longer as concentrated in metal engineering industries. Hence the lack of statistical significance between innovations and Eastern Trade. If most of the innovations were related to production processes or technological differentiation it is no surprise that Western Trade was not characterized by horizontally differentiated products.

In the case of horizontal differentiation of Eastern Trade one should also consult the Andersson and Tolonen who argued that Finland managed to exploit its "geo-economic" position between Soviet Union and Sweden in 1960–1980. The authors argue that Eastern Trade was *relatively* technologically intensive – which is in line with horizontal or vertical differentiation by R&D – and could grow in conjunction with imports due to its clearing system, enabling Finland to close its technological gap with Western Europe. With regards to Swedish trade, the authors state that Swedish production shifted to lower-wage Finland as predicted by product cycle theory. Both statements are in line with the limited evidence here on Eastern Trade being horizontally differentiated according to R&D and Western Trade being homogenous.[482]

Testing for the validity of these claims remains an area for future research. Then again it is not obvious that a phenomenon related to Eastern Trade should even be attempted to explain with models that assume free markets. Indeed, NTT assumes that horizontal differentiation reflects appreciation for variety whereas Eastern Trade was handled on a governmental level without market mechanisms.

The point of this thesis was certainly not to test the validity of any particular theory – the Heckscher-Ohlin model in particular has already been subjected to a much scrutiny in the literature – as doing so would necessitate several tests such as sign test, slope test, t-test and variance ratio test.[483] While one should not put too much stock into high rates of R^2,

[482] Andersson & Tolonen 1982, 35. I am assuming here that homogenous products are correlated with utilizing unskilled labour.
[483] See Estevadeordal & Taylor 2002 for such an example of testing H–O model.

I cannot resist the urge to point out that the three-factor H–O model performs markedly better in explaining the variation within industries in 1956–1970 than in 1980–1989.[484] This supports Pihkala's statement that neoclassical trade theory, or the H–O model, performed better in the time preceding free trade integration although he dates this period to 1920–1960.[485] Since integration proceeded only gradually, the model might be applicable during 1960–1970 as well based on these tentative results.

What was the underlying trade model after 1970 then? Since the C–H–O model is less explanatory in 1980–1989 than H–O model in 1956–1970, another model might be more appropriate for the 1980s. These could include the models which originated in the post-war era but have since fallen out of fashion, such as increasing returns to scale, technological gap, product cycle and other demand-oriented models. Paavonen interprets textile exports' development through product cycle theory and Andersson and Tolonen's research does certainly point to it being a possible area of further inquiry.[486] That the innovations of MFM, TRE, CHE and TEX tended not to be novel in world markets, while not a definite proof of the theory's validity due to Eastern Trade's influence, is a mechanism of the model, in the phraseology of Rodrik's diagnostic framework. Perhaps new exports may be explainable with product cycle theory or a similar model then.

Additionally, recalling Pat Hudson's admonishment of supply-side dominance should encourage us to put more effort into studying demand-side models after all. Or perhaps export diversification alongside Eastern Trade ensured that there was more than one trade model simultaneously at work. As Leamer and Levinsohn noted some models might be specific to some industries and not to others.[487] Checking the validity of a correct model for Finnish exports of the late post-war period is another potential area of future research. The evidence here suggests that the characteristics of Eastern Trade would have to be accounted for in that inquiry as well.

Developments in Finland were not necessarily unique though. After Norway's Efta Agreement in 1960, some of its home market industries, particularly consumption goods industries, could not sustain themselves while others adapted to international competition.

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[484] As mentioned earlier the concept of R^2 differs from the ratio used in OLS regressions since fixed effects models are used instead. R^2 that is referred to here is the so-called within R^2.
[485] Pihkala 2007, 46–47
[486] Paavonen 2008, 279–281
[487] Leamer & Levinsohn 1995, 1342

The latter group included the basic metal, metal engineering and chemical industries – new export industries of Finland as well.[488] And as Fritz Hodne puts it:[489]

> – – industry survived in the open economy by utilizing natural resources, like cheap energy, fish and forests, or competitive skills in engineering and other modern high technologies – – there has been an inrush from abroad of consumer goods, for instance shoes, apparel, furniture, cosmetics that gradually ousted the Norwegian producers by price, quality or design – – the old distinction between the home market and export markets has been blurred.[490]

This is almost identical to a description of how structural transformation of Finnish economy proceeded, the last sentence in particular. In Denmark as well, textile industries continued to wither due to international competition by 1980.[491] The Nordic experience implies that had Eastern Trade not been a characteristic of Finnish foreign trade, textile and apparel industries would have likely succumbed to low-cost competition earlier than in the late 1980s, perhaps even in the 1970s or 1960s.

Of course, since textile exports' dependence on communist countries was not evidently higher than 35%, this point has perhaps been overestimated. Chemical exports' Eastern Trade share was roughly on the same level, suggesting that textile exports declined in the long-run because they were unproductive and labour intensive. Indeed, both Pihkala and Paavonen maintained that the industry lost its competitive edge and production was moved countries with lower labour costs due to solidary wage policy and cheap imports.[492] Eastern Trade may have slowed down this development, but it is questionable to believe that these low-wage industries would have been compatible with Finnish income growth in the long run, even if Soviet Union had continued its existence.

Returning to the Nordic context, one can observe similarities in Denmark as well. Chemical and metal manufacturing became important industries during free trade integration after fears of international competition driving domestic manufacturers, less productive than in European industrial nations, to the ground. The difference with Finland is that oil crises of the 1970s damaged Denmark more – Eastern Trade did have its benefits after all – and that foodstuff exports increased thanks to domestic agriculture.

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[488] Bear in mind that this relates to the years prior to the 1970s, so mention of chemical industries here is unrelated to large-scale, oil and petrol manufacturing.
[489] Hodne 1983, 202–203
[490] Ibid., 203
[491] Johansen 1987, 181–183
[492] Paavonen 2008, 281; Pihkala 2001, 258

Table 32. Shares of Commodity Groups of Commodity Gross Exports in Sweden and Finland in the Early Post-War Period, %

	Sweden	**Finland**	**Sweden**	**Finland**
	1951/1955	**1956**	**1971/1975**	**1970**
Woodworking	13.7	23.5	6.7	14.9
Pulp and Paper	31.0	46.5	17.0	37.8
Metal Ore Mining	9.2	1.2	4.8	0.6
Basic Metal and Metal Products	12.0	1.5	13.7	7.9
Machine and Transport Equipment	20.8	10.9	40.5	13.8
Others	13.3	16.4	17.3	25.0

Notes: The classification of commodity groups likely differs by some unknown amount. Metal ore mining in Finland 1956 includes exports of other mining as well.

Source: Statistics Finland; Input–Output Tables 1956–1970; Schön 2000, Table 5.11.

The Danish success perhaps explains the relative decline of Finnish foodstuff exports although there was also a marked increase in the relative standing of Finnish agricultural exports during the 1980s. Hans Christian Johansen also mentions that shipbuilding went into crisis during the 1970s, whereas Finnish transport equipment industry most likely was not as struck as severely by those times thanks to Eastern Trade.[493]

Coincidentally, Finnish service exports were also not as important as in other Nordic countries during 1970–1987. While this was probably partly due to the shipping industries of Denmark and Norway, the fact that the Swedish service exports' GDP share was somewhat larger than in Finland in 1987 suggests that Finnish service industries did not internationalize to the fullest extent possible.[494]

The Swedish economy of the early post-war period developed into a high-wage one, at least in comparison to its closest competitors. Its export structure around 1950–1970 was affected by both capital and skill intensity according to Lennart Schön. While mechanization was a feature of Finnish export structure during those times as well and there is some indication that skill intensity may have been important, the case for human capital seems less certain in Finland than in Sweden.[495]

Finland was at any rate only catching up to Swedish export diversification as exemplified by Table 32. where commodity group shares of Swedish and Finnish exports are compared. While there is some discrepancy in years studied and probably in the composition of the commodity groups as well, the results here indicate that Swedish forest exports clearly declined in favour of metal exports earlier than in Finland. Exports of

[493] Johansen 1987, 177–184
[494] Miikkulainen 1989, 13–14
[495] Schön 2000, 381–384

machine and transport equipment were especially meagre in Finland when compared to Sweden in the early post-war period.

While Swedish textile industries declined in the 1970s, electrotechnical and medicinal manufacturing expanded during the 1980s in Sweden. The latter industry is customarily classified as a part of chemical industry. Skill intensity was another feature of this period. While Schön does not directly discuss exports in either case, rather manufacturing in general, this nonetheless indicates that Finnish and Swedish economies and exports developed similarly in some cases and less so in others. One finds evidence for skill intensity in Sweden in the 1980s, but not as much in Finland – and perhaps even more importantly – while I have asserted that export diversification was a feature of Finnish development this too seems muted compared to the Swedish case.[496]

When inspecting the series of IMF's export diversification index in Chart 5. one can observe that Finnish exports were not only more concentrated than in other Nordic countries in the 1960s but also that Finland did not manage to converge completely with Denmark or Sweden even by 2010. The relative lack of diversity in export structure did not go unnoticed in the early 1960s. Dahmén noted that Finland had not managed to produce competitive products relative to the U.S.A. as Sweden and Switzerland had. The reason for this was the "sluggishness of factors of production and Finland's slowness to discard industries and practices that lacked a future".[497] While free trade integration certainly alleviated the second problem, the institutional settings that led to problems in factor substitution can be studied in more detail in Dahmén's own research.[498]

Finland still shared some characteristics with other Nordic countries. For example, Fagerberg recognized that chemical production had evolved into a field of competitive advantage in all Nordic countries. Its development could be studied from a cross-country perspective then. Textile exports, on the other hand, were perhaps affected by both general international trends and specifically Finnish features. Yet the greatest difference here relates to the battle of primacy between forest and metal exports.[499]

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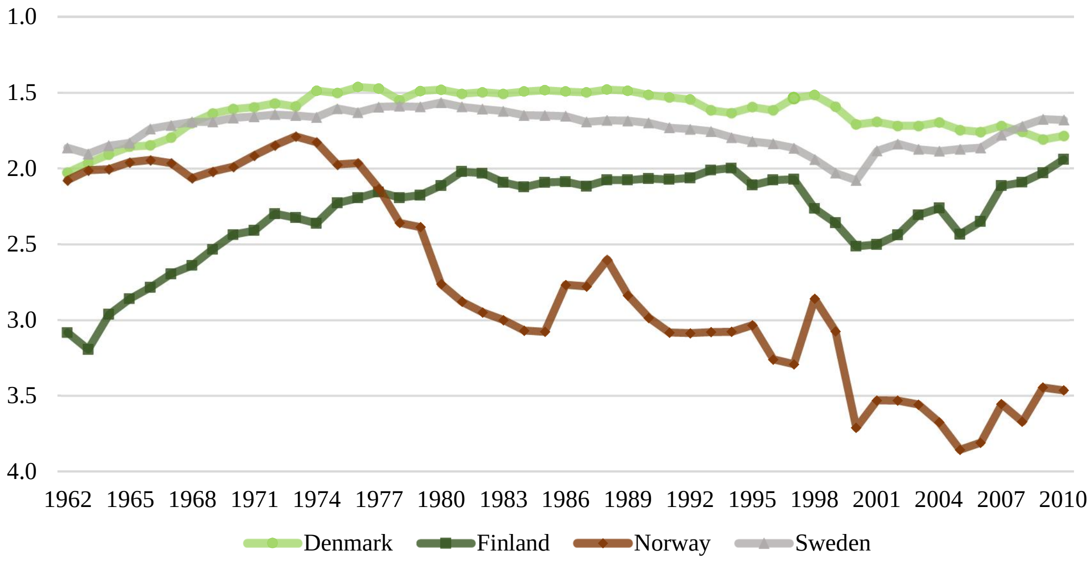
[496] Schön 2000, 476–478
[497] Dahmén 1963, 43
[498] Ibid., 42–51. These institutional issues include e.g. solidary wage policy and import regulation.
[499] Miikkulainen 1989, 13–14; Fagerberg 1987, 94

Chart 5. Export Diversification in Nordic Countries in 1962–2010



Notes: The diversification index does not only account for diversity of products, but also that of trading partners. The scale is inverted: an index score of 0 reflects totally diversified exports and higher scores reflect increased concentration. Norway's increasing concentration of exports after 1973, for example, likely relates to its oil exports.

Source: IMF Diversification Toolkit; see also IMF 2014 for a more in-depth discussion of export diversification.

While Maliranta noted that both Finland and Sweden had specialized in basic metal and paper industries – and speculating that this was related to industry-specific know-how and forming of forest and metal clusters – Sweden evidently developed its metal engineering exports earlier than in Finland.[500] Considering that Sweden was an important source for forest resources in international markets – even more so than Finland in some commodities – Finland could have developed metal exports to a similar degree.[501] Of course, it has to be admitted that Finnish and Swedish paper industries diverged when it came to their product lines. Sweden ended up focusing on "brown paper" after the oil crisis whereas Finland tended to produce paper grades that required more processing.[502]

Yet this does not preclude a growth in other export industries. Since basic metal and engineering industries were established in Norway as well, I do not think that Swedish metal exports would have supplied international demand to such an extent that a stronger and earlier growth in metal engineering exports would have been impossible in Finland. Here I think that a longer time-frame than the one found in this thesis is required.

It seems that Swedish metal exports developed in stronger terms than in Finland from the first globalization period up to the Depression of the 1930s. While it is true that Finnish

[500] Maliranta 1996, 95
[501] Yates 1959, 119–120. Sweden outmatched Finland in its shares of global sawn softwood and wood pulp exports in the 1950s.
[502] Heikkinen 2000, 379–281

metal industry did exist in the interwar period, its exports were on a lower scale than in Sweden. This is most likely related to the fact that metal exports were initially dependent on Russian markets, which disappeared in the political aftermath of the First World War. Perhaps this negative demand shock reverberated over the subsequent decades to the extent that a positive one in the form of war reparations, and its continuation in Eastern Trade, was required to increase the quality and technological standards, however modest, of metal engineering industries to an internationally competitive level. Therefore, the long-term development of metal engineering exports warrants further research.[503]

5.2 In Conclusion

The economic history of Finnish export structure, even if based on a framework of economics, has been lacking in empirics. The few empirical studies concerning Finnish export structure cover only slices of the post-war period and have refrained from using approaches provided by econometrics. The novelty of this thesis lies not in simply utilizing modern analytic tools however, although the approach here is also supported by a variety of traditional statistical tools of economic history, but in discarding the traditional but misleading measure of gross exports in favour of domestic value-added of exports. From a purely economic perspective the attention devoted to institutional features might be considered almost heterodox, but then again Dahmén had a somewhat similar approach too in his day too.

The approach adopted here resulted in the following observations. First, it is evident that that the post-war period should be separated to at least two periods. The export structure of 1956–1970 was characterized by capital intensity related to the mechanization. There are also some indications that skill intensity, or know-how, may have been important during this time. The clear decline in the use of natural resources is conversely very evident. This development does not only reflect the emergence of metal, chemical and textile exports which were not dependent on forest resources, but also that forest industries themselves became slightly less dependent on forestry's inputs in the course of the early post-war period.

In other words, Finnish industrial development at least concerning export structure was no longer a product of "a single raw material" even if Haapala and Lloyd claim that this

[503] See Schön 2000, 237–238 for a review of Swedish metal exports in 1890–1930 and Oksanen & Pihkala 1975; Pihkala 1969 for Finnish exports during the first globalization and the interwar periods.

was the case in the entire 20th century. While Finland of the early 2000s still arguably lives on exports, its livelihood had ceased to depend on forests by the year 1980. It is quite revealing that the catchphrase, “Finland lives on forests”, originated in the 1980s when resource intensity was no longer a determinant of export structure.

During the 1980s the determinants of export structure had changed – the conventional factors of labour, natural resources, physical and human capital were no longer explanatory. Scale advantage was the only measure during this time which had a positive and a fairly robust relationship of with value-added of exports, but even there the proof is less definite than what might be hoped for. Additionally, although previous research gave grounds to hypothesize that product differentiation was a likely cause of export structure, the opposite seems to have been the case. Finnish exports were relatively more homogenous instead of being differentiated. Closer inspection revealed that this arises from the distinct natures of Eastern and Western Trade.

While Western Trade was evidently homogenous and standardized, Eastern Trade was somewhat more comprised of export products that were relatively differentiated by R&D. While determining the nature of product differentiation is difficult, Western Trade seems to have been more technologically differentiated in the 1980s. However, it has also been claimed that Eastern Trade was relatively technologically advanced. This was indeed the case, but more so in the early post-war period when number of innovations was a feature of Eastern Trade. This finding supports the notion that Eastern Trade raised the technological level of Finnish exports to a level competitive in the West, at least considering metal engineering exports.

While the approach of this thesis was never concerned with explicit theory-testing, the results indicate that the conventional Heckscher–Ohlin model of factor intensities was explanatory in the early post-war period, but the Chamberlin–Heckscher–Ohlin model, which adds economies of scale and product differentiation to the set of factors of production, was not in the late post-war period. Far-reaching conclusions cannot be made regarding this point, but the results suggest that a different model – or indeed models – might be needed in order to characterize post-war export structure preceding the 1990s. When considering this point, it might beneficial to remember Pat Hudson’s criticism that the supply-side explanations dominate economic history excessively. The implications that product cycle theory and demand-driven models may be important in analysing the

Finnish post-war export structure – not least because Eastern Trade clearly affected trade patterns – suggests that she may be right.

Adapting a cross-country perspective might be fruitful as well. A brief international comparison of Nordic countries revealed similarities and dissimilarities in post-war development. One can witness the emergence of chemical industry in Nordic export structure. Yet Finland's relatively stagnant development of metal industries differs clearly from their growth in Sweden. The Finnish metal engineering industries' development was clearly related to Eastern Trade, but a longer-term perspective is warranted. One should consider not only Eastern Trade, but also the metal industries' entire trajectory: their birth in the context of Tsarist Russia, stagnation in the aftermath of the Revolutions of 1917 and resurgence in conjunction with war reparations to the Soviet Union. This development may still hide unanswered questions.

And speaking of international developments, the findings in this thesis also highlight the need to conceptually distance the arguments over a country's position in the international marketplace and the determinants of its export structure. By this I refer to the observation that labour intensity's negative association with exports is only statistically and historically significant if time fixed effects are excluded. Including time effects largely negates the impact labour intensity had on exports, which implies that the decline in the use of unskilled labour was a general phenomenon in all industries alike. This certainly would have had consequences for where Finland located in the global supply chains, but from a strictly national, cross-industry perspective labour intensity did not have a clearly negative or positive effect on exports.

Finally, there are grounds to believe that economic history of Finnish foreign trade should not only focus on the macro-level of international or Nordic trade patterns, but also on the micro-level. Modern empirical economic research is increasingly focused on products and companies, but Finnish quantitative historians has not embarked on such a line of inquiry as of yet.

The results of this thesis might be greatly altered if such research designs would be adopted. The evidence here certainly suggests that Rodrik's exhortation of understanding economics as a collection of many models, applicable to only some settings and not in others, must be appreciated. Finnish economic history cannot be studied with one model alone, economic or not, quantitative or not. Despite the fact that foreign trade and industrial development have been the staple topics of Finnish economic history, much work still remains to be done.

6. Appendices: Data Sources and Conceptual Issues

6.1 The Industrial Classification System Used in this Thesis

Data collection was based on the industrial classification used in the input-output tables of the 1980s.[504] Due to differences in classification systems, the list had to be modified in a few instances resulting in the following classification:

1. Agriculture AGR
2. Forestry and logging FOR
3. Fishing and hunting FIS
4. Metal ore mining ORE
5. Other mining OMI
6. Food manufacturing FOO
7. Manufacture of beverages and tobacco products BEV
8. Manufacture of textiles and wearing apparel, except footwear TEX
9. Manufacture of leather, fur garment, leather articles and footwear LEA
10. Manufacture of wood and cork products, including furniture WOF

10a. Manufacture of wood and cork products, excluding furniture WOO
10b. Manufacture of furniture and fixtures, excluding primarily of metal FUR
11. Manufacture of pulp, paper and paperboard PAP
12. Printing, publishing and allied industries PRI
13. Manufacture of chemicals and other chemical products CHE
14. Petroleum refineries OIL
15. Manufacture of rubber and plastic products RUB
16. Manufacture of non-metallic mineral products, except of petroleum and coal MIN
17. Basic metal industries MET
18. Manufacture of fabricated metal products and machinery MFM

18a. Manufacture of fabricated metal products FAB
18b. Manufacture of machinery MAC
19. Manufacture of electrical appliances, instruments and other precision equipment ELE
20. Manufacture of transport equipment TRE
21. Other manufacturing OTH
22. Electricity, gas and steam, waterworks and supply EGW

22a. Electricity, gas and steam EGS
22b. Waterworks and supply WAT
23. Building BUI
24. Other construction OCO
25. Trade TRD
26. Restaurants and hotels RES
27. Transport, storage and communications TRC

27a. Transport and storage TRA
27b. Communications COM
28. Financial institutions and insurance FIN
29. Letting and operating of dwellings and use of owner occupied dwellings DWE
30. Other real estate, business services, machinery and equipment rental and leasing BUS
31. Community, social and personal services CSP

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504 See for example National accounts 1988:1, 10–11.

While manufacturing of instruments and other precision equipment are appropriately grouped among electrical appliances in the 1980s, it is more questionable to assign them as electrical goods during the years 1956–1970. Therefore, instruments were classified among "22. Other manufacturing" during these years, which creates a slight break in the analysis. Additionally, since I–O tables for this earlier period included restaurants and hotels as a part of personal services, the industry group had to be classified into "34. Community, social and personal services" for the purposes of the panel covering the entire time span of 1956–1989. The I–O tables of 1956–1970 classified manufacture of machinery and fabricated metal products separately, but they were also combined in most cases.

6.2 Data Sources and Concepts

General Notes on Input-Output Tables and Systems of Classification

A general issue with all statistical sources used in this thesis arises from the fact that industrial classifications changed more than once during the post-war period. All of the compiled series could not be classified in a systematic manner, since input-output (I–O) tables' input-coefficients, used in calculating factor intensities, were in some cases too aggregate to allow for reclassification. Within those boundaries and as a rule, all the data across industries was compiled to match the classification system used in input-output tables of the 1980s. Some measurement error is still likely to arise from different classification systems, but this cannot be avoided fully. The statistical sources, on the other hand, can be considered to be of good quality, since most of them are from publication of Statistics Finland and the Official Statistics of Finland.

The input-output tables compiled by Statistics Finland cover the years 1956, 1959, 1965, 1970, 1980, 1982, 1985 and 1989. It has been noted that due to poorer information available in those times, the input-output tables of 1959, and by the same reasoning those of 1956 as well, are not as reliable as or fully comparable with later input-output tables.[505] A case in point might be that the input-output table of 1959 does not include data on service exports, other than that of insurance, or industries approximately comprising industrial groups 31. - 34.[506] Therefore service export figures for these groups were added on the basis of balance of payments data from Bank of Finland and I–O tables of 1965.[507]

Additionally, the I–O tables of 1956 were published on a more aggregated industry level than the other I–O publications. To ensure compatibility between 1956 and the other years, but without diminishing the sample size, disaggregated estimates for metal ore mining and other mining, textile and clothing, leather and footwear, rubber and plastic product, other manufacturing and letting and operating of dwellings, real estate and business service and community, social and personal service industries were calculated on the basis of I–O tables of 1959 and 1965 alongside Industrial Statistics. The estimated figures for value-added of exports are slightly different from those calculated with the original values. Usually the discrepancy is negligible, though there are noticeable differences in textile, clothing, leather and footwear manufacturing and in transportation services – the new figures are larger by approximately 7% and 11% respectively. However, on an aggregate level the value-added of exports is only one percent larger when compared with the original data.

[505] Ahde 1990, 28
[506] Forssell 1965, 45. Note that input-output studies are listed in statistical sources rather than in literature.
[507] See Airikkala et al. 1976 for Bank of Finland data.

In conclusion, the estimates on the basis of disaggregated 1956 data are reliable enough though one must exercise due caution in interpreting the results for transportation, textile and clothing and leather and footwear industries in 1956, which are likely to be overestimated to some extent. Generally speaking though, since the input-output data are cross-sections, they might be biased by shocks and developments that took place during those specific years. Pihkala noted that the amount of exports declined in 1956 and 1982 and prices of exports in 1956 and 1959. In 1985 and 1989 the amount of exports did not increase either. It is certainly possible that these business cycles affect the results of this thesis, but the availability of data does not allow for alternatives. The year 1956 might be especially problematic due to the general strike of that year, but I will discuss why the bias might not be large in the section concerning labour data.[508]

On Deflating

The data gathered for the thesis was denominated in nominal values. To nullify the effect of inflation, all the monetary factors were deflated with producer price indices, with original base year of 1949, calculated by Statistics Finland. Export prices were deflated with the export price index, imports with the import price index and most of the other factors with the wholesale price index. The foreign trade indices only include data on commodity trade with the result that service trade values are not wholly trustworthy, except for trade and transportation industries, which revolve around commodities. The wholesale price index does not account for services either. This is a consequence of the difficulty in defining services, which can be quite unique, and appraising their value, which can be prone to change drastically in a short time.[509]

Wholesale price index for domestic products was ultimately chosen as a deflator in most cases, since the focus here is on supply-side characteristics of private sector and not on consequences for consumers reflected by the consumer price index. There are alternative producer prices indices however, such as producer price index for manufactured products, but it does not cover the primary sector like the wholesale price index.

However, wages and physical capital were handled in a different manner as I suspected that wholesale price index had better alternatives, though all of them are Statistics Finland's price indices. Wage sums were deflated with the consumer price index since it corresponds more accurately with the notion that wages are compensation for labour. Physical capital was deflated by first dividing it to two parts: that pertaining to construction and that to machinery and transport equipment. Construction capital was deflated with the building cost index whereas machinery and transport equipment capital was deflated with the wholesale price index for domestic and imported machinery goods, including both electrotechnical goods and transport equipment.

Note that excluding electrotechnical goods would raise the value of machinery and transport equipment.[510] Since the electrotechnical industry emerged during the late post-war period, I opted not exclude its price development here. Regardless, it should be noted that the actual levels of capital might be underestimated here. However, this is not necessarily an issue for this thesis since the potential bias does not alter the value of industries' machine capital relative to other industries.

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[508] Pihkala 2001, 246
[509] Aulin-Ahmavaara 2007, 92–93
[510] This is likely related to the drastic price reductions in ICT products noted by Aulin-Ahmavaara. See Aulin-Ahmavaara 2007, 92.

Then again, index series tend to follow each other closely so the choice of one index over the other does not likely change the results significantly.[511] More problematic is that, since all data disaggregated by industry are deflated with the same aggregate index, industrial price differences are implicitly disregarded. The producer price index series for manufactured products does reveal that different industries could differ significantly – e.g. with 1949 = 100 manufacture of transport equipment has an index score of 1411 and manufacture of electrical machinery that of 938. However, this index series does not cover all the manufacturing industries disaggregated for the purposes of this thesis and lacks most notably any information on chemical industries. While average index scores could be used to proxy price changes in these cases, the resulting panel data could be noncomparable in an unpredictable way. Therefore, I prefer to use a single index series as a deflator for simplicity's sake, unless otherwise mentioned.[512]

Labour

Labour intensity of production is measured with one million hours worked in a given industry – a measure that is preferable to using the number of employees, for instance. Number of hours worked takes into account part-time work, different lengths of workdays, and also Finland's gradual move into a five-day working week from 1966 to the beginning of 1970,[513] that the number of employees would not. The number of working hours include all employees, not just wage-earners or manual labour. While manual or unskilled labour reflects labour intensity relative to human capital, as skilled labour, the difference between salaried employees and wage-earners is not clear-cut, and there is not enough data on primary and tertiary sectors for such measures.

The input-output tables for 1982, 1985 and 1989 include data on working hours. While Statistics Finland also has figures for the same period, it follows a revised industrial classification. Due to possible misclassification, data from input-output tables was used. Hours worked by industry for the years 1965, 1970 and 1980 was gathered from National Accounts of Statistics Finland.[514] The publication's figures are revised, and thus preferable. However, in some cases,[515] the data was too aggregate and had to be estimated to a more disaggregated level. This was done by constructing weights based on working hours contained in PX-Web dataset of National Accounts of Statistics Finland for 1980. For 1965 and 1970 weights were calculated from hours worked of wage-earners as measured in Industrial Statistics. To the extent that working hours of salaried employees differs from those of wage-earners, this creates some bias in the results.

The years 1956 and 1959 were the most problematic due to lack of data, since the old National Accounts utilized working-year measures,[516] which is not directly comparable to working hours. In the case of manufacturing industries, it was assumed that hours worked in total developed similarly to those of wage-earners calculated in Industrial Statistics. As for primary and tertiary sectors, Pekka Tiainen's data was used similarly,[517] although since it also includes those employed not on the private sector, it had to be re-estimated to include only private sector employees. The estimates were calculated with

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[511] Statistics Finland, Producer price indices [e-publication]; Lehtinen & Ranki 1988, 33–34

[512] Statistics Finland, PX-Web databases, Prices and Costs, Producer price indices, Producer Price Indices 1949=100

[513] Tiainen 1994, L28

[514] National Accounts 1981, 1984

[515] To be exact in those of mining, food, beverage and tobacco, chemical, petroleum refineries, rubber and plastic products and fabricated metal products and machinery industries.

[516] National Accounting in Finland in 1948–1964, Tables, 1968

[517] Tiainen 1994, Table 9.

proportions of private sector's working hour figures relative to all sectors' in the National Accounts 1981 for the year 1960.

Finally, it should be noted that it is quite probable that the general strike of 1956 also affects the data for that year, at least when it comes to labour. However, it has been argued that the strike did not by itself alter the economic life of companies since the Baltic Sea was frozen, stockpiles were full and the export markets were not booming.[518] Other factors than labour were probably not affected, though wage increases worsened the economic situation and gave impetus for the devaluation of markka in 1957.[519] Yet it is likely that the decline in labour intensity over 1956–1989 would be even more dramatic if the starting point would be different.

In conclusion, the working hour data can be considered to be reliable and also a conceptually appropriate measure for labour intensity.

Physical Capital

Practically speaking capital refers to fixed equipment such as constructions and machinery etc. but the concept of capital, and the question of how to measure it, is not clear-cut. For simplicity's sake, I will disregard the Cambridge controversies and other theoretical debates and rely on the existing literature of national accounting in Finland. However, the correct measure for capital is not as self-evident as in labour as even in national accounting there are different concepts of capital stock. The usual ones are calculated as the cumulative value of past investments: gross stock of fixed capital and net stock of fixed capital.

The former concept supposes that fixed capital is valued "as good as new" even if machines and constructions deteriorate in time. In other words, when using the gross capital measure, one assumes that capital stock retains its full productive capacity up to its expiration date. Net stock of fixed capital on the other hand, does not assume this. A capital good is defined there as "the current purchaser's price of a new asset of the same type less the cumulated consumption of fixed capital" where the consumption refers to loss of value due to "physical deterioration, normal obsolescence, normal accidental damage and aging".[520] That depreciation of value is not simple to calculate and relies on age-price profiles and even educated guesses.[521]

A preferred concept to net stock of capital would be that of capital services, since the net stock reflects wealth more than productive capacity.[522] Pirkko Aulin-Ahmavaara and Jalava compare capital services to labour in the sense that the latter is "services" flowing from human capital.[523] While capital services would be the best concept for capital intensity, there is no dataset to cover the time periods nor the industries for this thesis. Therefore, I prefer net capital stock as the measure for capital intensity, since it accounts for the age and deterioration.

The main source used was Statistics Finland's publication "Stock of fixed capital 1960 – 1993: Tables" which includes revised figures on net capital stock. Age-profiles were revised and moving averages of mileage for machinery used in manufacturing were

518 Mertanen 2004, 334
519 Mertanen 2004, 330–332
520 Jalava 2007, 60
521 Aulin-Ahmavaara 2007, 93–94; Jalava 2007, 55–56
522 Aulin-Ahmavaara 2007, 94
523 Jalava 2007, 61

adopted. As in the case of working hours, the data was too aggregate in some cases,[524] and lacking in 1956 and 1959. Weights based on Industrial Statistics' data on value of fixed capital was used to disaggregate these industries. This is admittedly a crude approach, since the value of fixed capital in Industrial Statistics is priced according to fire insurance value.[525] For the years 1980–1989 I utilized Statistics Finland's national accounts' time series of net capital stock in disaggregating these industries.[526]

For 1956 and 1959 auxiliary series were used with the assumption that their changes relative to the year 1960 would correspond to those with the unobserved net capital stock figures. Tiainen's data on net capital stock was used to calculate estimates for primary and tertiary sectors, while also correcting for non-private sector activities.[527] Industrial Statistics' data on value of fixed capital was used to estimate changes in manufacturing industries.

In conclusion, the net capital stock data is reliable enough at least for the years 1965–1989 while there is some uncertainty concerning 1956 and 1959. However, the possible measurement error is likely not too sizeable.

Human Capital

There are a variety of different measures for human capital, but none are entirely satisfactory. R&D expenditure, a natural starting point, by industry assumes that research and development require a great deal of skilled labour. The figures are based on Statistics Finland's publications from the series "Research activity" and "Yrityssektorin tutkimus- ja kehittämistoiminta". Since these were not published annually, the figures for 1971 are used as a proxy for 1970, whereas the data across industries for 1980 and 1982 were calculated as averages of 1979 and 1981, and 1981 and 1983, respectively. It should be noted that all of these publications utilized company surveys, so the figures are less reliable as those of national accounts. Not all companies reported all R&D expenditure for example, which led Statistics Finland to estimate some figures. At any rate, the response rate was quite high ranging from circa 81% – 92%, and if there was information on non-responsive companies from past years that data was used instead.[528] The rate for 1985 was only 75% though.[529]

Further estimates had to be calculated since the data on industries was often too aggregated on certain years, when the publications relied more on product group classifications. As a solution, disaggregated estimates of R&D expenditure by industries for 1980 and 1982 were created based on cross-tabulation of R&D expenditure per industries and product groups for 1985.[530] Here I am assuming that the distribution of R&D expenditure of product groups across industries was stable throughout 1980–1985, which is not exactly accurate, but probably approximately so. For the year 1971 aggregate product group figures was used to calculate estimates, since it was classified differently than in the 1980s publications. The number of salaried employees, or office workers, obtained from Industrial Statistics, was also used as an auxiliary series when product group information was not as disaggregate as needed. Due to lack of better information,

[524] To be exact in the case of mining, food, beverages and tobacco, textile and clothing, leather and shoe, and other manufacturing and furniture industries.
[525] See for example Industrial Statistics 1970, 14. Power installed measured in kilowatts was also used in the case of 1956–1960 for disaggregating other manufacturing industry.
[526] Statistics Finland, National Accounts in StatFin
[527] See Tiainen 1994, Table 13.
[528] See for example Koulutus ja tutkimus 1990:24, 3 and Research activity 1981, 7.
[529] Liitetaulukot Tilastotiedotukseen KO 1986:13, 2
[530] Tilastotiedotus KO 1986:13, Liitetaulukot, Table 5

this is the most suitable approach, but one that does decrease the reliability of the figures to some extent.

The lack of similar R&D data for 1956–1965 requires the calculation of another measure that can be used to compare the entire time period. Additionally, there is some theoretical uncertainty on the proper factor role of R&D expenditure, since it has been claimed that it should be conceptually included in capital formation.[531] It is also used to measure product differentiation, as discussed later on.

As mentioned by Wright "it has become a standard convention in empirical trade studies to take the relative industry wage as a proxy for skill requirements".[532] Indeed, average wage rate might be a more appropriate proxy for skilled personnel in general than R&D intensity, which is more reflective of scientific personnel. Wage sum data is available throughout the period. For the years 1970–1989 wage sums were taken from Statistics Finland's national accounts data in StatFin database. As in the capital and working hour series, National Accounts 1981 Time series for 1960–1981 was used to gather data for the years 1965 and 1970. Tiainen's long series and the old national accounts covering 1948–1964 were used for calculating the wage sums of 1956 and 1959, though in some industries figures were corrected to private sector amounts based on data from "National Accounts 1981".[533] Old national accounts' wage sums in manufacturing were in some cases disaggregated with weights calculated from wage data in Industrial Statistics. Additionally, the wage-earner and wage sum series in industries BUS and CSP were interpolated for 1956 and 1959 based on statistics relating to private services.[534]

Wage sums were divided by working hours per industry, so the measure for human capital intensity is the average wage per hour. However, the data on working hours used for labour intensity was not used here, since it includes also data on entrepreneurs' working hours. Since they are not wage-earners, including their working hours can bias the results by entrepreneur/employee -ratios across industries. For this reason, only working hour data of wage-earners was used. The data sources are the same as the ones used in calculating labour intensity except that the data covering 1980–1989 was obtained from Statistics Finland's StatFin database.

A conceptual and empirical problem with wage rates is that they do not simply reflect skill levels in the presence of high rates of unionization. If some industries were both export-driven and highly unionized, interpretation of wage rates will be misleadingly high. There is published data on membership of different unions in up to 1988,[535] but classifying unionization rates by ISIC cannot be done reliably. Unionization was measured by dividing the trade union members by all employees in a given industry. Admittedly, the measure is uncertain, but a better approach would require a more comprehensible dataset.

Since the data on the level of union membership is not accurate, one cannot make strong statements on the possible biases here. One would expect that wage rates in 1959 are more reliable reflections of human capital than those in 1989, since union membership was less common in the 1950s. Paper and woodworking production had similar unionization rates throughout the post-war era, and on a larger scale than in the manufactures of metal,

531 Aulin-Ahmavaara 2007, 95
532 Wright 1990, 654
533 Tiainen 1994; National Accounts 1981, 1984; National Accounting in Finland 1948–1964 – Tables, 1968
534 See Kaartinen 1970.
535 Yli-Pietilä et al. 1990

textile and chemistry production. This would imply that the high wage rate of paper manufacturing in 1989 could be partially a result of trade unions' bargaining power. It is likewise possible that woodworking manufacturing's wages should have been even lower. Since textile manufacturing seems to have had a higher unionization rate than other new exports industries in 1989, it is likely possible that its low wage rate also corresponds with low levels of human capital, though gender of its employees may affect results. As chemistry and food manufacturing had a relatively similar rate of unionization – the difference in favour of chemical industry – chemical industry's rate of human capital is likely true as well. Metal industries tended to have a relatively high union membership ratio, except for basic metal industry. However, some of its employees might have been members in trade unions assigned into metal engineering industries.

Another potential pitfall in wage rates is that there may be a systematic down pressure on wages of the female workforce. The measure here is calculated as the share of female employees relative to all employees in a given industry. If such there is a gender bias, industries with a relatively high ratio of female employees, but a standard level of human capital, will have lower wages creating a false impression of lower rate of skill intensity. The same applies to the opposite where a high ratio of male employees results in higher wages. In order to counter this effect, the share of female employees was calculated on the basis of general economic censuses of 1953 and 1964 and population censuses of 1950 and 1960 with Statistics Finland's publication "Economic activity and housing conditions of the population" containing data for 1970–1990.[536]

The data concerning the share of women is more accurate than the unionization data. It is undoubtedly the case that the employees in textile industries were mostly women. Same can be said of retail and wholesale trade. Conversely, in forest industries the share of female employees was generally less than 30% and such was also the case in transport and communications. While the paper industry's relatively high average wage rate could be related to its predominantly male workforce, this seemingly was not the case in woodworking industry.

In metal industries, with the exception of electrotechnical industry, the share of women was less than 20%. The lack of female workers in these industries perhaps explains why their wage rates tended to be higher than in ELE, but in comparison with the median of manufacturing industries these industries' wage rates do not stand out. This suggests that gender was not a primary source of wage differences between them and other industries.

Chemical and business and other real estate service industries' – both relatively high wage industries – workforce was also more masculine than feminine, but to a lower degree than in metal or forest industries. While agriculture was also relatively balanced in this respect, forestry workers were predominantly male, which might explain the higher wage rate in the latter relative to the former.

The question of how gender interacted with wage rates in the post-war period cannot be solved here, but one can draw some conclusions here. Gender was not probably the main source of wage differences across industries, but its effect may have been large in textile industries for example. Jari Eloranta and Matti Hannikainen have also noted that services tended to employ a lot of women as well.[537] However, the wage gap was also a product of human capital differences among men and women.[538] One could make a similar

[536] See OSF: Population 1995:6
[537] Eloranta & Hannikainen 2018 (unpublished), 13
[538] Hannikainen & Heikkinen 2006, 170

statement regarding unionization where high wage rates of paper industry may have been influenced by bargaining power of trade unions, but a general impact remains uncertain.

It should also be mentioned that Finnish post-war wages were affected by so-called "wage solidarity" where wage differences across industries were curtailed. This most likely diminished labour flows into more productive sectors, since a wage-earner would not earn a higher premium in another industry. Thus, it is probable that wage differences observed are smaller than the differences in true skill intensity across industries. Average wage rate could be interpreted as "lower bounds" of skill intensity, although wage increases in unproductive industries may just reflect wage solidarity as well.[539]

A third method for measuring human capital, is the number of officials and clerks, or salaried employees. This measure, used for example by Heikkinen in a study concerning the decades preceding the First World War, assumes that an industry with high technical requirements also requires educated personnel.[540] While the assumption that production workers have a lesser skill-set rather than office workers is most likely accurate in the beginning of the 1900s, it is more questionable in modern times, when non-manual occupations can be relatively monotonous and lower-paying than manual ones.[541] For this reason and for the fact that there is not enough data on office workers for primary and tertiary sectors – data on manufacturing can be located in Industrial Statistics – hourly wage rate controlled by unionization is the preferable measure.

In conclusion, average wage rate per hour is used throughout the post-war period to measure skill intensity. R&D expenditure is perhaps preferable to wage rate in inspecting technological skills, but it is less reliable due to possible measurement error caused by estimated figures. Wage rate is a good measure insofar as unionization and gender variables capture their respective possible biases on wage rates. Share of office workers is only used as an auxiliary series to reinforce findings of these two measures.

Natural Resources

Possible conceptual issues related to natural resources in H–O framework have already been mentioned and discarded in the light of importance that this factor likely had for Finnish export performance. While Varian simply uses share of material inputs relative to gross output as a measure for natural resources,[542] this does not account for all the indirect use of natural resources. Therefore, the intensity of natural resources is measured for the purposes of this thesis by the proportion of value-added created in primary sector industries for export demand relative to all value added necessary for export demand. The industries include agriculture, fishing, forestry and mining. These figures are obtained from calculating domestic value-added embodied in exports and can be considered as reliable as the input-output tables used in this thesis – that is very reliable.

Scale Advantage

Scale advantage is not only hard to measure but intraindustry trade studies have also had mixed results concerning its empirical validity, which means that any measure here should be treated with due caution. Regardless, Parjanne recommends average plant size as the best proxy for scale advantage due to its simplicity, and in her estimated regression model, it is statistical significance and has the expected sign. Theoretically the measure is associated with product standardization and homogeneity – and it is negatively

[539] See Dahmén 1963, 44 for a discussion of wage solidarity.
[540] Heikkinen 1997, 94
[541] See Yli-Pietilä et al. 1990, 4, 150–151.
[542] Varian 2017, 120

correlated with product differentiation even if NTT assumes that the existence of economies of scale is important for intra-industry trade. Thus, scale economies can be an independent rationale for trade as well. Parjanne measures average plant size in the following manner:[543]

$$ES_j = \frac{VA_j}{n_j}$$

That is, the value-added of an industry is divided by its number of establishments. While Parjanne studies average plant size, my thesis concerns also primary and tertiary production. Therefore, I use and refer to establishment data. The distinction between plants and establishments is not great in manufacturing though. Intuitively if a certain industry has a lower number of establishments than the other but with same value-added, establishments must be on a larger scale. On the other hand, Leamer and Levinsohn have criticized the variable as having no theoretical relationship with economies of scale that are a feature of New Trade Theory.[544]

Using establishment data from Industrial Statistics can be misleading since value-added data from input-output tables takes into account small-scale industries.[545] On the basis of comparing data in Industrial Statistics and general economic census of 1964, Industrial Statistics seem to contain data only concerning large companies. In other words, only 30% of all establishments in general economic consensus were covered by Industrial Statistics, but the data covered 94% of both the number of personnel and the value of sales of the census. Yet there are wide disparities in sectors – paper industry is well covered by Industrial Statistics, but textile industries are not. Therefore, average establishment size is overemphasized if one uses Industrial Statistics and the data on manufacturing would not be comparable with that of primary and tertiary sectors gained from other sources. Thus, I prefer the general economic censuses and company registers that cover all sectors, as source material.

The data for scale advantage is gathered from general economic censuses of 1953 and 1964 as well as published company register data of Statistics Finland from 1972, 1980, 1982, 1986 and 1989. That is, the data for 1956 is proxied by 1952 figures, 1965 by 1964, 1970 by 1972 and 1985 by 1986. I do not expect that scale advantage would change drastically in a few years, but this does create at least a small measurement error. Additionally, I calculated estimates of average plant size for the year 1959 for mining, manufacturing and energy industries based on the data from Industrial Statistics of the same year. The number of establishments and gross value of production for each industry were weighted based on coverage ratios of Industrial Statistics relative to general economic census of 1964.[546]

Despite being preferable to Industrial Statistics, general economic censuses still have incomplete data on some industries, such as agriculture, forestry and community, social and personal services.[547] The number of establishments might be underestimated insofar as small-scale services were not covered by the census.[548] However, the statistical material itself was inspected thoroughly and can be considered to be reliable.[549] General

[543] Parjanne 1992, 131, 134
[544] Leamer & Levinsohn 1995, 1378
[545] See for instance Statistical Surveys N:o 59, 67 or Forssell 1965, 110.
[546] Industrial Statistics of Finland: Volume I 1968, Table A
[547] OSF XXXV:1 Volume 3, 9–15
[548] See e.g. OSF XXXV:2 Volume 3, 19
[549] OSF XXXV:1 Volume 1, 10–12

economic censuses are comparable to company register data when it comes to establishments, if not enterprises, with the exception of wholesale trade.[550]

There are some empirical issues in the company register data beginning in the 1970s. For example, the data includes companies that were subject to sales tax, which possibly biases the series, although the number of establishments also includes those which practiced sales tax-exempt entrepreneurship.[551] There was a continuous attempt to improve the coverage of enterprise data to include not only sales taxable companies, but all units engaged in entrepreneurship, which means that the series is not systematic.[552] Although the data for 1972–1982 covers manufacturing and certain service industries almost entirely, the publication calls for caution in interpreting other industries.[553] The coverage of agriculture and forestry was still rather poor in the 1986 and 1989 publications, but services can be deemed mostly satisfactory.[554]

In 1986 a revised industrial classification, TOL1988, was adopted which creates a break, although the publication for 1986 still included figures according to old TOL1979 which was used here.[555] Although industrial classification systems are still fairly similar, the manner of classifying the main industry of multi-industrial enterprises was revised as well,[556] which solidifies the difference between the data for 1989 and the rest of the series. The most significant difference between 1982 and 1986 is an over tenfold increase in the number of establishments in forestry, from 98 to 1053 establishments, with marginal differences in the labour force of forestry – such a decentralization strikes me as highly unlikely to arise from real developments. The forestry data must be interpreted with caution, since it is not clear what causes the break in the series – the collection guidelines actually incorporate smaller enterprises in 1982 than in 1986.[557] It is possible that prior to 1986, the series only includes forestry activities of manufacturing companies as in the census of 1953.[558] There were other major discrepancies on industries across time in primary and tertiary sectors as well. As a result, most of the industries that were noted by Statistics Finland as having low coverage were removed from the regression dataset with the exception of 1986 and 1989 data.

Another source of incompatibility is that the years 1972 and 1980 include auxiliary establishments, such as storages, personnel offices or transport sections, in the total number of establishments.[559] While auxiliary establishments could have been added to the rest of the company register data, I opted not to, since the general economic censuses of 1953 and 1964 tended to incorporate these auxiliary establishments in the main establishments unless they were in different municipalities.[560] At any rate, the number of auxiliary establishments seems to have been low, so this is a minor issue.[561] Additionally, data on metal ore mining was missing for the years 1972 and 1980 and estimates were

550 Tilastotiedotus YR 1976:4, 8
551 See Tilastotiedotus YR 1982:22, 11.
552 Tilastotiedotus YR 1985:5, 4
553 See Tilastotiedotus YR 1985:5, 5.
554 OSF: Enterprises 1988:8, 10
555 OSF: Enterprises 1988:8, 6
556 OSF: Enterprises 1988:8, 8
557 OSF: Enterprises 1988:8, 9; Tilastotiedotus YR 1985:5, 5
558 See OSF XXXV:1 Volume 3.
559 Tilastotiedotus YR 1985:5, 5
560 OSF XXXV:2 Volume 1, 32; OSF XXXV:1 Volume 1, 9
561 OSF: Enterprises 1988:8, 15

calculated on the basis of Industrial Statistics and its coverage ratio of company register data concerning the year 1982.

In conclusion, incompatibility and coverage issues create statistical breaks and measurement errors in the data for scale advantage. On the other hand, the data covers a wide range of industries and was compiled by official statisticians and with evident expertise. Although the approach here is preferable to the most obvious alternative of using Industrial Statistics, and it utilizes the best data available, the results cannot be interpreted without due caution.

Product Differentiation

Although conceptually important in New Trade Theory, product differentiation is one of the hardest variables to measure for the purposes of this thesis. Parjanne notes that there are not many satisfactory proxies for it, but marketing and R&D expenditure are often used. Even they have some conceptual issues though. Marketing could be an outcome of product differentiation as well as its cause. Furthermore, there is some uncertainty whether its intensity is a fundamental requirement for only strictly non-durable consumption goods instead of investment goods, even if there have been studies where advertising has been statistically significant in the latter case.

As for R&D expenditure, even disregarding technological differentiation, it can be related to vertical or horizontal differentiation. While the latter is the key concept in NTT, it has been suggested that R&D inputs only reflect it up to a certain threshold after which R&D intensity corresponds with technological differentiation which is negatively associated with IIT. Yet the choice of measures is constricted here by the availability of data more so than conceptual appropriateness – a problem shared by R&D studies in general.[562]

R&D expenditure by industries and product groups were gathered to calculate human capital intensity, which can be used as a measure for product differentiation too. Conceptually this might mix up the interpretation of human capital and product differentiation and H–O and NTT models to some extent. Yet since this thesis is not focused on testing theories but on empirics, this is not too problematic as long as possible correlation between them is kept in mind. Since product differentiation refers more to nature of products rather than the nature of industries, R&D expenditure based on product group data is preferable here. That product group data was scaled by industry size however.

The other statistical source for research-oriented product differentiation were the SFINNO and H-INNO datasets of innovations that cover the entire post-war period.[563] Here the primary factor is the number of innovations by industry, which is a cruder measure than R&D expenditure. Also, there is a break in the series, since SFINNO data for 1985 and 1989 utilized company surveys. On the other hand, only innovations that were classified into industries in SFINNO were included in the data here – there were no innovations without classification in H-INNO. The total number of innovations was substantially larger in 1985 and 1989, which is likely partly due to the switch in data collection techniques. Since the two biases go into opposite directions, the innovation activities of the late 1980s will not be overblown, and the series is comparable supposing that some industries were systematically more likely not have innovations classified in the SFINNO. The number of innovations is focused on manufacturing though. While

[562] Parjanne 1992, 88–91
[563] See Saarinen 2005.

primary sector's products were not necessarily differentiated, the same cannot be said about services. Marketing might be a more suitable type of expenditure there.

Yet marketing expenditure is a factor that is more problematic to measure. Parjanne utilized unpublished data from Markkinatutkimus Oy for 1985,[564] but considering that this company does not exist anymore, there is no possibility for collecting data for earlier years.[565] Statistics Finland has a publication related to marketing expenditure by industries, but only for the year 1985.[566] As a result, marketing intensity cannot be studied in thesis in detail, although it can be examined for 1985 with Parjanne's disaggregated data.[567]

In conclusion, product differentiation is the most troublesome factor when it comes to measurement. R&D expenditure and number of innovation series are not without problems and are likely to disregard developments in services. At any rate, within the scope of this thesis there are no better alternatives due to lack of proper data.

Monopolistic Competition

The measure for monopolistic competition was a tricky one to construct. Empirical work on monopolistic competition tends to use share of five largest companies' sales in an industry as a proxy for its level of concentration. The rationale is that a high level of product differentiation in an industry ought to correspond with low levels of concentration, or a high number of firms in the n-5 group. However, the concentration variable – popular measure or not – does not actually reveal the number of firms in that category nor does it take into account relative market positions. And a low level of concentration can reflect perfect, not monopolistic, competition. Hjerppe criticizes this ratio as unsuitable for long-term studies, since it usually just illustrates a truism that small markets tend to be more concentrated. In other words, as the number of companies rise so too will concentration ratios decline by default.[568]

Parjanne, on the other hand, argues that concentration measures tend to be correlated with each other, and therefore the choice between measures is not too critical. She uses unpublished data of Industrial Statistics to construct a three-firm concentration ratio, but this approach was considered too time-consuming for the purposes of this thesis. Another source that was considered is the turnover data in the series "The… Largest Companies in Finland" and "Suomen Pankit ja Osakeyhtiöt", but it was deemed to be unsuitable for a concentration measure. A serious problem here is that the largest Finnish companies throughout the post-war period were multi-industrial conglomerates and using their data would clearly inflate the concentration ratio for many industries. These companies' departmental or establishment data could be gathered, but this would be too time-consuming as well.[569]

It is worth pointing out here that in a textbook model of intraindustry trade neither monopolistic competition nor concentration ratio actually cause intraindustry trade. Rather monopolistic competition, or a market with many companies with some market

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564 Parjanne 1992, 202

565 https://www.kauppalehti.fi/yritykset/yritys/markkinatutkimus+oy/01113365 (27.3.2018)

566 See Tilastotiedotus KO 1987:16.

567 Parjanne 1992, Appendix 5

568 Parjanne 1989, 92–94; Hjerppe 1979, 17. See Hjerppe 1979, 15–17 for a succinct overview of concentration measures.

569 Parjanne 1989, 92–94. Take for example, chemical industry where many forest companies also engaged in sulphite spirit production that might be classified as chemical production. Based on Industrial Statistics of 1959, sulphite spirit production only accounted for 1.2% of chemical production.

power, is a result of product differentiation. The nature of differentiated products ensures that companies in a given industry enjoy some ability to set their own prices, and that there are many companies instead of a monopoly. Thus, product differentiation should coincide empirically with low barriers of entry and many companies, and a concentration ratio of *n* companies' factor relative to total is not the obvious measure.[570]

Hjerppe herself uses number of employees as a criterion for the size of companies, and maintains that it and gross value of production or value-added tend to be highly correlated with each other. The number of employees is a superior criterion compared to the monetary ones, since it is not affected by inflation – for example the Industrial Statistics' data on different levels of value-added is not comparable over time for this reason.[571] Conversely, she does note that using the number of employees by itself is not an adequate measure, since large companies tend to be relatively more capital intensive than labour intensive, which can unduly deflate a labour-based concentration ratio.[572]

For the purposes of this thesis, an ad hoc concentration ratio was calculated on the basis of number of employees in large establishments relative to all employees in an industry. A large establishment is defined as having as much as or more than 200 employees on its payroll, which is the closest rank to Statistics Finland's definition of a company that is not a small or medium sized enterprise.[573] The measure is calculated as follows:

$$MC_j = \frac{ne_j}{Ne_j}$$

Where ne_j is number of employees in establishments employing more than 199 or 200 personnel and Ne_j is the total number of employees, both in a given industry.[574] The advantages of this measure, collected from Statistical Yearbooks of Finland, is that it is consistent over time, although the industrial classification system changes twice in 1980 and 1989. Conceptually this measure captures high barriers of entry, though the question of number of companies is less than certain. The measure should be negatively correlated with the number of companies as a low employment share of large establishments should reflect a large number of small and medium sized companies. Of course an industry could still be concentrated into five or ten large establishments, which have differentiated products, so the measure is not perfect by any means.

There are a number of possible issues with the measure. The effect of fusions, which were numerous at least in 1949–1975,[575] are only captured if they increase the number of employees in large-scale establishments relative to small or medium-sized ones. Another is that the measure is susceptible to the capital intensity bias noted by Hjerppe, which

570 See Feenstra & Taylor 2012, 170–177
571 Hjerppe 1979, 15
572 Hjerppe 1979, 15
573 https://www.stat.fi/meta/kas/pienet_ja_keski.html (4.4.2018). The major difference is that the definition used in the thesis only refers to employees and disregards turnover or gross output levels.
574 Beginning in the year 1970 the number of employees is measured as 49 or fewer due to change in the classification used by the Statistical Yearbooks. It is also uncertain if the figures include small-scale handicraft manufacturing employing less than five persons, which is not measured by Industrial Statistics. See e.g. Industrial Statistics 1956, 7–8. On the other hand, the fact that the tables explicitly give a starting point of one and refer to additional sources argues for the opposite case. See e.g. Statistical Yearbook of Finland 1961, 422.
575 Hjerppe 1979, 67

refers to large companies saving labour through capital.[576] Even in that case, the labour-ratio can be interpreted as a lower bound of the actual phenomenon. At any rate, I stress that the conceptual importance of this measure is in the number of small companies and in low barriers of entry rather than simply market power proxied by concentration ratio.

The main problem with the labour-ratio of large establishments is the implicit assumption that establishments correspond with companies. It is possible that a single company has more than one small establishment in the same industry. However, using establishment data solves the multi-industrial conglomerate problem, since these large companies' market power is proxied only by the amount of personnel they have in large-scale establishments in the industry in question.

As a result, the labour-ratio of large establishments is not a perfect measure for monopolistic competition. It does not measure market power of large companies, or the lack thereof, adequately, but it does quantify the low amount of companies and especially high barriers of entry better than the usual concentration ratio of n companies.

Eastern Trade

The motivation for Eastern Trade was to control for potential distortions of trade with communist economies in models assuming perfect competition. Note that Eastern Trade refers only to exports, not exports and imports. The level of these exports' confounding effect was measured by calculating the share of so-called Eastern group countries' exports out of total exports.[577]

$$ET_j = \frac{ecom_j}{E_j}$$

Where the denominator reflects the sum of gross exports to communist economies and the numerator total gross exports, each by a given industry. The data was collected from official foreign trade statistics gathered by Finnish Customs.[578] While the numbers can be viewed as reliable, there is only information on commodity exports. As a result, one implicitly has to assume that there were no service exports to the East. While one might object based on so-called project exports to the Soviet Union, it seems that they were classified into different commodity categories, machinery in particular, in the foreign trade data here.[579]

Official foreign trade publications classified exports and imports for the 1980s according to the industrial classification system, but not during the prior decades. Therefore, exports had to be classified into industries with data either on the product group level for 1956 and 1959 or on the product level for 1965 and 1970. The data concerning the 1950s is therefore less reliable due to being more aggregated. Furthermore, despite the correspondence between trade data, classified as Brussels Tariff Nomenclature, and industrial data, classified more or less according to the Standard Industrial Classification, being a standard issue in historical trade studies, there is no published correspondence table available. Therefore, a correspondence table had to be constructed for the purposes

[576] On the basis of eyeballing the data, this does not seem to constitute a major issue, since there are not many industries with high capital intensity and a high ratio of employees in small establishments, though the energy industry could be a case like this.
[577] The countries in question are Albania, East Germany, Bulgaria, Hungary, Poland, Romania, Czechoslovakia, Soviet Union, North Korea, China, Mongolia and North Vietnam / Vietnam. The list was determined on the basis of official foreign trade statistics. See OSF I A: 1988 Volume 2, 5.
[578] OSF I A: 1956–1989
[579] OSF I A: 1988 Volume 2, 45

of classifying exports during 1956–1970, but it is probably not identical with the one official statisticians used for classifying foreign trade in the input-output tables or in the figures published in the foreign trade statistics of the 1980s.

An additional issue with the data regarding the 1980s was that it was too aggregated. As a solution estimates following the Standard Industrial Classification (SIC) were calculated on the basis of disaggregated data following the Brussels Tariff Nomenclature (BTN) for certain industries.[580] In other cases unit price and volume indices were used to calculate current price series with the help of archived statistical data.[581] The archival material consisted of the original Board of Customs data, concerning exports across industries and countries for 1975, obtained from the National Archives of Finland.[582] While this procedure created some measurement error, the resulting series corresponded very closely with the series of exports across industries in 1980–1985 which was obtained from the archive of the Board of Customs.[583] The archival data obtained from Board of Customs lacked figures for exports across industries and countries so it was not possible to calculate measures for Eastern Trade on its basis.

In conclusion, the ratio of Eastern Trade to total exports can be viewed as reliable and as broadly comparable throughout the period. The lack of service exports is likely not to be a problem since there is no evidence that it was an important factor in Eastern Trade.

Tariff Rates and Customs Barriers

The level of protectionism by industries was calculated through the same official foreign trade statistics publications as in Eastern Trade. Since the tables for 1956–1980 use the same BTN classification system as product group data used in Eastern Trade, the same correspondence table was used to classify tariffs into industrial classification.

However, the problem with the published statistics of tariff rates is that only the most important tariffs are listed. The discrepancy between the sum of showcased data and total tariffs is not great, but I have scaled up the calculated series to match the total tariff level.[584] Here I assume that the sectoral differences in the samples in official foreign trade publications reflect the actual differences in tariff levels industry-wise.

The published data for 1982–1989 switched to using HS classification, which is similar to BTN in many respects. However, since the product group data was too aggregated to reclassify the figures according to industrial classification, weights based on 1980 data were used to disaggregate the data for the latter years.

However, nominal tariff rates do not account for the effects tariffs have on input prices. Using effective rate of protection arises from the need to quantify how tariffs alter the production costs of the industrial value-chain. Kauppila defines effective rate of protection as “the percentage addition made possible by the existence of the tariff to the

[580] To be exact foodstuff and beverage and tobacco industries and metal ore mining and other mining industries. Certain instruments were reclassified into electrotechnical goods.
[581] These industries included oil industry, rubber and plastic industries, other machinery and chipboard production.
[582] National Archives of Finland: Tullihallitus, Kcaa Vientitilastot kategorioittain, 1974-1978, Kcaa:4, Viennin kategoriat maittain I-XII 1975
[583] E.g. Archives of the Board of Customs: Tullihallitus, Vienti toimialoittain, Vienti tammi - joulukuu 1980.
[584] For example, in 1959 the sum of disaggregated customs duties covered 81% of all customs duties collected, but in 1956 the same ratio was 89%. See OSF I A: 1959, Appendix 5 and See OSF I A: 1956, Appendix 5.

value-added of the domestic industry, with prices at free-trade levels".[585] It reflects the immediate increase in domestic prices and imported inputs due to tariff policy. It follows that a higher degree of value-added, or a lower degree of input use, makes an industry more resistant to increases in tariff rates. A higher nominal tariff rate increases an industry's output price and value-added by the same amount, but a tariff-driven increase in input prices makes production costlier. Since value-added can in simple terms be defined as the difference between output and inputs, costlier inputs reflect lower value-added and lower effective rate of protection.[586]

$$\frac{t_j - \sum_i a_{ij} t_i}{1 - \sum_i a_{ij}}$$

In order to compare his interwar tariff rates with post-war rates, I follow Kauppila's approach who calculates the standard measure for effective rate of protection:[587] Where t_j is the nominal tariff rate, measured by the value of collected duties relative to the value of imports in a given industry,[588] j is the final product industry and t_i is likewise the nominal tariff rate for any input industry of industry j. The input coefficients for that industry are reflected by a_{ij}, though it should be noted that these include both domestic and imported inputs rather than only domestic ones as in rest of this thesis. Kauppila modifies this standard equation by weighting the nominal tariff rates by proportion of domestic sales by industry to correct the unchanging export prices, which is done here as well by taking the proportion of gross exports of total gross output and subtracting it from one.[589]

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585 Kauppila 2007, 66
586 Kauppila 2007, 66–67
587 Kauppila 2007, 66–67. See Kitson, Solomou & Weale 1991 for another approach.
588 Kauppila 2007, 138
589 Kauppila 2007, 66–67

7. Appendices: Statistical Tables

Table A 1. Domestic Value-added of Exports in Finland 1956–1989, in Constant Prices

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	12.1	49.5	139.8	175.5	223.9	253.6	511.0	271.1
2. FOR	225.0	221.4	55.2	60.1	61.2	26.2	54.6	29.1
3. FIS	0.0	0.4	0.2	1.3	2.9	4.5	19.7	12.1
4. ORE	26.9	34.7	64.2	39.9	19.4	25.7	21.4	30.6
5. OMI	1.9	1.0	3.8	10.2	30.3	35.3	39.8	48.3
6. FOO	113.5	259.2	367.9	443.1	441.0	492.4	619.5	583.8
7. BEV	0.0	0.8	7.4	21.8	61.4	51.2	57.0	60.2
8. TEX	4.8	17.4	88.8	308.2	657.6	650.1	603.7	424.6
9. LEA	0.9	0.6	8.3	40.2	142.3	149.8	161.5	89.8
10. WOF	635.7	738.6	852.9	1 100.1	1 957.8	1 354.5	1 214.4	1 257.0
a. Woo	*625.7*	*743.4*	*838.1*	*1 062.8*	*1 834.0*	*1 221.1*	*1 113.2*	*1 180.4*
b. Fur	*20.0*	*4.9*	*21.2*	*51.2*	*141.8*	*140.9*	*106.1*	*80.6*
11. PAP	1 183.5	1 362.3	2 117.5	2 668.4	3 499.3	3 460.8	4 219.9	5 291.8
12. PRI	1.8	2.1	7.9	37.5	167.1	154.9	171.0	205.0
13. CHE	21.5	31.1	71.5	135.1	505.8	514.9	716.1	954.9
14. OIL	0.0	0.1	0.7	14.0	105.8	95.3	117.2	78.9
15. RUB	0.6	1.9	14.6	45.7	125.6	110.0	147.1	176.0
16. MIN	7.8	15.5	29.0	43.8	168.1	201.4	144.7	268.2
17. MET	15.2	42.9	151.4	300.2	634.4	568.4	761.8	1 127.5
18. MFM	76.4	161.3	218.0	488.6	1 265.4	1 746.2	1 954.9	2 322.0
a. Fab	*13.0*	*13.9*	*37.8*	*128.3*	.	.	.	.
b. Mac	*64.1*	*148.2*	*181.7*	*365.4*	.	.	.	.
19. ELE	19.3	28.7	65.3	146.2	517.4	609.5	779.9	1 199.4
20. TRE	163.6	174.4	193.4	396.2	572.6	1 051.4	1 210.2	1 163.1
21. OTH	1.9	2.8	22.2	42.8	71.1	70.0	92.0	63.2
22. EGW	0.0	1.0	1.2	31.5	35.1	34.5	22.8	5.3
23. BUI	0.0	0.0	0.0	1.0	1.5	1.3	2.0	0.0
24. OCO	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0
25. TRD	10.7	9.5	96.1	140.4	274.5	302.7	397.5	232.7
26. TRC	427.6	364.4	672.9	891.2	1 185.7	1 193.1	1 226.4	1 661.0
27. FIN	39.2	23.4	23.4	37.3	145.8	140.5	-48.2	133.5
28. DWE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29. BUS	0.0	0.0	0.0	55.9	409.4	619.2	573.8	568.6
30. CSR	2.4	26.5	57.6	8.8	79.8	82.1	118.4	124.2
Total	2 992.4	3 571.4	5 347.1	7 685.1	13 362.0	13 999.4	15 910.1	18 381.7

Notes: In millions of 2017 euros, deflated with Statistics Finland's export price index. Note that the sub-industries 10a., 10b., 18a. and 18b. do not sum up to their parent industry because the share of value-added changes when combining industries in input-output calculations. The aggregation bias is rather small generally speaking though. The sum of all industries' value-added does not completely match the total due to rounding errors. "." refers to a missing value.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Airikkala et al. 1976.

Table A 2. Direct Working Hour Requirements in 1956–1989, in 1 000 hours

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	179.8	208.6	167.0	127.5	85.9	78.3	73.3	60.5
2. FOR	147.6	139.7	72.2	48.7	26.0	28.6	25.6	19.4
3. FIS	103.9	77.8	103.9	105.6	38.8	37.8	78.0	69.7
4. ORE	64.8	38.6	25.1	15.6	17.8	25.3	19.3	7.1
5. OMI	58.3	57.0	36.0	23.9	29.3	18.2	15.4	10.6
6. FOO	16.3	15.9	14.0	11.3	9.5	9.0	8.4	7.4
7. BEV	33.5	31.9	25.4	17.8	13.3	12.6	10.2	7.8
8. TEX	58.9	63.6	63.5	40.2	32.1	31.2	28.2	24.6
9. LEA	60.7	60.9	70.3	47.0	26.1	29.1	26.3	23.6
10. WOF	53.0	52.9	43.8	32.7	19.4	22.1	19.2	13.6
11. PAP	19.4	20.1	15.5	11.7	7.8	7.9	6.5	5.7
12. PRI	57.4	52.6	42.1	33.4	19.6	18.9	16.7	13.3
13. CHE	22.4	19.4	18.7	15.3	7.7	10.5	9.1	7.7
14. OIL	18.9	11.3	6.4	2.9	1.3	1.4	1.4	2.3
15. RUB	50.1	52.4	40.6	38.1	29.6	22.9	20.6	15.0
16. MIN	53.8	58.2	41.3	33.0	19.8	18.5	18.3	12.9
17. MET	20.1	15.2	14.7	8.2	7.2	7.9	6.8	4.8
18. MFM	67.9	63.1	47.1	33.0	24.2	22.1	19.5	14.2
19. ELE	62.6	57.3	44.8	34.2	23.3	23.2	19.8	13.9
20. TRE	48.0	39.4	30.4	30.2	22.3	20.1	18.5	13.5
21. OTH	136.2	108.1	63.4	30.2	28.6	28.4	25.6	20.6
22. EGW	17.4	23.9	16.4	12.6	6.4	5.9	5.5	5.8
23. BUI	77.2	81.0	63.9	39.9	26.1	25.0	23.4	17.6
24. OCO	75.8	75.8	48.8	36.7	28.9	28.6	25.0	20.0
25. TRD	128.7	134.9	126.7	62.8	41.8	40.0	37.0	28.7
26. TRC	61.2	57.5	43.4	42.6	27.0	26.4	25.4	20.8
27. FIN	52.7	68.0	45.1	42.9	22.7	22.7	19.0	14.7
28. DWE	18.6	11.3	6.5	4.2	5.0	4.6	4.0	3.3
29. BUS	148.7	99.7	73.5	22.4	25.1	19.4	16.6	12.4
30. CSR	406.2	266.7	156.7	49.5	40.5	37.1	31.0	23.7

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for labour.

Table A 3. Total Working Hour Requirements in 1956–1989, in 1 000 hours

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	314.4	329.2	254.8	190.3	112.2	103.3	94.7	78.1
2. FOR	169.2	161.0	82.2	54.6	28.4	31.5	27.8	21.1
3. FIS	108.1	80.5	118.5	114.3	45.1	44.1	84.9	75.6
4. ORE	106.4	55.9	41.7	22.5	24.7	34.6	26.4	13.3
5. OMI	80.7	78.1	62.4	37.9	42.3	31.2	27.7	20.2
6. FOO	199.6	185.8	168.3	126.4	84.2	75.8	74.6	60.5
7. BEV	96.2	74.5	57.9	50.1	38.3	35.7	29.1	23.2
8. TEX	91.8	93.1	91.6	61.4	44.4	42.4	39.5	34.6
9. LEA	116.2	117.3	112.2	73.5	41.0	43.9	46.4	37.0
10. WOF	149.7	137.8	94.1	64.1	38.1	43.5	38.7	27.1
11. PAP	96.4	89.3	64.8	39.4	26.1	27.5	23.5	18.3
12. PRI	112.0	95.9	71.1	53.3	38.4	37.9	33.3	26.5
13. CHE	53.3	56.2	42.7	30.0	19.1	21.9	19.6	16.7
14. OIL	49.8	30.1	15.3	6.4	2.8	2.6	3.1	6.9
15. RUB	71.6	69.7	52.6	45.4	38.5	31.7	29.9	23.0
16. MIN	92.8	91.0	69.1	51.7	33.8	31.7	30.8	22.3
17. MET	69.7	56.2	51.6	27.7	22.4	25.1	21.4	13.6
18. MFM	96.4	83.3	65.5	45.2	37.1	34.3	30.6	22.5
19. ELE	98.5	81.5	61.1	48.8	32.8	31.4	27.6	20.9
20. TRE	78.7	56.9	48.7	45.4	35.3	32.4	29.0	22.2
21. OTH	163.4	132.6	87.6	41.4	38.0	37.8	34.2	29.5
22. EGW	61.9	48.9	41.3	26.0	18.6	17.5	16.5	16.4
23. BUI	126.7	126.4	100.3	66.2	44.8	41.8	38.5	27.7
24. OCO	126.1	112.2	81.0	58.8	44.6	43.8	37.7	29.6
25. TRD	151.6	146.1	140.5	76.7	55.2	51.3	46.6	36.2
26. TRC	86.1	78.5	61.8	57.2	39.2	38.5	35.0	29.4
27. FIN	63.8	85.2	61.0	58.9	32.7	32.5	28.2	22.0
28. DWE	51.4	42.2	28.5	16.1	13.5	12.0	11.6	10.0
29. BUS	170.6	144.9	108.6	40.5	40.2	32.6	28.0	20.3
30. CSR	424.9	275.5	177.6	77.8	59.4	52.7	44.3	34.1

Source: The author's own estimates, Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for labour.

Table A 4. Direct Net Capital Stock Requirement in 1956–1989, in 1 000 Euros

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	1 318.9	1 568.5	1 525.6	1 322.6	2 054.4	1 925.7	1 997.0	2 017.1
2. FOR	696.7	1 140.4	827.5	1 016.7	1 524.1	1 757.4	1 718.9	1 612.5
3. FIS	360.4	354.2	451.6	932.3	605.6	586.8	568.3	530.7
4. ORE	2 007.4	1 807.4	1 115.8	934.7	1 750.7	1 904.7	1 558.5	1 182.7
5. OMI	1 465.5	1 424.2	856.4	758.2	1 305.9	1 386.1	1 473.8	1 336.0
6. FOO	270.7	302.9	316.9	285.4	375.8	385.7	401.5	427.7
7. BEV	691.2	771.1	777.4	835.2	417.6	445.3	419.1	470.1
8. TEX	269.2	388.4	445.2	341.8	350.0	408.2	418.5	492.3
9. LEA	184.5	236.2	314.5	226.4	350.0	400.1	375.8	578.9
10. WOF	389.3	417.0	380.7	416.0	489.8	679.7	668.9	517.2
11. PAP	726.9	901.0	1 050.3	797.8	722.7	860.4	797.9	965.2
12. PRI	286.9	289.4	312.1	308.8	315.9	339.8	407.8	409.4
13. CHE	783.3	871.2	857.7	897.4	598.8	705.5	667.1	712.9
14. OIL	694.8	1 395.5	1 669.6	855.6	298.3	330.0	321.2	656.3
15. RUB	343.7	453.4	499.4	554.1	800.8	879.2	949.6	899.2
16. MIN	678.9	788.6	733.3	830.3	710.8	732.5	840.4	748.2
17. MET	573.1	499.1	636.1	562.1	638.3	740.2	643.6	577.6
18. MFM	541.3	593.2	441.9	414.0	432.5	431.5	440.4	390.9
19. ELE	285.8	284.0	325.8	324.0	433.7	487.1	483.5	403.0
20. TRE	724.2	693.8	492.4	571.9	667.1	585.4	655.5	622.0
21. OTH	747.1	601.3	441.5	548.7	368.7	413.0	442.8	561.8
22. EGW	2 769.9	5 695.6	4 116.5	3 653.1	2 384.4	2 284.3	2 251.2	2 723.7
23. BUI	83.3	104.7	75.3	76.4	99.7	107.7	123.4	93.3
24. OCO	292.3	238.6	275.1	301.2	353.1	362.1	343.0	319.1
25. TRD	1 349.8	1 761.0	1 651.9	1 123.9	1 069.0	1 088.4	1 145.6	1 136.2
26. TRC	1 325.5	1 586.9	1 389.6	1 817.0	1 695.2	1 752.2	1 693.9	1 430.0
27. FIN	1 653.5	2 035.3	1 410.2	1 409.3	962.5	985.0	833.0	597.9
28. DWE	15 694.4	11 114.7	10 659.7	8 815.0	16 586.6	16 725.0	16 828.0	18 002.6
29. BUS	4 068.8	2 857.4	4 141.1	1 918.7	1 906.1	1 505.3	1 335.4	1 638.4
30. CSR	3 701.9	2 693.7	1 766.8	636.4	963.0	931.2	840.5	683.0

Notes: In constant 2017 euros deflated by wholesale price index of engineering goods, including electrotechnical goods, for machinery and construction cost index for buildings and other capital. The net capital stock requirements reflect the amount of capital required to produce one million 2017 euros worth of production.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for physical capital.

Table A 5. Total Net Capital Stock Requirement in 1956–1989, in 1 000 Euros

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	2 559.0	2 757.4	2 592.8	2 259.9	2 971.0	2 855.5	2 863.4	2 903.2
2. FOR	876.9	1 374.4	955.8	1 132.6	1 604.1	1 869.0	1 812.7	1 699.7
3. FIS	422.5	411.4	685.2	1 825.6	815.4	810.1	818.7	812.1
4. ORE	3 144.5	2 524.7	1 731.3	1 378.5	2 385.8	2 749.8	2 182.5	1 820.3
5. OMI	2 012.4	2 108.5	1 723.8	1 541.2	2 112.7	2 301.1	2 379.6	2 225.1
6. FOO	1 953.3	1 965.3	2 121.3	1 866.1	2 612.2	2 517.7	2 703.6	2 751.8
7. BEV	1 707.9	1 542.4	1 542.2	1 560.9	1 413.8	1 426.5	1 266.6	1 309.0
8. TEX	617.3	809.2	891.4	711.4	719.7	785.4	819.8	986.5
9. LEA	716.1	834.9	879.4	650.5	831.0	929.7	1 016.0	1 222.5
10. WOF	1 219.9	1 467.2	1 234.2	1 212.4	1 518.5	1 927.3	1 901.0	1 542.9
11. PAP	2 264.6	2 806.8	2 717.0	2 033.7	2 191.3	2 620.5	2 434.9	2 362.3
12. PRI	1 150.0	1 202.9	1 065.1	956.6	1 239.2	1 392.4	1 432.9	1 416.1
13. CHE	1 506.9	1 839.9	1 714.6	1 629.7	1 416.8	1 578.1	1 490.9	1 499.8
14. OIL	1 414.0	2 014.9	2 015.9	1 014.3	402.0	418.7	446.9	1 048.2
15. RUB	732.2	929.7	883.7	848.9	1 339.1	1 434.5	1 588.8	1 552.1
16. MIN	1 534.1	1 714.8	1 646.7	1 605.1	1 503.7	1 564.8	1 679.0	1 505.5
17. MET	1 975.3	2 103.2	2 103.5	1 705.3	1 800.9	2 118.7	1 865.9	1 484.4
18. MFM	1 110.7	1 152.8	982.7	868.0	1 081.9	1 090.4	1 078.3	972.4
19. ELE	977.7	920.6	809.7	750.6	907.2	924.7	913.0	887.6
20. TRE	1 200.9	1 112.5	964.0	1 058.6	1 276.4	1 190.1	1 204.3	1 158.1
21. OTH	1 238.0	1 215.4	1 001.7	925.1	833.0	917.5	939.4	1 132.8
22. EGW	4 923.8	6 869.1	6 385.2	5 272.3	4 404.6	4 188.8	4 092.2	4 922.1
23. BUI	862.8	914.1	850.4	732.8	877.3	887.9	901.1	744.0
24. OCO	1 129.1	1 000.9	1 096.0	1 016.5	1 071.8	1 134.1	1 075.3	987.8
25. TRD	1 846.7	2 253.6	2 059.9	1 722.9	1 794.5	1 779.7	1 795.8	1 774.1
26. TRC	1 696.7	2 012.9	1 829.1	2 214.2	2 171.5	2 452.4	2 423.4	2 377.4
27. FIN	1 907.0	2 500.8	1 880.1	1 955.1	1 448.0	1 487.8	1 349.5	1 109.4
28. DWE	16 227.9	12 026.8	11 577.5	9 223.4	17 087.0	17 207.4	17 369.5	18 513.0
29. BUS	5 458.7	4 162.2	4 717.8	2 411.1	2 531.1	2 171.8	2 055.0	2 263.3
30. CSR	4 788.9	3 342.5	2 207.9	1 275.6	1 670.3	1 598.7	1 502.4	1 361.4

Notes: In constant 2017 euros deflated by wholesale price index of engineering goods, including electrotechnical goods, for machinery and construction cost index for buildings and other capital. The net capital stock requirements reflect the amount of capital required to produce one million 2017 euros worth of production.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for physical capital.

Table A 6. Direct Total Net Machinery and Transport Equipment Stock Requirement in 1956–1989, in 1 000 Euros

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	207.8	234.6	311.1	302.2	559.9	543.3	548.1	529.5
2. FOR	93.8	145.5	83.0	91.2	107.8	126.8	116.3	129.6
3. FIS	360.4	354.2	451.6	932.3	605.6	586.8	568.3	530.7
4. ORE	993.2	921.7	550.7	435.9	857.3	1 030.2	785.3	747.0
5. OMI	742.8	735.1	497.5	435.3	512.3	492.4	621.9	476.2
6. FOO	103.5	112.6	129.8	128.7	121.9	130.2	139.3	161.6
7. BEV	322.4	378.9	414.8	422.8	440.7	442.3	420.9	416.4
8. TEX	125.5	190.9	226.9	179.6	163.9	192.5	198.9	255.9
9. LEA	60.7	71.4	110.0	95.3	63.9	82.5	84.8	141.8
10. WOF	210.3	226.6	178.8	183.8	216.6	287.4	256.5	185.9
11. PAP	364.0	460.6	650.1	491.5	432.8	527.0	495.0	642.1
12. PRI	161.4	175.5	174.7	169.7	177.5	187.1	222.3	259.3
13. CHE	411.3	488.6	443.2	498.7	279.1	322.7	299.7	334.7
14. OIL	47.4	155.1	489.5	310.3	109.1	122.6	125.0	286.5
15. RUB	115.1	148.8	248.8	296.0	394.9	440.9	492.2	518.6
16. MIN	283.2	324.9	358.5	424.8	331.2	344.5	404.6	377.3
17. MET	371.0	345.0	373.8	320.1	349.0	398.8	345.2	334.7
18. MFM	200.4	213.7	178.5	188.0	167.5	164.9	168.0	158.9
19. ELE	97.1	103.7	142.4	160.9	163.2	193.5	202.1	188.4
20. TRE	154.8	144.1	103.0	145.7	162.5	135.1	156.5	141.7
21. OTH	1 087.4	863.5	723.0	821.5	757.8	816.8	771.7	818.3
22. EGW	532.4	932.2	886.9	824.1	701.4	654.0	636.6	804.6
23. BUI	67.9	79.2	59.5	48.7	39.4	40.1	46.9	39.7
24. OCO	176.6	166.3	205.7	222.1	201.4	203.6	187.4	191.8
25. TRD	394.1	492.0	443.0	300.7	272.9	285.8	322.0	387.7
26. TRC	764.6	891.4	700.0	881.1	695.0	705.6	634.4	521.8
27. FIN	105.3	122.4	95.6	125.1	102.5	110.8	122.3	156.6
28. DWE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29. BUS	569.7	379.3	265.4	112.9	102.5	92.2	110.4	165.0
30. CSR	333.2	229.3	167.6	73.0	144.5	127.1	111.3	109.0

Notes: In constant 2017 euros deflated by wholesale price index of engineering goods, including electrotechnical goods. The net machine stock requirements reflect the amount of capital related to transport equipment and machinery required to produce one million 2017 euros worth of production.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for capital.

Table A 7. Total Net Machinery and Transport Equipment Stock Requirement in 1956–1989, in 1 000 Euros

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	469.5	490.7	585.1	571.1	832.3	830.0	808.7	800.8
2. FOR	131.2	186.9	115.1	123.9	129.4	157.9	142.3	154.2
3. FIS	381.3	369.7	523.2	1 150.3	671.8	660.7	649.2	617.1
4. ORE	1 387.6	1 133.5	730.0	570.3	1 037.0	1 270.5	954.9	919.6
5. OMI	924.3	961.4	803.6	683.7	745.2	757.0	880.5	724.1
6. FOO	467.5	474.7	586.8	572.9	773.2	771.9	812.8	838.8
7. BEV	641.8	612.8	642.8	666.6	767.6	778.1	703.2	681.5
8. TEX	257.2	334.7	386.2	326.9	288.9	323.3	337.3	423.5
9. LEA	232.0	241.9	278.6	243.7	215.5	254.6	282.4	343.0
10. WOF	412.9	461.1	389.1	361.8	427.9	554.1	506.1	402.2
11. PAP	796.6	973.3	1 217.3	904.6	909.9	1 091.2	1 010.1	1 090.7
12. PRI	459.1	509.2	489.4	435.5	495.5	559.0	576.7	602.9
13. CHE	661.0	771.9	728.6	783.4	562.1	621.0	574.3	596.3
14. OIL	326.5	359.5	589.9	360.0	137.2	150.0	160.5	394.8
15. RUB	234.5	284.4	369.0	393.2	578.7	628.2	699.1	730.8
16. MIN	611.6	648.5	687.9	731.4	608.3	632.5	684.8	618.3
17. MET	1 028.7	1 118.6	1 030.4	847.0	834.2	969.4	833.8	712.3
18. MFM	433.9	428.6	384.5	367.7	400.7	404.2	388.4	358.7
19. ELE	391.3	376.4	331.4	333.7	314.5	338.4	340.7	340.5
20. TRE	338.7	276.6	265.2	329.1	365.9	342.8	332.7	315.1
21. OTH	1 303.6	1 111.1	976.1	967.4	928.9	1 013.4	940.4	1 037.3
22. EGW	990.3	1 197.4	1 451.4	1 235.6	1 310.1	1 224.9	1 161.0	1 453.7
23. BUI	332.7	363.2	307.8	289.5	292.2	293.3	288.5	237.7
24. OCO	495.8	498.6	542.3	504.2	447.9	462.3	420.0	392.7
25. TRD	538.2	565.1	525.3	466.8	468.5	475.3	488.4	536.5
26. TRC	886.3	1 020.1	823.9	1 008.9	830.1	842.5	761.4	655.2
27. FIN	170.1	255.7	237.9	274.4	225.5	242.0	247.8	275.1
28. DWE	114.9	176.9	242.4	102.3	142.7	135.4	149.0	142.8
29. BUS	667.0	616.9	516.0	263.4	286.0	292.6	300.5	323.0
30. CSR	426.6	274.9	296.6	254.9	340.6	309.8	277.6	269.3

Notes: In constant 2017 euros deflated by wholesale price index of engineering goods, including electrotechnical goods. The net machine stock requirements reflect the amount of capital related to transport equipment and machinery required to produce one million 2017 euros worth of production.

Source: The author's own estimates; Statistics Finland; Input-Output Tables 1956–1989; Tiainen 1994; see the appendices for capital.

Table A 8. Direct R&D Expenditure Requirements in 1970–1989, in 1 000 Euros

	1970	**1980**	**1982**	**1985**	**1989**
1. AGR	0.0	0.0	0.0	0.2	0.3
2. FOR	0.0	0.1	0.0	0.4	0.5
3. FIS	-	-	-	-	-
4. ORE	0.3	0.2	2.4	10.8	2.8
5. OMI	0.2	0.1	1.2	6.8	3.9
6. FOO	1.1	1.5	1.8	3.1	4.9
7. BEV	2.2	3.1	3.8	5.6	7.4
8. TEX	0.6	1.3	1.6	1.7	4.1
9. LEA	1.0	1.0	1.1	1.1	0.8
10. WOF	1.6	1.2	1.5	2.3	4.6
11. PAP	4.7	2.6	3.0	4.8	5.3
12. PRI	0.3	0.3	0.3	0.4	0.3
13. CHE	17.0	10.1	13.3	21.4	35.0
14. OIL	9.9	1.8	3.2	8.9	25.4
15. RUB	7.0	34.3	39.7	22.0	18.9
16. MIN	2.6	6.7	8.5	14.4	14.3
17. MET	9.4	6.3	7.3	7.9	4.4
18. MFM	9.5	13.8	15.0	23.8	17.2
19. ELE	39.2	39.3	48.1	52.0	83.5
20. TRE	2.1	7.5	7.8	17.4	13.0
21. OTH	1.2	2.2	2.8	6.7	15.3
22. EGW	1.3	1.0	1.7	3.3	8.3
23. BUI	0.1	0.3	0.6	0.7	0.6
24. OCO	-	-	-	-	-
25. TRD	0.3	0.5	0.7	1.1	0.4
26. TRC	0.9	0.9	0.9	1.5	1.5
27. FIN	0.7	0.7	0.8	0.9	0.5
28. DWE	-	-	-	-	-
29. BUS	3.0	6.3	3.9	3.4	9.1
30. CSR	5.3	4.9	4.1	6.2	5.9

Notes: “-” refers to a zero value. “0.0” are very small amounts of R&D expenditure. In constant 2017 euros deflated by Statistics Finland’s Wholesale Price Index. The R&D expenditure requirements reflect the amount of R&D expenditure required to produce one million 2017 euros worth of production.

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1970–1989; see the appendices for human capital.

Table A 9. Total R&D Expenditure Requirements in 1970–1989, in 1 000 Euros

	1970	1980	1982	1985	1989
1. AGR	2.5	2.6	3.4	4.9	6.9
2. FOR	0.4	0.3	0.4	1.1	1.2
3. FIS	1.1	0.9	1.1	1.5	1.8
4. ORE	1.8	1.5	4.4	13.2	6.7
5. OMI	2.7	3.7	5.2	12.2	11.2
6. FOO	3.6	5.2	6.1	9.6	14.5
7. BEV	4.6	6.3	7.2	9.8	12.6
8. TEX	2.0	2.8	3.3	4.1	8.4
9. LEA	2.7	3.4	4.3	4.2	5.1
10. WOF	3.3	3.3	4.4	6.7	9.5
11. PAP	8.4	6.3	7.5	11.7	13.3
12. PRI	2.6	3.3	3.6	5.2	6.4
13. CHE	22.2	14.2	18.3	28.7	45.0
14. OIL	10.5	2.2	3.6	9.7	29.1
15. RUB	8.2	37.9	43.6	28.2	27.8
16. MIN	5.7	10.2	12.7	20.7	21.1
17. MET	20.1	13.0	15.8	18.5	12.0
18. MFM	13.7	19.7	21.4	32.9	25.7
19. ELE	45.1	44.7	53.6	59.7	94.3
20. TRE	7.0	13.3	14.2	26.1	22.6
21. OTH	3.7	4.7	5.9	10.9	22.1
22. EGW	3.7	3.4	4.6	8.3	17.8
23. BUI	4.0	5.9	6.4	8.1	8.2
24. OCO	5.2	5.7	6.4	7.2	8.0
25. TRD	1.4	2.3	2.3	3.1	3.2
26. TRC	2.2	2.5	3.0	4.7	5.5
27. FIN	1.7	2.3	2.2	2.9	3.4
28. DWE	0.9	1.2	1.3	2.2	2.9
29. BUS	4.6	8.1	5.7	6.1	12.5
30. CSR	6.8	6.9	6.2	9.0	9.8

Notes: "-" refers to a zero value. "0.0" are very small amounts of R&D expenditure. In constant 2017 euros deflated by Statistics Finland's Wholesale Price Index. The R&D expenditure requirements reflect the amount of R&D expenditure required to produce one million 2017 euros worth of production. Total requirements could be biased by untrustworthiness of data on primary and tertiary sectors.

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1970–1989; see the appendices for human capital.

Table A 10. Average Wage Rates in 1956–1989, in Euros per Hour

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	4.3	3.2	3.4	6.3	6.1	6.9	6.8	7.9
2. FOR	5.1	4.7	6.1	7.9	11.2	11.6	11.8	13.2
3. FIS	0.0	0.0	4.6	6.1	12.7	13.8	11.8	11.5
4. ORE	6.6	7.3	9.3	11.8	16.5	17.4	18.5	21.6
5. OMI	5.3	5.5	6.2	9.4	11.9	12.6	14.3	15.7
6. FOO	4.8	4.8	6.0	7.6	11.5	12.1	13.2	15.6
7. BEV	5.7	5.6	7.8	10.3	14.1	15.1	16.6	19.1
8. TEX	4.7	4.6	5.4	6.6	9.2	10.1	11.0	12.5
9. LEA	5.0	5.0	5.4	6.7	9.2	10.1	10.7	12.4
10. WOF	5.2	4.9	5.9	7.1	10.9	11.5	12.4	14.4
11. PAP	6.1	6.2	8.0	9.7	15.8	16.7	18.3	20.8
12. PRI	6.2	6.4	7.3	9.9	14.2	15.3	17.4	19.9
13. CHE	6.9	8.3	7.9	10.2	13.9	14.4	16.6	18.7
14. OIL	7.8	7.6	11.4	15.1	15.8	16.1	18.1	22.6
15. RUB	5.7	5.9	6.0	6.3	11.9	12.7	13.7	16.1
16. MIN	6.1	6.0	7.1	9.3	12.3	12.6	14.0	16.2
17. MET	6.0	5.9	7.8	10.3	14.4	15.2	16.5	18.5
18. MFM	6.1	6.1	7.6	9.6	13.0	13.7	15.1	17.4
19. ELE	5.1	5.1	7.1	9.3	12.6	13.5	14.7	16.8
20. TRE	8.8	8.8	7.9	10.4	13.6	14.1	15.6	17.0
21. OTH	3.9	4.0	8.3	8.0	11.5	11.7	12.7	15.0
22. EGW	6.3	6.4	8.6	11.3	14.8	15.1	17.1	19.2
23. BUI	5.6	5.6	8.3	8.9	13.9	14.2	16.3	19.6
24. OCO	6.0	5.9	7.0	9.0	13.2	13.3	14.1	15.9
25. TRD	4.7	4.6	6.5	7.6	11.3	11.6	12.4	14.8
26. TRC	5.8	5.7	7.6	10.2	12.7	13.1	14.4	16.4
27. FIN	6.3	6.2	10.6	11.7	15.9	15.4	17.0	19.2
28. DWE	2.3	2.4	6.8	3.2	9.3	9.0	9.4	10.4
29. BUS	7.6	7.8	7.4	10.0	14.9	15.1	16.3	19.0
30. CSR	4.3	4.2	5.5	6.5	10.6	11.2	12.3	14.1

Notes: In constant 2017 euros deflated with Statistics Finland’s Cost-of-Living index.

Source: The author's own estimates; Statistics Finland; Tiainen 1994; see the appendices for human capital.

Table A 11. The Share of Office Workers in Total Workforce 1956–1989, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	.	.	.	.	.	.	.	.
2. FOR	.	.	.	.	.	.	.	.
3. FIS	.	.	.	.	.	.	.	.
4. ORE	16.9	20.5	24.0	27.7	30.8	29.5	31.7	31.6
5. OMI	10.1	12.5	12.2	15.4	19.5	24.2	28.3	29.4
6. FOO	15.4	16.2	17.8	18.8	23.9	25.0	25.9	25.0
7. BEV	17.0	18.9	21.5	24.0	31.4	32.8	35.1	34.2
8. TEX	9.6	11.7	14.3	14.2	16.3	17.0	17.2	19.2
9. LEA	9.8	10.1	13.4	12.8	14.1	13.9	13.3	15.3
10. WOF	10.8	10.7	11.7	12.3	15.7	17.6	19.2	23.5
11. PAP	14.8	15.7	17.2	19.6	23.5	23.5	24.1	26.2
12. PRI	25.6	25.5	29.2	33.2	35.0	35.8	37.1	38.0
13. CHE	23.6	26.8	28.6	32.3	37.6	39.8	42.1	47.0
14. OIL	20.9	23.4	41.3	46.6	46.0	44.4	50.8	59.1
15. RUB	15.5	17.4	20.0	19.2	20.8	23.6	22.5	25.4
16. MIN	17.2	18.5	18.1	19.9	22.8	23.1	24.5	24.1
17. MET	16.1	17.7	18.8	22.2	24.7	27.5	28.4	28.6
18. MFM	16.8	18.7	21.0	23.2	27.6	28.5	31.1	31.8
19. ELE	21.5	23.1	24.2	24.6	31.9	35.0	38.5	43.1
20. TRE	15.5	17.4	19.8	22.7	26.0	25.4	27.2	28.0
21. OTH	15.7	18.9	18.2	21.3	20.0	20.1	19.8	24.4
22. EGW	24.5	25.9	27.2	31.3	40.0	39.8	41.4	43.3
23. BUI	.	.	.	.	.	.	.	.
24. OCO	.	.	.	.	.	.	.	.
25. TRD	.	.	.	.	.	.	.	.
26. TRC	.	.	.	.	.	.	.	.
27. FIN	.	.	.	.	.	.	.	.
28. DWE	.	.	.	.	.	.	.	.
29. BUS	.	.	.	.	.	.	.	.
30. CSR	.	.	.	.	.	.	.	.

Notes: "." refers to a missing value. The share of office workers also includes owners working in establishments.

Source: The author's own estimates; Industrial Statistics; see the appendices for human capital.

Table A 12. The Share of Value-added originating from the Primary Sector in Domestic Value-added of Exports in 1956–1989, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	81.5	83.0	81.5	78.2	74.2	72.4	76.3	72.3
2. FOR	97.6	96.5	97.6	96.1	97.3	96.1	96.3	96.1
3. FIS	-	97.7	87.0	84.0	91.5	90.7	89.6	87.0
4. ORE	61.7	84.0	81.4	87.2	79.7	67.8	75.3	77.4
5. OMI	79.1	80.7	67.3	77.1	69.1	65.4	61.8	63.3
6. FOO	52.1	45.6	51.8	50.4	51.1	48.2	54.1	45.7
7. BEV	-	8.0	7.2	10.6	10.8	10.5	10.4	9.2
8. TEX	2.0	1.3	1.8	1.1	1.0	0.9	1.1	1.1
9. LEA	4.8	7.4	6.8	5.0	4.9	4.8	6.0	5.3
10. WOF	47.5	43.5	45.7	39.3	35.9	35.8	35.8	30.2
11. PAP	32.5	27.5	32.7	27.4	22.7	23.3	20.9	20.8
12. PRI	7.1	5.3	5.5	4.3	4.0	3.9	3.4	3.2
13. CHE	7.4	7.0	5.8	4.4	3.5	3.7	3.7	2.7
14. OIL	-	2.1	2.9	1.5	0.8	0.9	1.1	1.3
15. RUB	1.6	1.1	1.4	1.4	1.8	2.2	2.0	1.6
16. MIN	8.4	8.9	8.4	7.2	4.4	3.8	3.5	3.4
17. MET	12.8	25.9	22.5	21.9	10.6	7.6	8.8	7.4
18. MFM	3.0	3.3	3.0	4.4	2.2	1.6	1.6	1.4
19. ELE	4.3	5.6	4.5	3.5	1.8	1.2	1.1	1.1
20. TRE	2.9	2.1	2.5	3.4	2.2	1.7	1.4	1.3
21. OTH	5.7	5.7	5.6	3.6	2.9	2.6	2.4	1.9
22. EGW	-	5.2	4.1	2.3	3.0	3.4	3.6	2.4
23. BUI	-	-	-	6.4	6.1	4.7	4.3	-
24. OCO	-	-	4.4	-	-	-	-	-
25. TRD	1.0	0.4	0.5	0.6	0.7	0.6	0.5	0.4
26. TRC	2.0	0.4	0.7	0.9	1.1	1.0	0.9	0.8
27. FIN	0.4	0.6	0.9	0.9	0.9	0.7	0.6	0.5
28. DWE	-	-	-	-	-	-	-	-
29. BUS	-	-	-	1.5	1.5	1.1	0.9	0.7
30. CSR	1.6	0.7	1.2	6.8	5.8	4.2	3.8	3.5

Notes: “-” denotes that industry did not have any exports in that year and as such had no figure corresponding with resource intensity. Primary sector is defined as the industries of agriculture (AGR), forestry (FOR), fishing (FIS), metal ore mining (ORE) and other mining (OMI).

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1956–1989; see the appendices for natural resources.

Table A 13. Average Establishment Size in 1952–1989

	1952	1959	1964	1972	1980	1982	1986	1989
1. AGR	.	.	.	.	.	.	.	.
2. FOR	.	.	.	.	.	.	3.1	3.5
3. FIS	.	.	.	.	.	.	.	.
4. ORE	10.6	16.7	17.2	25.7	11.6	7.8	18.6	25.1
5. OMI	0.2	0.2	0.3	0.9	0.9	1.0	0.3	0.3
6. FOO	0.2	0.4	0.5	0.5	0.2	0.3	0.3	0.4
7. BEV	0.6	1.8	3.4	1.3	6.1	6.2	10.9	15.4
8. TEX	0.1	0.2	0.3	0.6	0.5	0.5	0.5	0.3
9. LEA	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.3
10. WOF	0.1	0.2	0.2	0.3	0.4	0.3	0.3	0.5
11. PAP	4.1	4.6	6.0	6.7	5.9	7.3	10.8	14.9
12. PRI	0.4	0.4	0.7	0.5	0.6	0.6	0.8	0.8
13. CHE	0.9	1.4	2.2	1.9	2.3	2.3	3.8	6.9
14. OIL	0.5	4.3	6.2	5.0	17.3	17.5	21.8	15.4
15. RUB	0.8	0.4	0.6	0.8	0.7	0.7	0.8	0.7
16. MIN	0.2	0.2	0.4	0.6	0.8	0.9	1.1	1.4
17. MET	2.4	1.7	2.5	4.1	4.6	4.1	5.9	11.1
18. MFM	0.3	0.3	0.5	0.5	0.5	0.6	0.7	0.8
19. ELE	0.7	0.7	1.0	1.6	1.2	1.3	1.4	1.5
20. TRE	0.3	0.3	0.4	1.0	1.1	1.4	1.8	1.7
21. OTH	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.2
22. EGW	0.8	0.7	1.0	3.2	5.9	6.4	4.9	3.1
23. BUI	0.5	.	0.7	0.9	0.6	0.8	0.7	0.9
24. OCO	.	.	.	.	.	.	1.0	1.2
25. TRD	0.1	.	0.1	0.1	0.1	0.1	0.2	0.2
26. TRC	0.1	.	.	.	.	.	0.7	0.9
27. FIN	.	.	.	.	.	.	.	.
28. DWE	.	.	.	.	.	.	.	.
29. BUS	0.1	.	0.1	1.6	1.1	1.3	0.6	0.7
30. CSR	0.0	.	0.1	0.2	0.2	0.2	0.2	0.4

Notes: “.” refers to a missing value. Measured as value-added in millions of 2017 euros, deflated by Statistics Finland’s Wholesale Price Index, divided by the number of establishments. Several industries were dropped due to unreliability of data and possible systematic breaks in the series.

Source: The author's own estimates, Statistics Finland; Input-Output Tables 1956–1989; see the appendices for scale advantage.

Table A 14. Direct R&D Expenditure Requirements across Product Groups in 1970–1989, in 1 000 Euros

	1970	1980	1982	1985	1989
1. AGR	0.3	0.4	0.5	0.9	0.9
2. FOR	0.7	0.6	1.0	0.9	1.6
3. FIS	-	-	-	-	-
4. ORE	3.9	10.7	11.1	12.5	2.8
5. OMI	2.9	5.2	5.5	7.9	3.9
6. FOO	1.1	1.9	2.3	3.0	3.9
7. BEV	2.2	3.9	4.8	5.6	16.9
8. TEX	1.0	1.6	1.8	1.7	3.0
9. LEA	1.7	0.3	0.4	1.1	4.3
10. WOF	1.2	1.2	2.2	2.0	2.3
11. PAP	6.7	4.0	4.6	5.2	7.5
12. PRI	0.5	0.3	0.3	0.3	0.5
13. CHE	19.3	14.9	19.4	10.9	32.0
14. OIL	11.2	2.0	3.5	9.8	21.4
15. RUB	7.9	12.3	12.4	71.1	58.4
16. MIN	3.9	4.5	6.5	10.7	13.1
17. MET	8.1	6.2	7.2	7.2	6.9
18. MFM	9.2	13.2	13.8	18.9	20.2
19. ELE	36.5	51.8	63.9	74.4	93.7
20. TRE	1.9	4.8	5.2	12.1	9.0
21. OTH	6.3	4.7	5.8	16.6	10.4
22. EGW	1.3	1.0	1.8	3.2	6.7
23. BUI	-	0.2	0.2	-	0.9
24. OCO	0.3	-	-	1.3	-
25. TRD	0.4	0.1	0.1	0.0	0.1
26. TRC	1.0	1.0	1.0	1.2	3.1
27. FIN	1.9	0.6	0.7	0.5	0.2
28. DWE	-	-	-	-	-
29. BUS	2.2	0.9	2.0	2.5	3.5
30. CSR	0.7	0.4	0.5	0.9	0.9

Notes: “-” refers to a zero value. “0.0” are very small amounts of R&D expenditure. In constant 2017 euros deflated with Statistics Finland’s Wholesale Price Index. While R&D expenditure is calculated according to product groups it is weighted according to industry size, or gross value of production. Total requirements that also cover backward linkages are disregarded here, since in the case of product differentiation only the end product’s qualities matter.

Source: The author's own estimates, Statistics Finland: Input-Output Tables 1970–1989; Vuori 1994; see the appendices for product differentiation.

Table A 15. The Number of Innovations in 1956–1989

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR								
2. FOR								
3. FIS								
4. ORE								
5. OMI								
6. FOO							1	6
7. BEV								
8. TEX			1		1	2		1
9. LEA					1			1
10. WOF		2	1	3	4	3	1	1
a. Woo		*2*	*1*	*3*	*4*	*3*	*1*	*1*
b. Fur								
11. PAP		1	1	1	1	2	1	1
12. PRI								
13. CHE	3	5		2	1	2	7	4
14. OIL				1	1		1	
15. RUB	1	1	2	5	2	2	2	6
16. MIN	1			1	2	1	3	
17. MET		2		2			3	1
18. MFM	15	15	22	11	18	29	25	21
a. Fab	*4*	*4*	*4*	*1*	*1*	*4*	*6*	*3*
b. Mac	*11*	*11*	*18*	*10*	*17*	*25*	*19*	*18*
19. ELE	1	2	6	2	16	22	15	22
20. TRE	4	2	4	3	4	4	4	3
21. OTH	2	2	6	2	1	2	1	
22. EGW		1	1	1	2	1		
23. BUI							3	2
24. OCO								1
25. TRD							3	
26. TRC					3	1	1	
27. FIN								1
28. DWE								
29. BUS				2	2	5	18	11
30. CSR						1		
Total	27	33	44	36	59	77	89	82

Notes: There is a statistical break in 1980 and 1982 due switching from historical innovation data to survey-based data.

Source: SFINNO; H-INNO data included there was gathered in Saarinen 2005; see the appendices for product differentiation.

Table A 16. The Share of Employees working in Large Establishments in 1956–1989, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	.	.	.	.	.	.	.	.
2. FOR	.	.	.	.	.	.	.	.
3. FIS	.	.	.	.	.	.	.	.
4. ORE	78.3	80.7	78.7	85.4	87.3	82.0	85.1	42.4
5. OMI	0.0	0.0	0.0	0.0	11.0	15.0	0.0	6.4
6. FOO	14.0	17.2	28.3	28.2	34.2	35.1	32.7	36.0
7. BEV	50.6	61.5	73.4	81.8	82.9	82.6	73.9	81.3
8. TEX	54.2	51.0	48.3	46.2	45.2	40.5	40.7	36.3
9. LEA	36.9	28.6	22.6	26.5	26.6	30.2	27.7	19.9
10. WOF	37.5	41.9	44.7	50.6	42.8	38.2	37.4	37.6
11. PAP	70.0	78.1	81.1	81.3	83.3	81.9	81.0	85.5
12. PRI	27.8	33.0	37.3	41.4	41.1	40.8	40.1	48.4
13. CHE	30.7	43.2	54.5	56.9	57.4	57.6	58.7	61.4
14. OIL	0.0	60.3	70.2	68.7	100.0	100.0	100.0	76.4
15. RUB	83.1	79.8	71.4	70.9	51.0	45.9	46.0	34.0
16. MIN	43.1	48.7	49.9	52.4	38.1	37.5	31.7	37.1
17. MET	68.3	73.6	84.4	84.7	86.1	84.5	84.0	78.3
18. MFM	47.4	54.0	57.0	57.0	52.1	100.0	45.9	44.6
19. ELE	56.1	58.9	65.7	70.2	73.4	81.4	65.0	67.4
20. TRE	58.4	58.3	54.6	47.7	76.1	76.3	75.9	74.5
21. OTH	20.7	16.5	25.2	24.5	26.8	27.8	25.4	23.8
22. EGW	18.3	25.7	30.6	29.5	35.3	38.9	39.2	44.5
23. BUI	.	.	.	.	.	.	.	.
24. OCO	.	.	.	.	.	.	.	.
25. TRD	.	.	.	.	.	.	.	.
26. TRC	.	.	.	.	.	.	.	.
27. FIN	.	.	.	.	.	.	.	.
28. DWE	.	.	.	.	.	.	.	.
29. BUS	.	.	.	.	.	.	.	.
30. CSR	.	.	.	.	.	.	.	.

Notes: "." refers to a missing value. Large establishments are defined as having more than 200 employees. Note that shoe manufactures are classified in TEX, not in LEA, in 1959–1970.

Source: The author's own estimates, Statistics Finland; Statistical Yearbooks of Finland 1956–1989; see the appendices for monopolistic competition.

Table A 17. The Ratio of Customs Duties Relative to Imports in 1959–1989, %

	1959	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	45.2	26.0	10.7	5.1	5.5	5.4	6.5
2. FOR	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3. FIS	1.6	2.7	2.8	0.5	0.7	1.2	1.4
4. ORE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5. OMI	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. FOO	118.0	43.0	25.8	6.7	4.3	2.0	4.2
7. BEV	141.0	58.2	60.9	16.6	10.6	9.8	9.0
8. TEX	24.4	15.9	4.9	3.3	4.6	3.0	5.0
9. LEA	33.6	21.0	8.2	4.8	5.2	4.3	5.1
10. WOF	5.7	0.7	0.0	0.0	0.3	0.2	0.5
11. PAP	9.2	8.5	3.7	0.8	0.5	0.4	0.3
12. PRI	0.0	0.0	0.0	0.0	0.1	0.1	0.1
13. CHE	1.5	1.4	0.6	0.3	0.5	0.3	0.3
14. OIL	19.7	0.9	0.3	0.0	0.0	0.0	0.0
15. RUB	9.0	6.1	3.6	2.1	3.3	1.5	1.4
16. MIN	5.1	0.8	1.6	0.6	1.2	0.6	0.8
17. MET	7.1	5.1	1.2	0.3	0.3	0.2	0.1
18. MFM	4.0	2.7	1.8	0.7	0.6	0.4	0.6
19. ELE	7.6	8.7	4.8	2.5	2.4	1.8	2.1
20. TRE	11.2	12.6	4.5	1.8	1.5	1.3	1.5
21. OTH	12.0	6.0	4.0	5.4	4.2	4.6	2.7
22. EGW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23. BUI	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24. OCO	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25. TRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26. TRC	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27. FIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28. DWE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29. BUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30. CSR	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: The industrial classification used here is not identical to one in Table 18. which was classified differently in order to match it with Kauppila’s data for 1934.

Source: The author's own estimates; Statistics Finland; Input–Output Tables 1959–1989; Board of Customs; see the appendices for customs barriers.

Table A 18. Effective Rates of Protection in 1959–1989, %

	1959	1965	1970	1980	1982	1985	1989
1. AGR	48.6	30.2	11.5	6.7	8.1	7.5	9.4
2. FOR	-2.6	-0.9	-0.2	0.0	-0.1	0.0	0.0
3. FIS	1.6	3.0	3.1	0.4	0.7	1.2	1.4
4. ORE	-0.6	-1.1	-0.2	-0.1	-0.2	-0.1	0.0
5. OMI	-0.5	-1.6	-0.4	-0.3	-0.2	-0.2	-0.2
6. FOO	277.6	109.2	76.8	32.3	5.2	-22.7	0.9
7. BEV	224.7	96.1	110.7	32.6	20.4	15.9	13.3
8. TEX	27.8	17.6	4.2	2.2	3.2	2.2	4.5
9. LEA	18.0	25.8	5.7	3.0	3.7	3.4	3.7
10. WOF	4.5	-0.2	-0.5	-0.2	0.1	0.2	0.6
11. PAP	7.4	8.8	2.8	0.6	0.4	0.3	0.0
12. PRI	-1.5	-1.3	-0.5	-0.2	0.0	0.0	0.0
13. CHE	-7.7	-5.4	-0.2	0.0	0.3	0.1	0.1
14. OIL	41.9	0.6	0.6	0.1	0.1	0.0	0.0
15. RUB	8.8	3.9	5.1	2.8	4.7	2.0	1.8
16. MIN	6.8	0.2	2.3	0.8	1.7	0.8	1.1
17. MET	11.3	10.6	1.9	0.1	0.3	0.2	0.0
18. MFM	1.9	1.5	1.7	0.6	0.4	0.3	0.3
19. ELE	8.0	10.6	5.8	2.4	2.0	1.5	1.6
20. TRE	9.9	15.2	3.5	1.8	0.7	0.6	0.7
21. OTH	12.1	4.6	4.1	5.7	4.3	4.6	3.4
22. EGW	-0.8	-1.0	-0.3	-0.1	-0.1	-0.1	-0.1
23. BUI	-3.5	-1.6	-1.1	-0.5	-0.5	-0.3	-0.3
24. OCO	-1.7	-2.4	-1.2	-0.4	-0.4	-0.2	-0.2
25. TRD	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
26. TRC	-2.0	-1.7	-0.5	-0.2	-0.1	-0.1	-0.1
27. FIN	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0
28. DWE	-0.3	-0.1	-0.1	0.0	0.0	0.0	0.0
29. BUS	0.0	-0.1	-0.2	-0.1	-0.1	0.0	0.0
30. CSR	0.0	-0.3	-8.2	-1.9	-1.0	-0.5	-0.7

Notes: The industrial classification used here is not identical to one in Table 18. which was classified differently in order to match it with Kauppila’s data for 1934. Therefore the figures for EFP differ slightly in a few cases.

Source: The author's own estimates; Statistics Finland; Input–Output Tables 1959–1989; Board of Customs; see the appendices for customs barriers.

Table A 19. The Share of Eastern Trade in Exports 1956–1989, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	2.9	0.3	12.6	5.8	5.0	4.7	14.8	4.7
2. FOR	16.6	10.9	8.1	0.9	13.6	0.0	8.8	6.0
3. FIS	5.4	0.0	46.3	0.6	0.0	0.0	0.0	0.0
4. ORE	34.7	23.3	10.9	19.0	5.7	37.0	6.3	6.6
5. OMI	49.6	53.1	16.0	6.8	5.5	7.8	2.5	3.4
6. FOO	16.0	18.6	37.8	25.7	40.4	48.6	45.4	21.6
7. BEV	99.1	0.0	2.1	0.1	21.8	31.7	28.8	15.4
8. TEX	5.0	4.4	21.0	12.7	21.7	35.2	32.3	19.9
9. LEA	4.4	10.5	4.1	12.8	43.1	71.3	64.5	41.4
10. WOF	16.6	5.8	2.3	2.5	4.5	12.8	3.9	3.5
11. PAP	17.6	15.3	17.4	16.0	21.8	22.3	17.0	11.8
12. PRI	71.8	8.0	63.8	32.7	17.4	23.4	24.4	12.5
13. CHE	71.4	50.8	26.6	44.4	33.4	36.8	30.4	19.7
14. OIL	15.0	2.4	16.0	13.2	1.9	9.7	6.3	14.5
15. RUB	5.8	0.0	6.0	3.3	27.1	23.7	22.9	15.7
16. MIN	2.5	0.7	0.1	4.3	20.2	33.4	17.9	15.9
17. MET	29.1	18.2	18.5	2.6	10.8	10.9	10.0	6.5
18. MFM	78.8	82.0	54.6	30.9	28.2	45.7	34.4	20.2
19. ELE	49.3	82.8	43.2	25.0	25.5	31.2	25.0	22.1
20. TRE	93.1	87.4	79.2	44.6	41.1	46.7	55.6	43.6
21. OTH	13.8	2.5	20.7	5.7	2.9	3.3	1.5	2.7
22. EGW	.	.	.	.	.	.	.	.
23. BUI	.	.	.	.	.	.	.	.
24. OCO	.	.	.	.	.	.	.	.
25. TRD	.	.	.	.	.	.	.	.
26. TRC	.	.	.	.	.	.	.	.
27. FIN	.	.	.	.	.	.	.	.
28. DWE	.	.	.	.	.	.	.	.
29. BUS	.	.	.	.	.	.	.	.
30. CSR	.	.	.	.	.	.	.	.

Notes: "." refers to a missing value. Board of Customs does not have data on service exports. "East" refers to Albania, East Germany, Bulgaria, Hungary, Poland, Romania, Czechoslovakia, Soviet Union, North Korea, China, Mongolia and North Vietnam / Vietnam.

Source: The author's own estimates; Board of Customs; see the appendices for Eastern Trade.
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Table A 20. The Share of State-Owned Companies' Gross Value of Production of Total in 1956–1985, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**
1. AGR	.	.	.	.	.	.	.
2. FOR	.	.	.	.	.	.	.
3. FIS	.	.	.	.	.	.	.
4. ORE	98.0	98.4	97.8	92.8	95.4	94.4	100.0
5. OMI	5.0	2.6	2.5	1.1	20.0	33.5	32.2
6. FOO	0.4	0.4	0.3	0.2	0.2	0.2	0.2
7. BEV	28.3	22.3	20.3	18.1	19.1	18.9	16.7
8. TEX	0.5	0.6	0.5	0.4	4.8	4.8	4.3
9. LEA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10. WOF	13.2	15.3	11.4	9.0	8.1	7.8	8.4
11. PAP	24.6	28.1	27.7	24.2	23.4	22.9	21.7
12. PRI	2.8	2.5	2.5	0.1	2.7	2.8	2.6
13. CHE	27.9	33.1	39.6	44.1	50.6	52.0	52.6
14. OIL	0.0	74.5	80.6	89.1	96.4	95.1	95.3
15. RUB	0.1	0.1	0.1	0.0	0.0	0.0	0.4
16. MIN	0.3	0.8	0.2	0.1	0.5	0.5	0.2
17. MET	54.3	58.6	62.8	73.0	78.0	80.1	79.5
18. MFM	11.4	12.8	11.5	10.2	11.8	12.7	12.1
19. ELE	3.1	3.3	2.9	1.3	7.2	5.6	4.7
20. TRE	31.3	28.9	25.8	24.4	22.9	20.7	24.3
21. OTH	2.3	3.8	2.7	3.2	0.0	0.0	5.8
22. EGW	28.6	27.2	28.1	19.4	28.3	28.4	27.7
23. BUI	.	.	.	.	.	.	.
24. OCO	.	.	.	.	.	.	.
25. TRD	.	.	.	.	.	.	.
26. TRC	.	.	.	.	.	.	.
27. FIN	.	.	.	.	.	.	.
28. DWE	.	.	.	.	.	.	.
29. BUS	.	.	.	.	.	.	.
30. CSR	.	.	.	.	.	.	.

Notes: "." refers to a missing value. Including both state-owned joint stock companies and other state-owned establishments. The Industrial Statistics of 1989 have no data on the nature of ownership.

Source: The author's own estimates; Statistics Finland; Industrial Statistics.

Table A 21. Propensity for Cartelization in 1956–1989

	1956	1959	1965	1970	1980	1982	1985	1989
1. AGR	3	3	3	3	3	3	3	3
2. FOR	3	3	3	3	3	3	3	3
3. FIS	1	2	3	3	3	3	3	3
4. ORE	4	4	4	4	4	4	4	3
5. OMI	3	3	3	3	3	3	3	3
6. FOO	2	2	2	2	2	2	2	2
7. BEV	3	4	4	4	4	4	4	4
8. TEX	2	2	2	2	2	0	1	2
9. LEA	1	2	2	1	1	1	1	2
10. WOF	2	1	3	3	2	2	3	3
11. PAP	4	4	4	4	4	3	4	4
12. PRI	2	1	1	1	1	1	1	3
13. CHE	2	3	3	2	3	2	2	2
14. OIL	2	3	3	3	2	2	2	3
15. RUB	2	2	2	2	2	2	2	1
16. MIN	3	4	4	4	1	2	1	2
17. MET	4	3	4	3	4	4	3	4
18. MFM	2	2	1	1	1	1	1	1
19. ELE	2	1	1	1	1	2	2	1
20. TRE	2	2	1	2	2	2	2	2
21. OTH	0	0	0	0	2	1	2	2
22. EGW	2	2	2	2	1	2	2	3
23. BUI	1	1	1	1	1	1	0	0
24. OCO	1	1	1	1	1	1	1	1
25. TRD	2	2	2	2	2	2	1	2
26. TRC	2	2	2	2	2	2	2	2
27. FIN	2	2	2	2	2	2	2	2
28. DWE	2	2	2	2	2	2	2	2
29. BUS	2	2	2	1	1	1	1	1
30. CSR	2	2	2	3	2	2	2	2

Notes: The variable for propensity for cartelisation is calculated first by checking if the industry exceeds the 1956 median in capital intensity, natural resource intensity, the employment share of large establishments, or if it was under the average of the number of innovations in 1956. The values reflect the number of conditions fulfilled with “4” as the maximum.

Source: The author's own estimates; Statistics Finland; SFINNO; see the appendices for sources regarding product differentiation, capital, natural resources and monopolistic competition.

Table A 22. Estimates of Trade Union Membership in Workforce in 1956–1989, %

	1956	**1959**	**1965**	**1970**	**1980**	**1982**	**1985**	**1989**
1. AGR	1.7	1.3	2.9	5.3	12.2	10.2	10.2	12.5
2. FOR	1.0	1.0	1.0	1.0	14.8	15.6	17.5	22.2
3. FIS	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4. ORE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5. OMI	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6. FOO	22.0	18.7	22.3	48.9	69.5	70.7	72.3	76.7
7. BEV	22.0	18.7	22.3	48.9	69.5	70.7	72.3	76.7
8. TEX	20.2	17.9	41.8	50.9	80.0	82.6	89.1	105.5
9. LEA	25.4	25.5	44.0	52.5	69.5	67.8	70.8	114.0
10. WOF	51.1	41.4	60.9	82.4	93.8	106.2	110.8	111.8
11. PAP	54.9	57.3	60.5	82.4	94.4	107.7	114.7	114.0
12. PRI	51.3	53.7	53.9	56.9	77.7	70.7	70.4	77.8
13. CHE	39.1	39.1	39.1	70.7	77.5	73.2	71.0	83.2
14. OIL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15. RUB	57.4	56.9	91.3	45.0	59.4	64.5	67.7	60.7
16. MIN	18.2	19.5	16.0	24.7	26.9	26.0	23.5	24.3
17. MET	9.6	9.5	6.6	6.2	6.6	6.8	6.7	7.4
18. MFM	38.8	37.2	40.9	68.7	79.1	75.9	75.7	81.0
19. ELE	38.8	37.2	44.7	57.5	67.9	74.5	72.8	82.6
20. TRE	38.8	37.2	44.7	57.5	67.9	74.5	72.8	82.6
21. OTH	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
22. EGW	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7
23. BUI	30.6	32.0	47.5	62.1	83.1	77.2	77.3	69.1
24. OCO	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25. TRD	12.7	14.4	4.6	23.8	52.3	50.5	47.9	47.5
26. TRC	37.6	24.4	46.3	24.1	34.5	49.8	51.2	47.7
27. FIN	25.8	21.5	32.6	50.4	71.7	69.9	68.7	66.9
28. DWE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
29. BUS	21.7	19.5	22.6	51.6	82.1	68.3	56.3	54.8
30. CSR	8.0	7.1	7.7	19.6	30.6	31.0	30.7	32.6

Notes: The estimates are not without problems. For example, the data on trade union members across industries had to be deduced based on the names of different unions. The resulting figures suffer from measurement error as can be observed from how the estimates suggest that wood-processing industries had unionized members in excess of their total number of employees. In metal engineering industries it is assumed that all of them had similar rates of unionization. If there was no data on union membership the unionization ratio was changed to 1% since it was assumed that there were some trade union members in all industries, but this likely makes no difference one way or another.

Source: The author's own estimates, Statistics Finland; Yli-Pietilä et al. 1990; see the appendices for labour.

Table A 23. The Share of Female Employees in Workforce in 1953–1989, %

	1953	**1960**	**1965**	**1970**	**1980**	**1985**	**1989**
1. AGR	46.6	41.8	37.9	38.6	45.5	43.1	46.5
2. FOR	4.3	1.4	0.9	2.2	7.7	17.7	16.7
3. FIS	11.7	5.7	5.7	8.1	18.4	18.6	18.2
4. ORE	9.2	11.0	12.8	13.3	14.2	14.0	12.1
5. OMI	19.2	9.4	14.9	12.2	10.9	13.8	12.8
6. FOO	50.5	49.8	54.4	52.3	55.2	53.8	54.3
7. BEV	55.6	46.5	44.5	42.7	43.3	41.3	39.5
8. TEX	77.5	80.2	78.3	79.9	83.2	83.8	82.1
9. LEA	47.8	48.9	55.3	54.9	57.8	58.0	58.7
10. WOF	22.9	23.1	27.6	26.3	25.8	24.8	23.0
11. PAP	28.9	26.2	27.6	25.1	28.6	26.3	25.4
12. PRI	50.3	46.3	48.8	46.9	48.2	48.6	49.1
13. CHE	40.8	39.9	41.1	41.2	38.6	38.6	37.9
14. OIL	22.7	14.3	19.0	22.5	18.5	21.8	15.9
15. RUB	51.9	43.0	41.4	41.8	44.2	41.7	39.9
16. MIN	24.3	22.7	23.9	22.2	23.9	23.5	23.0
17. MET	14.2	12.7	14.4	13.3	18.7	18.6	18.3
18. MFM	17.3	15.3	17.1	17.9	19.5	18.4	17.9
19. ELE	30.3	30.9	33.5	35.8	45.0	40.8	41.7
20. TRE	10.3	9.0	11.6	11.7	17.1	16.7	15.9
21. OTH	31.7	28.2	33.1	38.5	48.2	43.8	44.7
22. EGW	12.1	13.5	13.6	16.1	20.2	21.3	19.6
23. BUI	7.2	6.1	8.7	7.2	8.0	8.4	9.3
24. OCO	6.2	5.3	7.3	6.6	11.2	12.1	13.2
25. TRD	54.8	54.1	61.1	56.4	56.0	55.2	55.2
26. TRC	22.4	20.6	30.5	23.0	24.8	26.8	28.4
27. FIN	56.8	67.4	62.6	72.2	76.1	76.2	74.9
28. DWE	22.0	41.7	.	72.0	62.6	60.7	59.6
29. BUS	33.3	39.0	39.9	39.5	42.7	44.1	45.4
30. CSR	81.2	86.8	84.0	71.3	60.3	63.7	59.6

Notes: Figures for AGR and FIS in 1953 are actually from the census of 1950.

Source: The author's own estimates, Statistics Finland; see the appendices for labour.

Table A 24. Grubel-Lloyd Indices, Unit Price Dispersion and Capital Intensity in 1980–1989

	1980			1985			1989		
	G-L	**X/M**	**K**	**G-L**	**X/M**	**K**	**G-L**	**X/M**	**K**
AGR	0.5	7.0	2 054.4	0.9	1.0	1 997.0	0.6	37.4	2 017.1
FOR	0.7	22.4	1 524.1	0.4	9.2	1 718.9	0.2	21.6	1 612.5
ORE + OMI	.	42.6	.	.	36.6	.	.	40.1	.
ORE	0.3	.	1 750.7	0.2	.	1 558.5	0.2	.	1 182.7
OMI	0.0	.	1 305.9	0.0	.	1 473.8	0.1	.	1 336.0
FOO + BEV	.	7.1	.	.	4.3	.	.	0.7	.
FOO	0.9	.	375.8	0.9	.	401.5	1.0	.	427.7
BEV	0.8	.	417.6	0.9	.	419.1	0.8	.	470.1
TEX	0.8	.	350.0	0.8	.	418.5	0.5	.	492.3
Textiles	.	6.0	.	.	3.5	.	.	6.8	.
Clothing	.	8.8	.	.	10.9	.	.	34.1	.
LEA	0.9	11.4	350.0	.	14.6	375.8	0.6	5.3	578.9
WOO	0.1	12.8	489.8	0.2	7.5	668.9	0.3	1.9	517.2
PAP	0.1	8.3	722.7	0.1	9.0	797.9	0.1	.8.9	965.2
RUB	0.5	6.6	800.8	0.6	6.4	949.6	0.5	0.2	899.2
CHE	0.5	1.1	598.8	0.5	3.4	667.1	0.5	3.8	712.9
OIL	0.2	8.3	298.3	0.2	11.5	321.2	0.2	13.3	656.3
MIN	0.9	3.6	710.8	0.8	13.9	840.4	0.9	30.4	748.2
MET	0.8	0.0	638.3	0.9	3.4	643.6	0.9	4.3	577.6
FAB+MAC	0.6	.	432.5	0.8	.	440.4	0.7	.	390.9
FAB	.	9.5	.	.	5.2	.	.	1.1	.
MAC	.	7.5	.	.	13.1	.	.	25.8	.
ELE	0.6	11.9	433.7	0.6	23.6	483.5	0.7	69.9	403.0
OTH	0.5	5.9	368.7	0.7	14.9	442.8	0.4	32.1	561.8

Notes: G–L refers to Grubel-Lloyd index, X/M to unit price dispersion and K to capital intensity. Note that K refers only to direct capital/output -ratio. "." refers to a missing value.

Source: The author's own estimates; Board of Customs; Statistics Finland; Input-Output Tables 1980–1989

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