REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS
MA IN ECONOMICS

MASTER'S THESIS

DEINDUSTRIALIZATION REVISITED

SERCAN YILDIZ
19729007

THESIS SUPERVISOR
Assist. Prof. HASAN AĞAN KARADUMAN

İSTANBUL
2022

REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS
MA IN ECONOMICS

MASTER'S THESIS

DEINDUSTRIALIZATION REVISITED

SERCAN YILDIZ
19729007
ORCID NO: 0000-0002-0034-7288

THESIS SUPERVISOR
Assist. Prof. HASAN AĞAN KARADUMAN

İSTANBUL
2022

REPUBLIC OF TURKEY
YILDIZ TECHNICAL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS
MA IN ECONOMICS

MASTER'S THESIS

DEINDUSTRIALIZATION REVISITED

SERCAN YILDIZ
19729007

Date of Defense: 29/06/2022

The thesis has been approved with unanimity of votes by the jury.

	Title - Name - Surname	Signature
Thesis Supervisor	**: Assist. Prof. Hasan Ağan Karaduman**	
Jury Members	**: Assoc. Prof. Senem Çakmak Şahin**	
	Assoc. Prof. Emine Tahsin	

İSTANBUL
JUNE 2022

ÖZ

YENİDEN SANAYİSİZLEŞME
Sercan Yıldız
Haziran, 2022

Bu çalışmada, literatürde sanayisizleşme sebepleri olarak öne sürülen açıklamalar sabit etkiler tahmin yöntemi kullanılarak test edilmiştir. Literatürdeki önceki çalışmalardan farklı olarak, gelişmiş ülkelere ek olarak gelişmekte olan ülkeleri de içeren çok daha büyük bir örneklem kullanılmıştır. Bulgularımız önceki ampirik çalışmalarla kısmen uyuşmaktadır. Ulaştığımız ampirik sonuçlar göstermektedir ki imalat sanayii ve hizmet sektörü arasındaki imalat sanayii lehine olan üretkenlik farklılığı, imalat sanayiinin istihdam payındaki azalıştan sorumlu olan en etkili ve dirençli sebeptir. Diğer değişkenlerin etkileri farklı tahminler arasında istikrarlı bir örüntü sergilememektedir. Bu göreli üretkenlik değişkeni analize dahil edilmediğinde, göreli üretkenliğin rolü kişi başı gelir değişkenleri tarafından imalat sanayii istihdam payı üzerinde konkav bir etki sergileyecek şekilde kapsanmaktadır. Diğer yandan, Güney ülkelerinden imalat sanayii ithalatının sanayisizleşme üzerindeki etkisine dair bir bulguya ulaşılamamıştır. Bu uyuşmazlık muhtemelen önceki birçok çalışmada mevcut olan kusurlardan kaynaklanmaktadır. Birincisi, önceki çalışmalarda kullanılan örneklemler genel olarak sadece gelişmiş ülkeleri içermektedir. İkincisi, küçük örneklemler kullanmanın bir sonucu olarak, birçok çalışmada gözlem sayıları oldukça düşüktür. Üçüncüsü, zaman sabit etkiler çoğunlukla kontrol edilmemiştir. Açıkçası, zaman sabit etkileri analize dahil etmediğimizde biz de önceki çalışmalarla benzer sonuçlara ulaştık. Zaman sabit etkileri analize dahil etmenin önemli etkisi muhtemelen uygun şekilde ölçülemeyen artan dış kaynak kullanımından kaynaklanmaktadır. Sonuç olarak, sanayisizleşme olgusunun varolan açıklamaları teorik düzlemde akla yatkın gelse de bu açıklamalar için ampirik çalışmalarda sıklıkla kullanılan değişkenler uygun şekilde belirlenmiş gözükmemektedir.

Anahtar Kelimeler: Sanayisizleşme, Sanayi Politikası, İstihdam Yapısı

ABSTRACT

DEINDUSTRIALIZATION REVISITED
Sercan Yıldız
June, 2022

In this study, the frequently discussed explanations proposed as the reasons for deindustrialization in the literature are examined through the fixed effect estimation method. We use a much larger sample which also includes developing countries in addition to developed countries. Our findings are partially in line with the previous empirical analyses. Our empirical results show that productivity difference on behalf of manufacturing industry over service sector is the most effective and robust reason that is responsible from the decrease in employment share of manufacturing industry. The effects of other variables do not exhibit a stable pattern among different estimations. If the relative productivity variable is excluded from the analysis, income per capita variables capture its role suggesting a concave effect on manufacturing employment share. On the other hand, there is no evidence for the effect of manufacturing imports from the Southern countries on deindustrialization. This discrepancy probably results from the drawbacks in many previous studies. First, the samples used in the previous studies include only developed OECD countries. Second, as a result of small samples, observation numbers are quite low in many empirical studies. Third, time fixed effects are mostly not controlled. Indeed, we get much similar results with the previous studies when we exlude time fixed effects from our analysis. The significant effect of incorporating time fixed effects into the analysis probably stems from increasing outsourcing practices that cannot be measured properly. In conclusion, although the existing explanations for the phenomenon of deindustrialization sound reasonable on theoretical ground, frequently used variables for those explanations in empirical studies seem to be not well-grounded.

Key Words: Deindustrialization, Industrial Policy, Employment Structure

TABLE OF CONTENTS

ÖZ ..... **iii**
ABSTRACT ..... **iv**
TABLE OF CONTENTS ..... **v**
LIST OF TABLES ..... **vi**
LIST OF FIGURES ..... **vii**
ABBREVIATIONS ..... **viii**
1. INTRODUCTION **1**
2. THEORETICAL FRAMEWORK **6**
2.1. Definition 6
2.1.1. Emphasis on Manufacturing Industry 6
2.1.2. Employment *versus* Output 9
2.2. Reasons for Deindustrialization 12
2.2.1. Economic Maturation 13
2.2.2. Productivity Growth Differences 16
2.2.3. International Trade 16
2.2.4. Economic Failure 18
3. EVIDENCE FROM PREVIOUS STUDIES **19**
3.1. Descriptive Analyses 19
3.2. Empirical Analyses 20
4. SAMPLE DATA AND EMPIRICAL OVERVIEW **28**
4.1. Explained Variable: Employment Share of Manufacturing Industry 29
4.2. Explanatory Variables 31
4.2.1. Income per Capita 31
4.2.2. Relative Productivity 33
4.2.3. International Trade Flows 36
4.2.4. Unemployment and Investment 40
5. EMPIRICAL MODEL AND RESULTS **44**
6. CONCLUSION **52**
REFERENCES **55**

LIST OF TABLES

Table 5.1: Descriptive Statistics..... 45

Table 5.2: Baseline Model with Different Estimators 46

Table 5.3: Fixed Effect Estimations..... 50

LIST OF FIGURES

Figure 2.1: Employment Structure and Economic Development 13

Figure 4.1: Share of Manufacturing Industry in Total Employment 30

Figure 4.2: Manufacturing Employment Shares and Income per Capita 32

Figure 4.3: Relative Productivity 34

Figure 4.4: Relative Productivity and Manufacturing Employment Shares 35

Figure 4.5: Trade with South 37

Figure 4.6: Trade with North 38

Figure 4.7: Manufacturing Employment Shares and Trade Flows 39

Figure 4.8: Unemployment and Investment 41

Figure 4.9: Relationship between Unemployment and Investment 42

Figure 4.10: Manufacturing Employment, Unemployment and Investment 43

ABBREVIATIONS

ALFS	: Annual Labour Force Statistics
FDI	: Foreign Direct Investment
GDP	: Gross Domestic Product
GFCF	: Gross Fixed Capital Formation
GMM	: Generalized Method of Moments
LSDV	: Least Squares Dummy Variables
OECD	: Organization for Economic Co-operation and Development
POLS	: Pooled Ordinary Least Squares
PPP	: Purchasing Power Parity
TFE	: Time Fixed Effects
UN Comtrade	: United Nations Commodity Trade Statistics
WITS	: World Integrated Trade Solution

1. INTRODUCTION

The Industrial Revolution undoubtedly marks one of the main milestones in the history of humanity. Since its remarkable results with regards to radical increases in production capacity was realized, industrialization has been a major aim of many nations for more than two centuries.

It first began in Britain at the end of the 18th century, then it spreaded to the continental Europe and the USA in the beginning of the 19th century. Eventually, it took effect in almost the whole world over time. The first industrializers have become the advanced countries of today's world.

During the long-term course of economic development, industrial sectors expanded and contracted in response to changes in socio-economic conditions. However, in the post-World War II period, a consistent change in the employment structures of advanced countries started to become more and more visible: A steady tendency for the employment share of industrial sector to fall, especially that of manufacturing industry.

Clark (1940) had already observed a downward trend in several advanced countries for the proportion of working population engaged in secondary production to start falling after reaching a peak while that engaged in tertiary production to rise, even in the pre-war period.

Continuing rise in the weight of service sector in the advanced economies was later started to be discussed under various titles. Fuchs (1968) heralded the new stage of economic development reached by the US economy with more than half of employed population in services, and he investigated the possible reasons behind its transition from an industrial to a "service economy".

Apart from economics, the changing socio-economic structure triggered related discussions in also other social sciences. As a sociologist, for example, Bell (1973) defined the fundemantal features of the coming "post-industrial society" in his prominent study.

Meanwhile, the term "deindustrialization" was being used in a debate concerning a quite different context. Instead of a decline in modern manufacturing industry, the point in question was the decline in the traditional Indian manufacturing in the colonial period.

In his relatively "recent" study in that literature, Bagchi (1976) depicted the problem in the following way. India witnessed a remarkable decline in traditional artisanal production during most of the 19th century. The reason was the flood of the British manufactured goods, especially textile products, into domestic economy as a result of free trade. However, this decline in artisanal production was not compensated by the rise of a manufacturing industry in the modern sense. Instead of this, the decline of traditional artisanship led to an increase in the population dependent on agricultural production.

In the turbulent world of the 1970s, a new kind of literature on deindustrialization emerged in Britain. This time the issue was the replacement of modern manufacturing industry by service sector.

Indeed, the change in the British economic structure as well as that in other advanced economies had begun before the emergence of this literature. The share of manufacturing industry in total employment had already tend to fall. However, those changes in the employment structure had not drawn attention immediately in the sense of a negative phenomenon. An economic shock would be required as a trigger.

The trigger showed up itself by the 1970s which were the expiration years of the post-World War II economic expansion period. Successive economic shocks such as the 1973 oil crisis, the 1973-1974 stock market crash and the 1973-1975 recession in general marked the end of the "golden age" in the advanced economies of the West. Concomitantly, in addition to the ongoing decline in the employment share of manufacturing industry, manufacturing employment started to contract in also absolute terms.

Those adverse developments triggered a debate on the contraction of manufacturing employment and production capacity in the British politics at the highest levels. In a parliamentary debate, for instance, the Chancellor of the Exchequer Denis Healey said: "We must reverse the process of deindustrialisation – of a steady loss of jobs and factory capacity year after year" (Hansard HC Deb., 15 April 1975).

Soon after, the notion of deindustrialization in this modern sense started to attract growing attention within the academic world. Bacon and Eltis (1976) were among the first researchers who discussed this new phenomenon. They identified the expansion of public services as the main cause.

Another notable early contribution was that of Singh (1977). The term deindustrialization had such a negative connotation at the time that he mentioned the "conceptual difficulties" coming to mind from applying this notion to an advanced industrial country. Referring to the previous debate on the decline in the Indian artisanship resulting from the imports of the British manufactured goods, he also pointed out the irony that "an Indian economist should be discussing the question of the deindustrialization of the UK economy", by meaning himself. In other words, how such a backward country problem might be a subject for the first and the most industrialized country of the world? According to him, the problem in Britain was a result of a similar mechanism affected India in the Colonial Era. He attributed the economic slowdown in Britain to the shrinkage of the British manufacturing industry which failed to compete with its foreign rivals under the given free trade conditions.

The negative context commonly attributed to the term deindustrialization was challenged by Rowthorn and Wells (1987). They argued that deindustrialization might not necessarily be a pathological phenomenon. Instead, it could be the natural result of a successful development process. While considering the experience of Britain as an example of "negative deindustrialization", they also pointed out the hypothetical possibility of "positive deindustrialization".

As the literature has advanced, the explanations have got varied and the research on this phenomenon has diversified into various branches. The initial strand of the literature, of which subject of discussion is determining and examining the reasons for deindustrialization, has maintained its central role among others.

One of the most prominent explanations for deindustrialization is the maturation argument. It is argued that the share of manufacturing industry in total employment exhibits an inverted-U shaped pattern during the process of development. In the beginning of the process, manufacturing employment share starts to increase from low levels at a decreasing rate. As income per capita rises, it reaches a stationary phase in the middle of the process. Eventually, as income per capita continues to rise more,

economies come to the stage of maturity and the employment share of manufacturing industry starts to fall.

A more specific aspect, the difference in productivity growth rates between manufacturing industry and service sector on behalf of manufacturing industry is evaluated as a subcomponent of the maturation argument by some researchers. Some consider it as a different and independent factor under the title of technological advancement aspect. The potential for higher productivity growth in manufacturing industry relative to other broad sectors is a well-known stylized fact. It is argued that, because productivity growth is faster in manufacturing industry relative to that in service sector, gradually less amount of labour is needed to meet the demand for manufactured products, which eventually leads to deindustrialization.

The effect of international trade on deindustrialization is another subject of discussion in the literature. Since manufactured products are highly tradable, the economic role of a country in global production chain is expected to have a substantial effect on the state of its manufacturing industry.

Finally, economic failures in a variety of forms may contribute to deindustrialization. They may result from global or domestic factors. Some factors may affect specifically manufacturing sector while they do not have adverse effects on economy in general.

Although those aspects mentioned above are generally accepted as the effective reasons for deindustrialization, some researchers argue that the magnitude of deindustrialization may be overrated due to an illusory factor, which is called “statistical illusion”. As outsourcing and subcontracting of some activities which had been traditionally registered under manufacturing industry before spreaded over years, the resulting statistical change in the official records may have reflected as a fall in the share of manufacturing industry on employment statistics. This is certainly not an actual reason for deindustrialization. However, it should be kept in mind when especially conducting empirical analyses.

The explanations proposed as the reasons for deindustrialization sound reasonable on theoretical ground. Moreover, previous empirical studies provide a considerable amount of evidence for those reasons. However, if those studies are evaluated more carefully by focusing on statistical details, it seems that they have many drawbacks which cast doubts on the reliability of their empirical results. To illustrate, observation

numbers are very low in especially early studies. Most of the samples used in previous studies includes the data only for high-income OECD countries. On the other hand, time fixed effects are generally not controlled in fixed effect estimations, which may cause misleading results.

The aim of this study is to reexamine the existing explanations for deindustrialization using a much larger dataset and more proper model specifications relative to previous studies. Our dataset is much larger both in quantitative sense in terms of observations and in qualitative sense in terms of the coverage of countries, which also includes developing countries in addition to developed countries.

The study is organized as follows. The significant theoretical aspects are clarified and the reasons for deindustrialization are discussed in more detail in Chapter 2. Previous studies are reviewed in Chapter 3. Chapter 4 provides the details about our sample data such as data sources, the calculation methods and the empirical overview of variables. Chapter 5 presents the empirical model and results. Finally, we summarize our findings and inferences in Chapter 6.

2. THEORETICAL FRAMEWORK

2.1. Definition

Deindustrialization is commonly defined as a persistent fall in the share of manufacturing industry in total employment. This definition has a few aspects needed to be explained. To begin with, the decline in question must be noteworthily persistent in terms of both magnitude and time period, temporary fluctuations are not counted. More importantly, the definition has a clear emphasis on the two aspects: manufacturing industry and employment. These two emphasis points worth to be discussed in more detail.

2.1.1. Emphasis on Manufacturing Industry

Economic activities are generally clustered into three broad categories: Agriculture, industry, and services. The same categories are also named as primary, secondary, and tertiary sectors, respectively. Manufacturing industry is a subsector of industry category which also includes mining, utilities, and construction subsectors.[1]

As a subject of discussion, almost all studies in the literature have specifically focused on manufacturing industry rather than industry in general. One reason behind this concentration is the "special properties" attributed to manufacturing industry. Another reason is mainly a practical aspect that industrial sector analyses based on manufacturing industry are considered to provide more accurate results in terms of cross-country comparisons.

In a series of studies, Tregenna (2009, 2013, 2015, 2016) presents a detailed discussion on the special growth-pulling properties of manufacturing industry. She associates the distinctive role of manufacturing industry among other sectors to a specific argument that has been influential in the branches of the heterodox economics. Especially the Kaldorian tradition and the structuralist economic thinking suggest that there is a

[1] Recent classification systems consider construction sector as a fourth broad category, but this change does not matter regarding our subject of discussion.

"sector-specificity in economic growth" because a unit of value-added is not equivalent across sectors especially in terms of its growth-enhancing effects. This approach differs from the mainstream growth theories that consider economic growth as sector-neutral. Even though there is an activity-specificity aspect in the newer endogeneous growth models which underline the significance of human capital and research and development, neither those endogenous models nor activity-neutral Solow-type growth models define a special role for manufacturing industry or industry in general. In the classical development economics, however, it is generally considered that there is a strong relationship between the economic growth rate of an economy and its sectoral composition. The transfer of labour to higher productive activities is seen crucial in the process of economic development. Industrialization in general, more specifically the growth of manufacturing industry, is considered as the engine of economic growth and technological advancement.

The crucial idea here is that growth in manufacturing industry pulls along aggregate economic growth in ways that growth in other sectors does not. Those growth-pulling characteristics of manufacturing industry can realize through several channels.

Probably the most striking feature of manufacturing industry is its higher potential for productivity growth. Most of overall productivity growth is considered to be derived from growth in manufacturing productivity. Hence, the expansion of manufacturing industry is supposed to stimulate economic growth through increasing overall productivity.

It is also argued that, differently from other sectors, productivity increases in manufacturing industry have a "cumulative" character. To illustrate; new farms or new service sector facilities such as retail stores, bank branches, restaurants or hospitals do not necessarily increase sectoral or overall productivity. The same situation is also valid for non-manufacturing industrial facilities such as new mines, housing constructions or water supply and sewerage systems. On the other hand, each new plant in manufacturing sector is more likely to cause an irreversible rise in productivity because newer production machines used in new plants tend to be endowed with a higher level of technology. Increasing productivity pressure also forces older firms to modernize their plants or exit from markets. Such possible developments eventually create a virtuous circle for cumulative productivity gains.

The high potential of manufacturing sector in terms of productivity gains lies behind the fact that much of technological progress occurs in this sector. Moreover, much of technological change realized in the rest of economy is also considered as disseminated from manufacturing industry. Even though almost all sectors in economy are interconnected in various scales, backward and forward intersectoral linkages of manufacturing industry are supposed to be stronger than that of other sectors. While manufacturing industry stimulates growth in other sectors by creating a demand for its inputs in the form of both products and services, more significantly, it also provides higher technology intensive inputs for those sectors as a leading source of technological innovation. Thus, it spreads the technological advancement achieved in itself to the rest of economy and leads to further productivity increases in also non-manufacturing sectors.

Another channel through which the growth-enhancing effect of manufacturing industry realizes is associated with international trade. Since manufactured products are highly tradable and generally include higher levels of value-added relative to tradable primary commodities, manufacturing industry has also a distinctive role in terms of supporting economic growth through exports. This trade aspect is especially critical for the countries suffering from the insufficient resource endowments in terms of primary commodities. Trade surpluses achieved in manufacturing sector can relieve resource-poor countries from the economic burden of trade deficits in non-manufacturing sector and balance of payment constraints resulted from necessary imports such as fossil fuels, particularly oil, and agricultural products for some countries. The relatively better economic performance of some prominent resource-poor countries such as Germany and Japan, which traditionally achieve trade surpluses thanks to their developed manufacturing industries, can be regarded as good examples of this aspect.

As mentioned above, the special properties attributed to manufacturing industry with regards to its role as the engine of economic growth are mainly affirmed within the heterodox branches of economics. Besides manufacturing industry has always been the primary subject of discussion in the literature on deindustrialization, this emphasis is justified with different reasons in some studies.

For instance, in their working paper published within the institutional body of the International Monetary Fund, Rowthorn and Ramaswamy (1997, 7) also focus on

manufacturing sector rather than industry "because much of the debate about deindustrialization has been about the loss of manufacturing jobs". They also mention the practical easiness of focusing on manufacturing industry. Because mining is significant in only a small number of advanced countries and employment in construction is volatile, including those sectors into analysis poses a difficulty when making international comparisons of industrial sector. Hence, excluding non-manufacturing sectors makes it possible to get more accurate results.

While the phenomenon of deindustrialization was of concern only for advanced countries in the beginning, it has also been discussed regarding with developing countries since the 2000s, mostly under the name of "premature deindustrialization". As developing countries have increasingly been included in the samples used in empirical studies, the focus on manufacturing industry has become more critical in terms of cross-country comparisons because the coverage of mining sector also includes the extraction of fossil fuels. Considering the fact that there are many resource-rich developing countries, it makes more sense to exclude mining sector from analyses.

Indeed, a considerable amount of evidence is provided by various studies suggesting that manufacturing sector plays a critical role in economic growth especially for developing countries (Dasgupta and Singh, 2007; Rodrik, 2013, 2014; Di Meglio and Gallego, 2022; Ravindran and Babu, 2022). On the other hand, only some subsectors of service sector that mostly connected with information and communication technologies have a similar growth-enhancing effect on economic growth.

As a result, independently of whether those "special properties" are accepted or not, there has been a clear consensus among the studies in the deindustrialization literature about the focus on manufacturing industry.

2.1.2. Employment *versus* Output

A similar consensus as that about the emphasis on manufacturing industry is not present in the literature when it comes to decide specifically which component of manufacturing industry should be regarded as the indicator of deindustrialization.

Many countries have experienced declines in both employment and output shares of manufacturing industry. While some researchers have focused solely on one of those measures, some have included both of them in their analyses. Nevertheless,

manufacturing share in employment rather than that in output has been commonly seen as the main indicator. There are several reasons for this dominant preference among researchers.

Changes in employment structure, particularly the transfer of labour from agriculture to industry, has always been a prominent point of interest relevant for industrialization and development process. Accordingly, the employment share of manufacturing industry has been a commonly used indicator for the degree of industrialization. Hence, it is not a surprising fact that such a conspicuous transformation that affects industrial sector has drawn attention to employment structure in the first place.

Since deindustrialization began, indeed, the relevant changes in employment structures have been felt more severely than those in output structures. This is partly because almost any kind of change in economic structure is likely to cause more acute results on employment side first. The immediate and more "visible" consequences such as changes in unemployment levels tend to drive public perceptions more intensely.

On the other hand, in most cases of deindustrialization, changes in employment structures have realized in more dramatic scales relative to those in output structures. While declines in the employment shares of manufacturing industry have been a common trend in many advanced economies, relatively fewer countries have witnessed a similar trend in their output structures. In the countries that have experienced declines in both employment and output shares of manufacturing industry, declines in employment shares have generally exceeded declines in output shares. Further, in addition to its falling shares, manufacturing employment has shrinked in also absolute terms relatively more frequently than manufacturing output in real terms. The consequent dramatic results such as the loss of manufacturing jobs, rising unemployment and closed factories has rendered deindustrialization a social and political phenomenon as well.

Apart from its relatively more significant effects, employment as an indicator is also considered more reliable because output measures are complicated by price movements. In addition, there is not a single type of output measure. On the one hand output shares in current prices are regarded as better in the sense of capturing the actual weights of sectors in economy, on the other hand output shares in constant prices more accurately show the changes of sectoral weights in real terms.

Nevertheless, many researchers have also used manufacturing output shares in current prices as the indicator of deindustrialization in addition to manufacturing employment shares, but mostly in a supplementary context. In some studies, by avoiding a debate on definition, output aspect has been regarded as the sole indicator probably due to the lack of sectoral employment data. Output data is more available for a longer time period especially when it comes to developing countries.

There is not any approach relevant to definition in the literature that explicitly offers solely output aspect instead of employment. However, Tregenna (2009, 433) suggests that "deindustrialization should appropriately be defined in terms of a sustained decline in both the share of manufacturing in total employment and the share of manufacturing in GDP". She states that output dimension should be given equal importance with employment because some growth-enhancing special properties of manufacturing industry and some reasons for deindustrialization operate through especially output channel.

In line with the major approach in the literature, we consider it more appropriate to define deindustrialization as a persistent fall in the share of manufacturing industry in total employment. This does not mean that output measures are useless in terms of deindustrialization analyses.

Certainly, to conclude whether a country deindustrializes or not, a proper analysis should elaborate on a broader set of indicators regarding manufacturing industry. Absolute employment levels, output levels and shares in terms of both current and constant prices, the size and the time period of changes in those measures should also be checked. Each measure shows a different aspect that cannot be captured by one another. Neglecting some of those aspects may result in misleading results. Apart from output measures, ignoring even another employment measure may lead us to a wrong conclusion. For instance, it would not be a sound diagnosis of deindustrialization for a country, of which manufacturing employment declined by a few percent in the sense of its share while it increased at a much higher rate in numbers in the same period.

However, as well as how a single indicator is insufficient to explain such a complex phenomenon, using two indicators instead does not bring us to a perfectly smooth ground that is completely safe from such difficulties related to the complexity of reality.

Any theorization of a real phenomenon inevitably requires a kind of simplification that misses some aspects of reality, but also it paves the way for a better comprehension. In this sense, focusing on a single "main" indicator without neglecting other related aspects provides a better discussion ground through setting an easily measurable and uniform reference point to start analyses.

Given that output measures are divided into two in the sense of current and constant prices, and they are strongly affected by relative price movements, employment measures are more reliable and uniform. Among employment measures, for the reason that absolute employment levels are unable to show current sectoral weights in economy, the employment share of manufacturing industry seems to be the best main indicator for deindustrialization.

As mentioned above, the emphasis on employment aspect in the literature has partly arisen from the fact that some countries diagnosed with deindustrialization have witnessed a decline in only employment shares of manufacturing industry without a concomitant decline in manufacturing output shares. The existence of such cases has provided ground for some affirmative arguments with regards to reasons for deindustrialization such as the maturation argument. Excluding those cases from deindustrialization analyses would mean to declare some of the most influential arguments in the literature as irrelevant.

2.2. Reasons for Deindustrialization

The research on the reasons for deindustrialization has constituted the initial and the main branch of the literature on deindustrialization. However, discussing those reasons on theoretical ground is not an easy task even today because there is not a consensus in the literature. The variety in explanations is already presented in the following chapter when reviewing previous studies. We will focus on our conceptualization in this section.

We consider it appropriate to cluster the reasons for deindustrialization under four titles, as presented in the previous chapter. Those are economic maturation, productivity growth differences, international trade, and economic failures.

The statistical illusion aspect, which corresponds to illusory results in employment statistics caused by outsourcing practices is not counted among the reasons for deindustrialization because it is not an actual reason.

2.2.1. Economic Maturation

The maturation argument is one of the most prominent explanations for the phenomenon of deindustrialization. It predicts a transition from primary to secondary sectors first and from secondary to tertiary sectors eventually in the process of economic development. Thus, as a logical consequent of this argument, deindustrialization is considered as an inevitable result of a successful development process.

The first comprehensive conceptualization of economic maturation was introduced by Rowthorn (1986) to the literature on deindustrialization. Figure 2.1 illustrates his conceptualization.

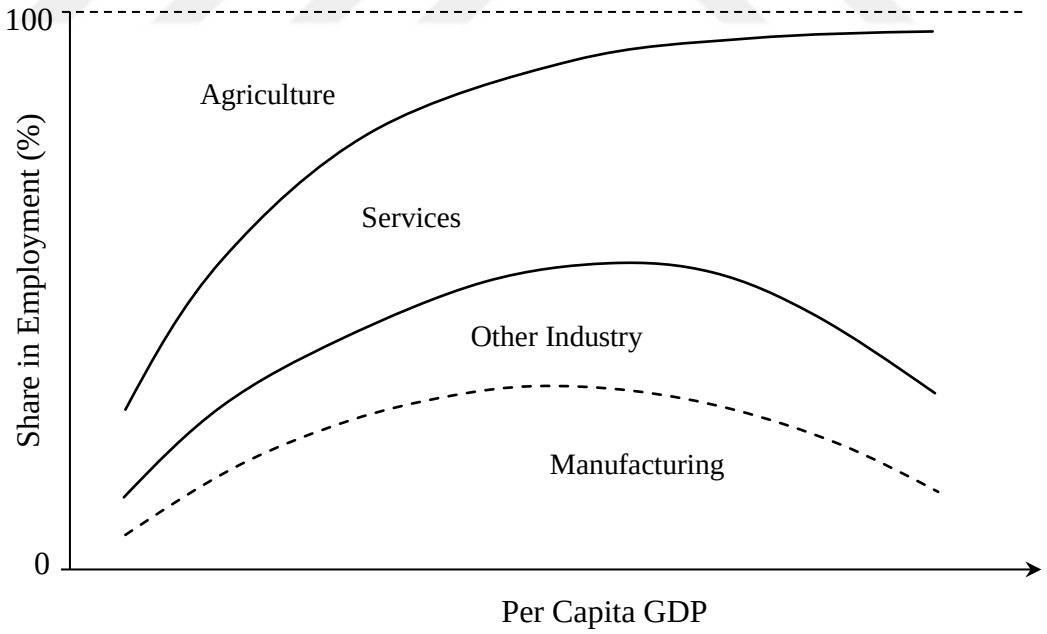

Figure 2.1: Employment Structure and Economic Development

Authors' redrawn version of a similar figure in the study of Rowthorn (1986, 9).

In the beginning stage of development, both industrial and service sectors grow by increasing their shares in total employment at the expense of agriculture. In the intermediate stage, the share of industry stabilizes while service sector continues to grow still at the expense of agriculture. In the final stage of development at which an economy reaches to the level of maturity, because only a small part of labour force is employed in agriculture, service sector employment continues to expand at the expense of industrial employment. As can be noticed in Figure 2.1, such a transformation in employment structure suggests an inverted-U relationship between manufacturing employment share and income per capita.

One aspect that commonly mentioned in various studies as a mainstay for the maturation argument is the well-known Engel's Law. Based on the housekeeping surveys he counducted in the mid-19th century, Engel found an expenditure pattern that the proportion of household income spent on food falls as income rises even if the expenditure on food in absolute terms increases. This empirical regularity led him to infer that agricultural sector would decline relative to other sectors in the course of development.

Engel's Law may be an interesting source of inspiration for the studies focusing on cross-country differences based upon income levels. However, considering the sophisticated production processes of today's modern economies, treating the share of agriculture in a country's output as the equivalent component for the food expenditure in a household budget can be problematic. To illustrate, in addition to fullfil a part of need for nutrition, agricultural products are also used as inputs in chemical and pharmaceutical industries. On the other hand, a significant amount of food production is provided by manufacturing industry. Moreover, together with textiles, food and beverages subsector constitutes one of the largest parts of manufacturing industry in terms of both employment and output in many developing countries.

A less known but more relevant conceptualization was later proposed by Clark (1940). Using the descriptive statistics extracted from different censuses conducted in many countries, he concluded that the "generalization of available facts" indicates "the most important concomitant of economic progress, namely the movement of working population from agriculture to manufacture, and from manufacture to commerce and services" (ibid, 176).

Clark called this generalization as “Petty’s Law”, referring to a similar set of inferences drawn by William Petty centuries ago. Although their argumentations appear to be similar, Petty’s intention was actually different. Focusing on wage variations between occupations, he associated cross-country differences in terms of national wealth with different employment shares of broad sectors. More specifically, he attributed higher income levels in Holland to the employment of fewer husbandmen and proposed decreasing the weight of husbandry in favour of manufacture and merchandize to increase total wealth in England:

> There is much more to be gained by Manufacture than Husbandry, and by Merchandize than Manufacture. … as Trades and curious Arts increase; so the Trade of Husbandry will decrease … if all the Husbandmen of England, who now earn but 8d. a day or thereabouts, could become Tradesmen and earn 16d. a day … then it would be the advantage of England to throw up their Husbandry … and if Trade and Manufacture have increased in England (that is to say) if a greater part of the People, apply themselves to those faculties … than when Husbandmen were more numerous, and Tradesmen fewer. (Petty, 1690)

It can be said that the causes in the analysis of Petty were considered as the necessary results in the progress of development by Clark. Inspired by the mostly intuitive inferences of Petty, Clark argued that a succesful process of development necessitates an ordered movement of working population between three broad sectors.

Furthermore, he also proposed two specific causes operating behind this process. The first is the changes in consumer demand patterns. In line with Engel’s Law, consumer demand can shift from primary to secondary products or tertiary services as income levels rise. The second reason emerges independently of consumer demand patterns. Even if consumer demand remains completely stable, output per worker may increase more rapidly in some sectors and this results in a transfer of labour from those sectors to others.

Besides all these, as a more relevant aspect for the phenomenon of deindustrialization, Clark observed a specific tendency in several advanced countries for the proportion of working population engaged in secondary production to start falling after reaching a peak, while that engaged in tertiary production to rise.

When all relevant explanations considered together, it can be said that the maturation argument sounds reasonable in general. However, there is not a consensus among researchers about the actual mechanisms operating behind it. Two possible explanations are frequently proposed, change in demand patterns and productivity

growth differences. While some researchers point out the former explanation as the mainstay, some point out the latter, and some propose a combination of both of them. Many researchers, on the other hand, consider producticivity growth differences as a separate reason, as is discussed in this study.

2.2.2. Productivity Growth Differences

The aspect of productivity growth differences mentioned in the literature on deindustrialization specifically represents higher productivity growth rates achieved in manufacturing industry relative to those in service sector.

It is a well-known stylized fact that most part of total productivity growth stems from specifically manufacturing industry. Productivity gains in other sectors are assumed to be mostly diffused from manufacturing industry.

If productivity growth rates are not equal among different sectors and demand patterns do not change much in an economy, the sector with higher productivity growth is expected to require continuously less amount of labour to meet its demand as time progresses. Thus, it is expected to be a transfer of labour away from sectors in which labour productivity grows more rapidly to sectors that have lower productivity growth rates. Even to just keep its employment share constant, the sector with higher productivity growth needs continuously increasing demand.

This aspect is discussed under the title of technology or technological advancement by some researchers. Sectoral productivity data is used to examine its effect. However, rather than productivity in just manufacturing industry, the ratio of productivity in manufacturing to that in service sector is used in the literature on deindustrialization because the phenomenon in question here is the replacement of manufacturing industry by service sector.

2.2.3. International Trade

International trade may affect the employment structure in various ways. These possible impacts can be discussed within the context of two main axes: Impact mechanism and the income levels of trade partners.

The type of impact mechanism determines the eventual outcome. To begin with, import penetration in the market for manufacturing industry products may deteriorate the development of domestic manufacturing sector. This type of a mechanism has long

been considered among the most significant reasons for the economic underdevelopment of many countries.

On the other hand, manufacturing sector imports do not necessarily have a negative impact on domestic industry. If manufacturing imports mostly consist of low-tech products, those imported goods may satisfy domestic needs and make it possible for labour force to concentrate on medium or high-tech manufacturing subsectors. In such a scenario, because higher-tech subsectors require less amount of labour, the employment share of manufacturing industry in total employment falls but the share of skilled labour within manufacturing employment rises. Similarly, as the neoclassical school suggests, exposure to free trade may force domestic firms to increase their productivity levels to be able to compete with foreign firms.

Income levels of trade partners can be discussed under tree categories: North-North, North-South and South-South. While North countries correspond to advanced or industrial "core" countries; South countries are underdeveloped or developing "periphery" countries.

North-South trade has been considered as one of the most important reasons for deindustrialization in advanced countries. Because wages tend to be higher in advanced countries, imports from developing countries in which labour is cheaper may force domestic firms in advanced countries to exit from market. Another channel is offshoring practices. Domestic firms may also prefer to move their production to the South.

In a similar manner, South-South trade may cause deindustrialization in developing countries. The increasing integration of developing Asian economies into the global economy, especially China, caused great concern in the 2000s within the context of premature deindustrialization. Rodrik (2016) argues that deindustrialization in developing countries is more likely to be driven by trade and globalization while that in advanced countries mostly results from technological progress.

Trade between advanced countries, namely North-North trade, has also been examined by some studies in the literature, mostly as a control variable. The impact mechanism in this context is not based on wage differentials among advanced countries. Some advanced countries traditionally tend to specialize in manufacturing sector in the world economy, such as Germany and Japan. Those countries generally experience trade

surplus thanks to their manufacturing industries and exhibit different patterns in terms of employment structure relative to other advanced countries.

Most of the studies in the literature have primarily focused on the aspect of international trade, more specifically, on the impact of North-South trade on the employment structure of advanced countries.

2.2.4. Economic Failure

Economic failure aspect is probably the most ambiguous one among the reasons for deindustrialization. Specific mechanisms are proposed for other reasons about how they result in deindustrialization. However, economic failures may realize in a wide range of forms.

Economic failures contributing to deindustrialization can be discussed under two axes. There may be global or domestic failures, and economy-wide or manufacturing industry related failures. Certainly, the interrelation among these dimensions cannot be ignored in especially today's world. Nevertheless, it may be useful to discuss a wide range of failure aspects under four broad categories.

Global crises may affect many countries at the same time. As mentioned above, temporary falls in manufacturing employment shares should not be considered as the realization of deindustrialization. However, some global crises such as the 1929 Great Depression or the 2008 Great Recession may cause long-term adverse consequences. On the other hand, globally effective policy shifts such as abandoning social wealth policies, switching to neoliberal policies or liberalization of capital movements may also affect employment structures.

Domestic failures can realize in more various ways. Domestic employment structures may deteriorate as a consequence of various policy mistakes, wrong monetary policies, domestically sourced crises, political instabilities, etc.

Finally, while some factors may result in economy-wide failures, some can be specifically effective on manufacturing industry. A slowdown or a shrinkage in economic growth probably affects all sectors in an economy. On the other hand, some factors that may be seen as positive developments for general social wealth under certain circumstances, such as appreciation of domestic currency, may result in adverse effects on manufacturing industry.

3. EVIDENCE FROM PREVIOUS STUDIES

Early studies generally tended to attribute deindustrialization to a single cause using mostly descriptive analysis methods. Empirical studies using various methods have provided more detailed evidence. Especially the studies based on econometric methods have tried to examine all the factors proposed as the reasons for deindustrialization by that time. We will discuss the evidence provided by the previous studies in this order according to the analysis methods used.

3.1. Descriptive Analyses

A notable early study is that of Bacon and Eltis (1976). According to the authors, a specific chain of events triggered by the expansion of public services as a non-market sector was the reason behind deindustrialization in Britain. Their argumentation can be roughly expressed in the following way. The increasing size of public services was accompanied by a rise in public expenditures and taxes. Higher tax burden on employees triggered inflationary wage claims. The consequent pressure on profits caused a decline in investments. As a result, productive resources were transferred from market sectors such as manufacturing to non-market services.

Singh (1977) addresses international factors as the cause. The increasing participation of Britain in the international economy under the given institutional arrangements, specifically free trade and the free convertibility of currency, caused a "structural maladjustment" in the economy. The liberalization of trade became detrimental to the British industry which was weak relative to its foreign competitors. While it led to a fast increase in imports of manufactured goods, this increase was not compensated by a concomitant rise in exports. In short, the British manufacturing industry failed to compete with its foreign rivals under the given free trade conditions. That failure in international competition caused deindustrialization in Britain.

In their comprehensive study, Rowthorn and Wells (1987) define three main factors by which the employment share of manufacturing is determined. These are economic development level, foreign trade structure and the phase of business cycle. Based on

international comparisons of employment structures and real incomes, the authors argue that economic development level is the most influential one among those factors. Trade specialization mostly did not change the general trend, except for Britain. Business cycle factor imposes only temporary effects on employment structures. They also define two types of deindustrialization. A developed and highly industrialized country may experience positive deindustrialization if it can achieve full employment and a continuous rise in real income during the process. On the other hand, due to adverse developments such as a severe recession, real income and industrial output may stagnate. In this case, service sector cannot absorb the labour displaced from manufacturing sector, and unemployment rises. While positive deindustrialization can be experienced in only advanced countries, negative deindustrialization may affect all countries at any level of development. The authors expect a positive deindustrialization in Japan in the coming decades and consider the experience of Britain as a case of negative deindustrialization. The authors also provide an econometric analysis which is discussed in detail in the following section.

3.2. Empirical Analyses

Unsurprisingly, econometric analyses have been the dominant method of empirical research in the literature. The empirical analysis provided in this study is also based on econometric methods. Accordingly, in order to make it easier for the audience to compare our analysis with the previous analyses, we elaborate on the econometric studies more thoroughly relative to other empirical studies.

Nevertheless, a few studies based on different empirical methods have drawn notable attention in the literature and have been frequently cited in also econometric studies as a point of comparison. Let us first briefly discuss on those studies.

One prominent study in this sense is that of Wood (1994). To measure the effect of the North-South trade on deindustrialization, he uses factor content of trade method, which allows to disaggregate factor contents in trade flows. His estimations suggest that the changes in trade with the South up to 1990 reduced the demand for labour in the Northern manufacturing by 12%. On the other hand, trade with the North increased the demand for labour in the Southern manufacturing by 11% in the same period. He argues that the imports of manufactured goods from the South was the main cause of deindustrialization in the Northern countries. He accepts the effect of economic

maturation. However, by comparing the actual decline in the Northern manufacturing employment with his simulation results based on the mathematical model provided by Rowthorn and Wells (1987, 321-332), he concludes that up to only 3 of 7 percentage points decline in the total manufacturing employment of all OECD countries between 1960 and 1989 can be seen as a consequence of economic maturity. He attributes the rest and the greater part of the decline to the changes in trade with the South. He proposes that his hypothesis is more consistent with the time-path of deindustrialization.

Using a similar method of input-output analysis based on factor content calculations, Kucera and Milberg (2003) estimates the impact of international manufacturing trade on deindustrialization in 10 OECD countries from the late 1970s to the mid-1990s. Thanks to their industry-level dataset that also includes the data for 22 manufacturing sub-industries, their conclusions are quite detailed and interesting. The country-level results suggest that the North-South manufacturing trade expansion accounted for just over one-fifth of the decline in manufacturing employment shares. When it comes to absolute numbers, however, it is estimated that over one-half of manufacturing job losses were driven by the North-South trade. That disparity derives from the fact that decline in manufacturing employment shares were mostly driven by increases in total employment rather than decreases in manufacturing employment. The industry-level results reveal large losses in labour-intesive industries, and in some higher-tech industries that were strategically targeted by the industrial policies of developing countries. However, even though some industries distinguish with more severe shrinkages, employment losses cover 20 of 22 manufacturing industries. According to the authors, this pattern of sector-wide employment losses was not the result of rising imports from the Southern countries. It was because of the decline in exports to those countries after the debt crises affected developing economies in the 1980s.

Tregenna (2009) utilizes mathematical decomposition techniques to examine the heterogeneous practices of deindustrialization in 48 countries over the period from the 1980s to the beginning of the 2000s. Through three different decomposition analyses, she calculates the effects of labour intensity, sector growth, sector share, economic growth, and labour productivity aspects on various “deindustrializations”. Based on the total results of those three decompositions, the countries in the sample are classified into four broad categories. In the first set of countries, only the labour intensity effect

is negative. The decline in the employment shares of manufacturing industry in these countries is primarily a result of the rise in manufacturing labour productivity. In the second category which covers half of the countries in the sample, the sector share effect is also negative, which means that the declining trend in the employment shares of manufacturing industry is accompanied by also a decline in the GDP shares. In the third category, the sector growth effect is negative as well in addition to the labour intensity and the sector share effects. This result demonstrates that manufacturing value added shrank in real terms in these countries. In the fourth category, the labour intensity effect is positive, and the labour productivity effect is negative for most of the countries. The first and the second categories mostly include high income countries while middle income countries generally fall into the third and the fourth categories. Tregenna (2009) does not directly examine the alleged reasons in a way that suggests a causal connection with deindustrialization. Instead, she addresses the heterogeneity in some related indicators amongst countries. Nevertheless, such an analysis can provide some intuitive perceptions about the reasons. She especially emphasizes that such a methodology can be useful in distinguishing between "positive" and "negative" deindustrialization, a conceptualization that originally proposed by Rowthorn and Wells (1987).

Palma (2005) identifies the four "sources" of deindustrialization. Rather than being reasons, these "sources" should be regarded as empirical patterns related with deindustrialization. Inspired by the study of Rowthorn (1995), he builds his analysis on the illustrations of the quadratic fitted curves that are drawn from the cross-sectional regressions of manufacturing employment shares on the logarithms of GDP per capita levels and their squared terms. The first "source" indentified is the existence of an inverted-U relationship between the two variables. Second, this relationship tapers off in time, which means, manufacturing employment shares corresponding to turning points decline over years. Third, income per capita levels corresponding to turning points also decline over years. Fourth, the Dutch Disease causes additional deindustrialization. The Dutch Disease is defined in a broad sense here, which covers the countries specialized in any kind of non-manufacturing exports including primary commodities and services. In a later study, Palma (2008) carried out a similar analysis with more recent data but could not find a "declining" pattern with regards to the third

"source". Thus, he updated it as "changing" income per capita levels corresponding to turning points.

When it comes to econometric analyses, the regression model suggested by Rowthorn and Wells (1987) in their comprehensive book can be regarded as the pioneer model in the literature on deindustrialization. Using the data for 12 developed OECD countries covering the period 1953-1978, the authors run cross-section and panel regressions. The dependent variable is the share of manufacturing industry in total employment. As the explanatory variables, they use the logarithm of real income per capita, the squared term of this variable, the ratio of net manufacturing exports to GDP, and unemployment level. These variables are used for capturing the effects of economic development level, trade specialization, and business cycle factors, respectively. According to the empirical results of this analysis, while the ratio of net manufacturing exports to GDP is the most important variable in explaining cross-country differences in manufacturing employment, intertemporal differences within individual countries mostly stem from income per capita and unemployment changes. These results are consistent with the authors' inferences suggesting that deindustrialization experienced by many advanced countries in the subsequent decades after the WW2 resulted primarily from economic development and partly from the recession in the 1970s. On the other hand, the reliability of those results is suspicious in statistical terms because the number of observations in the analysis is very low. While the number of observations spans between 9 to 12 in cross-sectional regressions, it rises to just 67 observations in panel regressions due to using 5-year intervals in the period 1953-1978. Nevertheless, probably because of being one of the earliest empirical analyses in the literature, the results and the formation of this model have been quite influential.

The empirical method of Rowthorn and Ramaswamy (1997) follows the general approach of Rowthorn and Wells (1987). Using a larger dataset capturing 21 OECD countries in 7 selected years over the period 1963-1994, the authors also estimate the effects of investment and the North-South trade. Their estimation results are similar as well as the model formation. There is an inverted-U relationship between income per capita and manufacturing employment share. Trade specialization is the most significant factor explaining cross-country differences. There is also evidence for the contribution of the falling investment rates to deindustrialization. On the other hand,

in contrast to the hypothesis of Wood (1994), there is little evidence for the effect of the North-South trade on deindustrialization. However, that conclusion should be treated with caution because it is based on the results of the pooled estimations. In the panel regressions including country dummies, the authors do not incorporate the variables capturing the effects of the North-South trade.

Saeger (1997) criticizes the accuracy of Rowthorn and Ramaswamy's (1997) claim about the "little" impact of the North-South trade on deindustrialization, by addressing the lack of country dummies in the relevant regression analyses. He emphasizes the essentiality of controlling for persistent country-specific factors when analyzing deindustrialization. In line with this approach, his empirical model is based on fixed effects estimation method. Utilizing the panel data for 23 OECD countries for the selected years between 1970 and 1990, he examines three explanations for deindustrialization. The focal explanation of the study is the North-South integration. Gross trade flows for the imports from and the exports to the South are used to measure this explanation, in addition to intra-OECD trade flows as the control variables. Another explanation is economic maturity that resulted from differential productivity growth between manufacturing and service sectors. Income per capita with its squared term and the ratio of real value added per employee in manufacturing to that in services are incorporated in separate specifications to examine economic maturity. Differently from the most studies in the literature, the third explanation is defined as changing relative endowments. In this sense, the production values of some natural resources are used to measure the effect of the Dutch Disease. In addition, human capital endowments are measured as the average years of higher education. A variety of fixed effect specifications provided in the study suggest a strong and robust evidence for the contribution of imports from the South and oil production to deindustrialization in the OECD countries, and a robust inverted-U relationship between income per capita and manufacturing employment share.

Extending the analytical framework provided in their previous study, Rowthorn and Ramaswamy (1999) uses a larger dataset, the annual panel data for 18 OECD countries over the period 1963-1994. This time they incorporate country dummies in all regressions but reach similar results. They conclude that more than half of deindustrialization was caused by the normal process of economic growth. On the other hand, the North-South trade contributed less than 20% to the decline in the

employment share of manufacturing, which was close to the effect of falling investments in magnitude. Moreover, they argue that imports from the South contributed deindustrialization mainly through stimulating labour productivity in the Northern manufacturing.

Rowthorn and Coutts (2004) update and extend the analysis of Rowthorn and Ramaswamy (1999) with new variables and a larger dataset covering 23 countries over the period 1963-2002. Their results are mostly similar. In addition, there is evidence for the contribution of trade openness to deindustrialization. The impact of imports from China is also measured but the relevant results are inconclusive.

Taking the regression model of Rowthorn and Wells (1987) as the baseline model, Alderson (1999) also examines the role of two additional aspects, which are direct investment outflows and Southern import penetration. As for the baseline model variables, his results are partially in line with the findings of Rowthorn and Wells (1987). There is evidence for the negative effect of unemployment and the positive effect of net manufactured exports to GDP ratio on manufacturing employment shares, and for the inverted-U relationship between income per capita and manufacturing employment shares. While unemployment variable is more successful in explaining within-country variation, net manufacturing exports to GDP ratio is a more powerful predictor of cross-country variation in deindustrialization patterns. However, in contrast to the findings of Rowthorn and Wells (1987), the analysis results of Alderson (1999, 710) suggest that income per capita variable is poorer at explaining within-country variation. Besides these, the author incorporates the new variables, direct investment outflow per capita and Southern import penetration as a percentage of GDP, to measure the effect of globalization on deindustrialization. Both of those variables have negative and statistically significant coefficients as expected, and both have a noticeable power in explaining cross-country variation.

Kang and Lee (2011) examine the role of investment flows in a more focused way apart from the usually addressed aspects. They examine the effect of foreign direct investment (FDI) flows on deindustrialization using the data for OECD countries from the 1980s to the end of the 2000s. Differently from the usual preference of using fixed effect estimator, their analysis is based on the generalized method of moments (GMM). Their findings are mostly in line with the rest of the literature. Most notably, the empricial results confirm an inverted-U relationship between income per capita and

manufacturing employment share, and a statistically significant effect of productivity differentials between manufacturing and services on deindustrialization. When it comes to FDI flows, the results suggest the negative impact of FDI outflows and the positive impact of FDI inflows on manufacturing employment shares, as expected.

Kollmeyer (2009) examines direct and indirect causes of deindustrialization using the panel data for 18 OECD countries over the period 1970-2003. To measure the impact of internal or domestic factors, he uses the variables income per capita with its squared and cubed terms, and cumulative productivity differential between manufacturing and services with its squared term. Differently from the previous studies, he argues that income per capita variables indicate the shift in demand patterns from manufactured goods to services. Imports and exports between the North-South and the North-North trade as a percentage of GDP represent the global factors. He estimates the relative weights of the factors demand shift, productivity differential and the North-South trade as 34%, 15%, and 24%, respectively. He also estimates the indirect effects of the global factors through the domestic factors. While unemployment as the control variable for economic failure effect accounts for 15%, time dummies account for 13%. He attributes the weight of time dummies to steadily rising human capital and outsourcing practices. His findings on the indirect effects suggest that the North-South trade promotes deindustrialization also indirectly through rising income and increasing productivity differential between manufacturing and services.

Van Neuss (2018) clusters the existing explanations under four categories as (1) non-homothetic preferences, (2) technology, (3) input-output linkages and outsourcing, and (4) international trade. Non-homothetic prefences express changes in demand patterns with respect to changes in income. The variables income per capita and its squared term are used to measure the effect of these changes. The ratio of labour productivity in manufacturing to that in services denotes the effect of technology. To measure the effect of outsourcing, the ratio of intermediate consumption to gross output in manufacturing is incorporated. The contribution of international trade is captured by a set of trade variables. The author argues that most studies in the literature underestimate the effect of the North-South trade due to inappropriate variable selection. More clearly, he claims that usual trade variables in the form of GDP shares are likely to give misleading results in terms of manufacturing trade because GDP includes also non-manufacturing sectors. He suggests using trade flows as a

percentage of total gross output in manufacturing, instead of those as a percentage of GDP. The empirical results are consistent with this argument. He controls the trade flows in the form of both GDP shares and manufacturing output shares. When the variables in the form of manufacturing output shares are incorporated, the magnitudes of the coefficients on the export variables decrease relative to the case in which GDP shares are used in the model. That means the positive contribution of exports to manufacturing employment is overestimated when GDP shares are incorporated. On the other hand, while the negative contribution of the import variables rises more than twofold, their significance levels increase as well. More importantly, the negative effect of the trade with the South becomes more visible. The rest of the results is in line with the previous empirical research. They confirm the contribution of productivity differentials between manufacturing and services on deindustrialization as well as the inverted-U relationship between income per capita and manufacturing employment.

4. SAMPLE DATA AND EMPIRICAL OVERVIEW

It is not easy to obtain an open-access cross-country dataset which includes sectoral breakdowns and covers a long time span. Moreover, unfortunately, using a single database that covers all variables is not possible when conducting an empirical study on deindustrialization. Considering the fact that collecting data from many different sources may pose a reliability problem to an econometric analysis, the data used in this study is retrieved from two main sources.

The data for trade flows is extracted from the the United Nations Commodity Trade Statistics (UN Comtrade) database through the World Integrated Trade Solution (WITS) tool provided by the World Bank.

All other data is extracted from the OECD data. The data for employment, value-added and gross fixed capital formation is taken from the OECD Structural Analysis (STAN) database. Among various STAN database series, that covering the latest data for the 38 OECD countries based on Revision 4 of the International Standard Industrial Classification of all activities (ISIC Rev.4) and the System of National Accounts 2008 (SNA08) is used. Unemployment data is taken from the employment by activities and status dataset which is a subset of the OECD Annual Labour Force Statistics (ALFS) database. GDP and GDP per capita data is taken from the Annual National Accounts Statistics.

There are two main restrictions on our dataset. The two OECD countries, Costa Rica and Israel, are automatically dropped from the econometric models by Stata due to lack of data. Productivity data for those countries is totally missing. Colombia is also excluded from tha sample to get a more balanced dataset because it has only five observations for employment and productivity variables. Excluding Colombia does not cause a significant effect on the results.

The other restriction on the sample is about the time interval. The years out of the period 1992-2019 are also automatically dropped from the analyses by Stata due to lack of data. The restriction about the starting year stems from the existence of the

East-European post-Soviet countries and Germany in the sample. The data for those countries before the year 1992 is almost totally missing. On the other hand, the last available data is present for the year 2019.

In conclusion, our dataset covers the data for the 35 OECD countries in the period between 1992-2019. Because there are missing values mostly resulting from the lack of productivity data, the number of observations in the empirical models is 844, which is quite high relative to those in the previous studies. A more detailed information about the sample data is given below when discussing variables thoroughly.

4.1. Explained Variable: Employment Share of Manufacturing Industry

Following the vast majority of the literature, the explained variable incorporated as the indicator for deindustrialization in this study is the share of manufacturing industry in total employment. It is calculated through the employment data extracted from the OECD STAN database.

Figure 4.1 shows the trajectory of manufacturing employment shares over years by countries. A general falling trend is easily noticeable for most countries during almost the whole period. Only some Eastern European countries distinguish with stable trends.

Considering the fact that real GDP per capita rises almost continuously over years in all of the countries in the sample, an inverted-U shaped pace for manufacturing employment shares is expected. There is not such a picture within the period covered by our sample, as is seen in Figure 4.1. This is not surprising because it is obvious that all countries in the sample experienced an industrialization phase in the preceding period that is not covered by our sample. Thus, it can be concluded that the alleged inverted-U shaped trajectory for manufacturing employment shares in the process of development as the maturation argument suggets is present when countries are considered separately.

However, the postulate of the maturation argument on the transformation of employment structure in development process is more about cross-country differences in employment structures with respect to different per capita income levels. This aspect will be discussed in the following section.

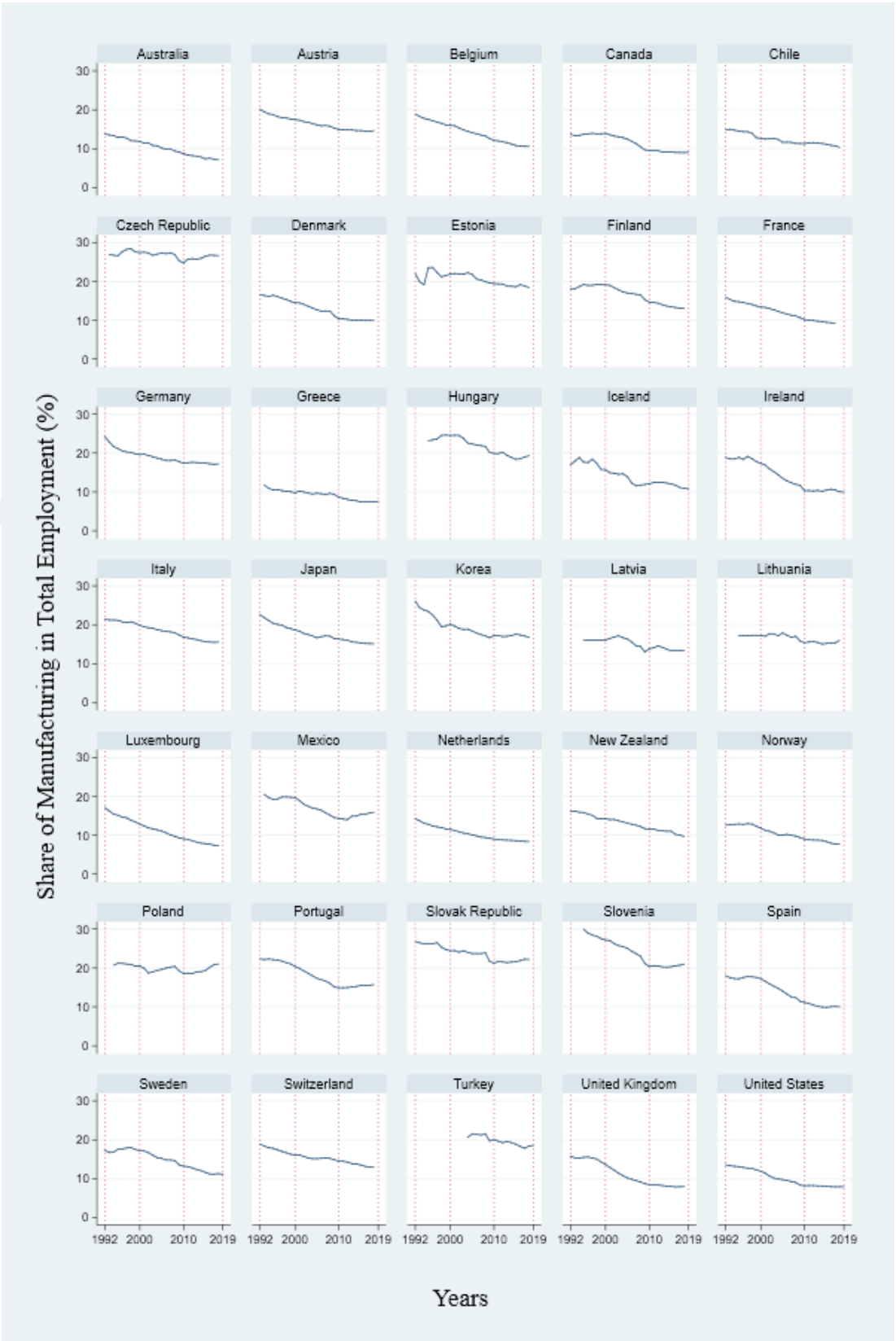

Figure 4.1: Share of Manufacturing Industry in Total Employment

Source: Authors' calculations based on employment data extracted from the OECD STAN database.

4.2. Explanatory Variables

Explanatory variables are chosen to measure the effects of the reasons presented in Section 2.2 under four categories. The variables income, relative productivity and international trade flows are used to examine the alleged reasons economic maturity, faster productivity growth in manufacturing industry, and international trade, respectively. To examine the economic failure aspect, two variables are incorporated, unemployment and investment. The justification for the chosen variables and their calculation methods are discussed thoroughly in this section.

4.2.1. Income per Capita

The natural logarithm of PPP adjusted GDP per capita in constant 2015 US dollar terms is used as the income per capita indicator. The data is extracted from the OECD Annual National Accounts Statistics.

Figure 4.2 shows the relation between manufacturing employment shares and income per capita. More clearly, it demonstrates the scatter plots and the quadratic fitted curves by years. The quadratic fitted curves illustrate the regressions of manufacturing employment shares on the natural logarithms of income per capita and their squared terms.

It can be said that, without controlling other variables, there is weak evidence for the alleged inverted-U relationship between manufacturing employment and income per capita. An obvious inverted-U shape is not present, but there is at least a concave relationship for most of the years.

Income per capita variable is controlled in all empirical studies in the literature without exception. However, it is ambiguous that which effect it represents. While some researchers argue that it captures the effect of income increases on domestic demand for manufactured products, some suggest that it demonstrate the effect of productivity differences between manufacturing and service sectors as a proxy variable.

According to us, using this variable does not provide any insight for changes in domestic demand patterns because the dependent variable manufacturing employment share is not a measure of domestic demand for manufactured products. On the other hand, the latter argument is partially consistent with our empirical results, as mentioned in Chapter 5.

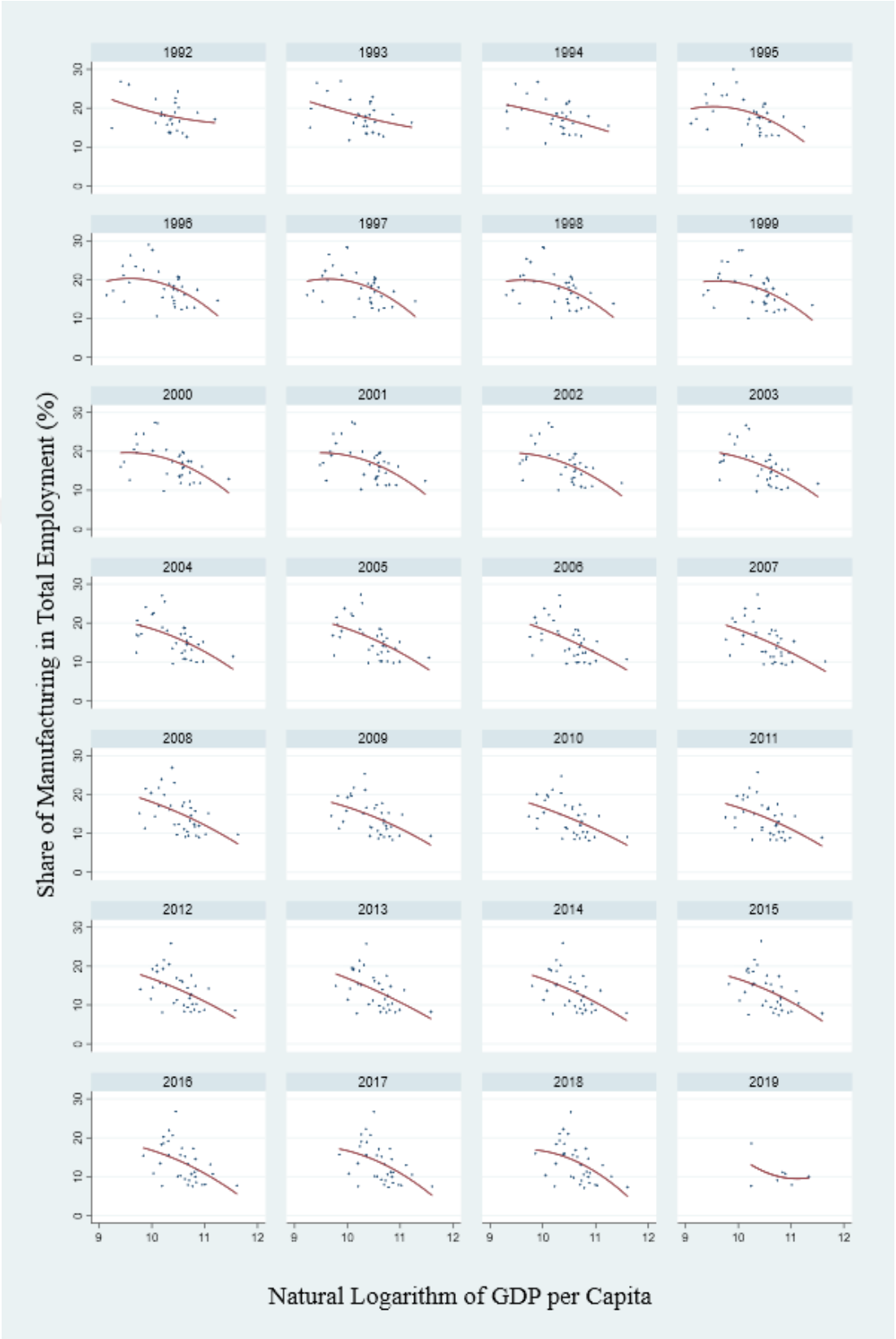

Figure 4.2: Manufacturing Employment Shares and Income per Capita

Source: Authors' calculations based on employment data extracted from the OECD STAN database and GDP per capita data extracted from the OECD Annual National Accounts Statistics.

4.2.2. Relative Productivity

Relative productivity demonstrates the ratio of real value added per person employed in manufacturing industry to that in service sector. It is calculated using sectoral value added at constant 2015 prices and employment data from the OECD STAN database.

Figure 4.3 shows the trajectory of relative productivity over years by countries. The existence of a mild but continuous rising trend for most countries can be noticed esasily. Ireland distinguishes with a dramatic increase from other countries. A few countries have a stable trend. Only one country, Chile, exhibits a decresing trend in terms of relative productivity. However, it has many missing values and so such an inference should be treated with caution. All in all, the argument that productivity growth in manufacturing sector generally exceeds that in service sector seems to be consistent with the data.

Figure 4.4 shows cross-country comparison of relative productivity by years. It includes the scatter plots and the fitted lines. The quadratic fitted curves are also checked as in Figure 4.2, but they are not presented here because the linear fitted lines and the quadratic fitted curves mostly exhibit a similar pattern.

The data illustrated in Figure 4.4 suggests a strong negative relationship between manufacturing employment shares and relative productivity. The distribution of the scatter plots demonstrates that the negative relationship is stronger in the beginning years of the period in question. It is even visible to the naked eye, without the help of the fitted lines. However, although it continues to exist, that negative relationship wanes and the slope of the fitted lines decreases over years.

All in all, the arguments proposed in the literature about relative productivity seems to be consistent with the data. Productivity growth in manufacturing sector generally exceeds that in service sector, as shown in Figure 4.3. There is a strong negative relationship between relative productivity and the share of manufacturing industry in total employment, as depicted in Figure 4.4.

However, it should be considered that those inferences are drawn from only descriptive analyses yet. All possible explanations should be checked together to get more reliable results, as is done in the following chapter.

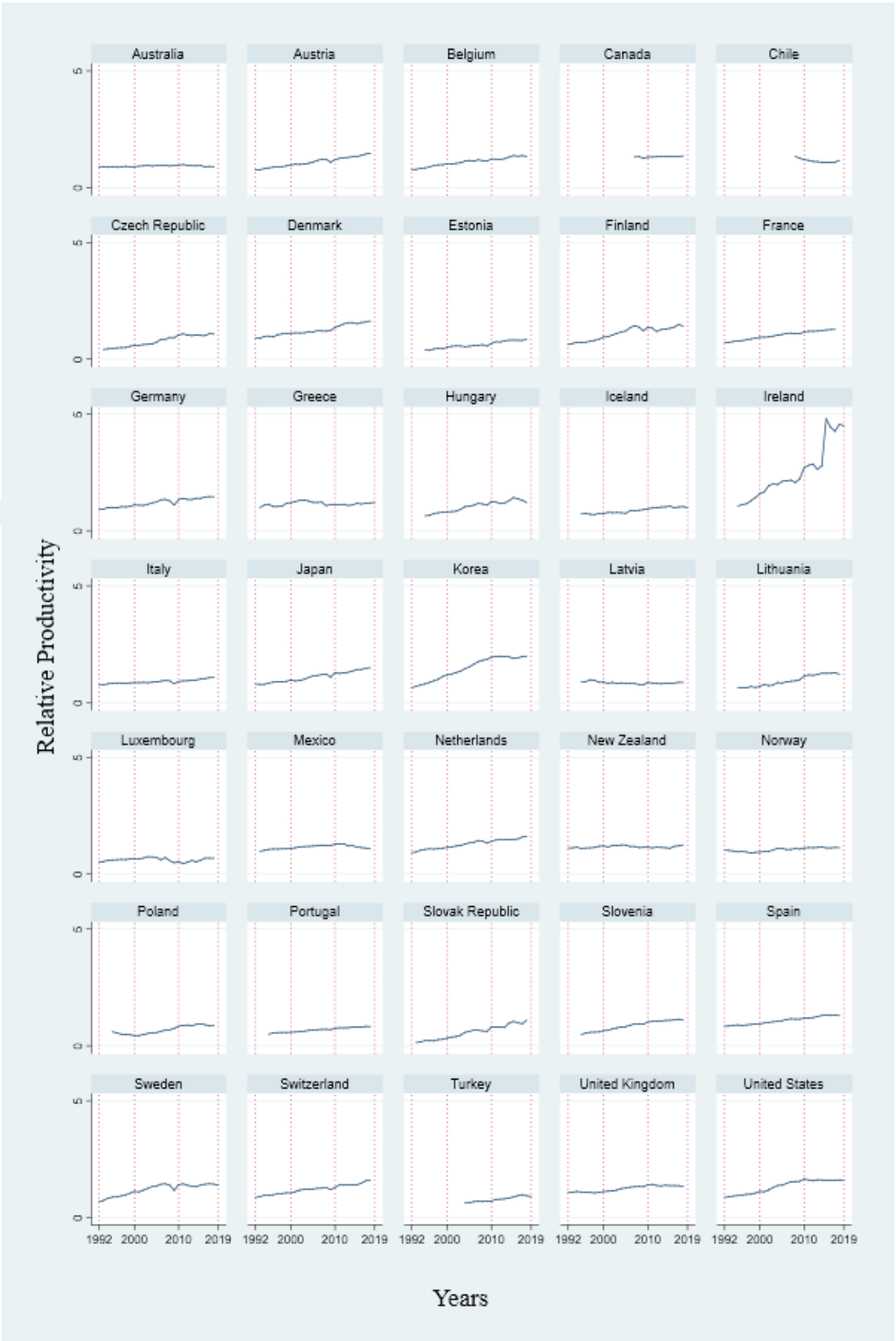

Figure 4.3: Relative Productivity

Source: Authors' calculations based on constant value added and employment data extracted from the OECD STAN database.

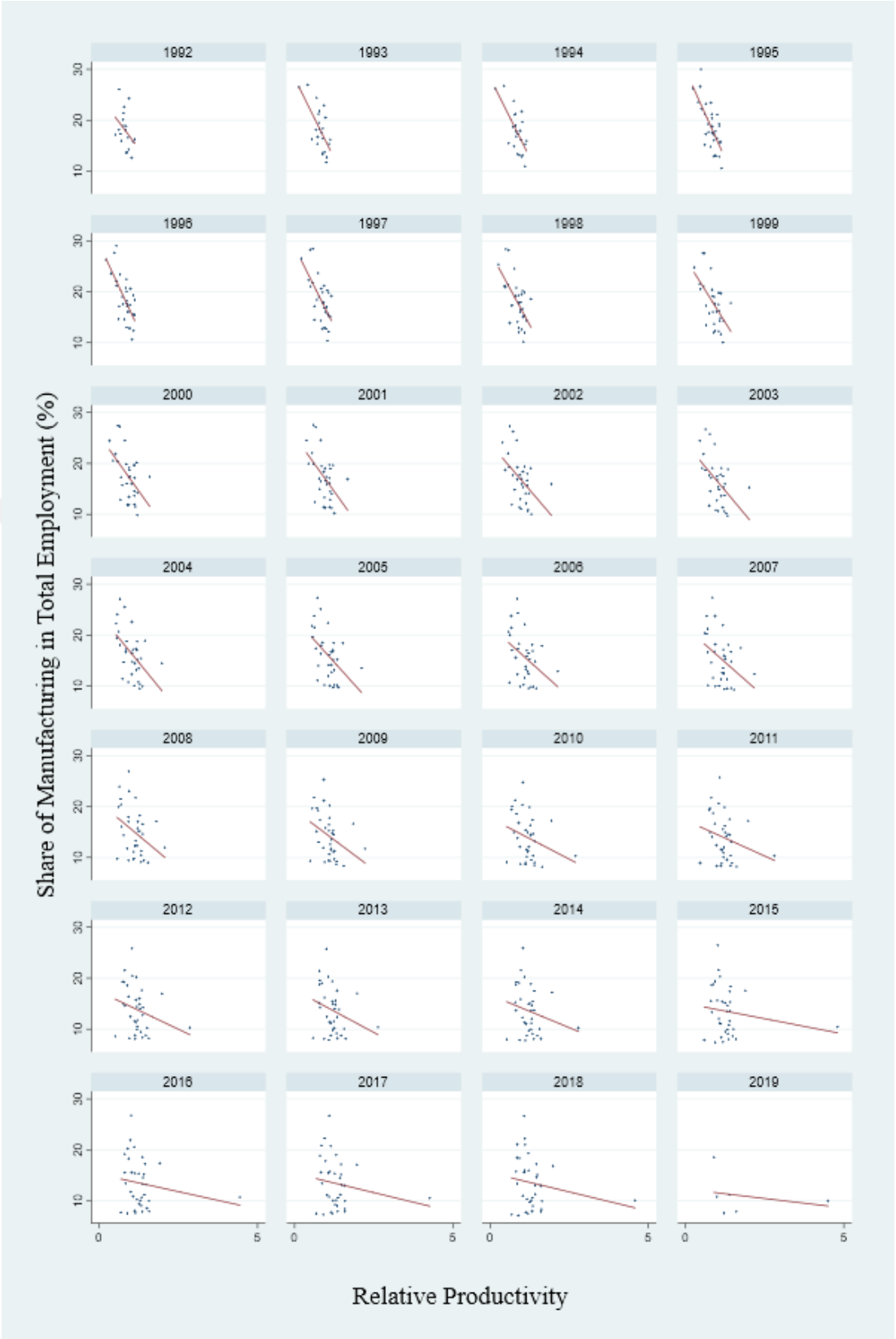

Figure 4.4: Relative Productivity and Manufacturing Employment Shares

Source: Authors' calculations based on constant value added and employment data extracted from the OECD STAN database.

4.2.3. International Trade Flows

International trade variables used in this study represents the GDP shares of manufacturing trade flows with the specified country groups, at current prices. The data for trade flows is extracted from the UN Comtrade database. The country group North corresponds to all high-income countries, as given in the database. The data for the country group South is calculated by subtracting trade flows with all high-income countries from total trade flows. GDP data is extracted from the OECD Annual National Accounts Statistics.

The variables are generated in line with the literature. Four categories are defined. Those are import from South, export to South, import from North, and export to North. Besides the results for all international trade variables have an importance in the analysis, our main intention here to examine the effect of more specifically import from South, which has frequently been emphasized in the literature.

Figure 4.5 shows manufacturing trade flows with the Southern countries. It seems that manufacturing imports from the South exhibit a rising trend in general. On the other hand, manufacturing exports to the South exhibit either a steady or rising trend.

Figure 4.6 shows manufacturing trade flows with the Northern countries. Manufacturing exports and imports with the North exhibit similar trends. However, differently from the trade with the South, there is not a noticeable trend in trade flows with the North.

Figure 4.7 shows the relationship between manufacturing employment shares and trade flows. It is normally expected to get negative slopes for imports and positive slopes for exports. However, as is seen in the figure, all trade flows mostly have a positive relationship with manufacturing employment shares when countries are evaluated together by years. Furthermore, the fitted lines of the variable import from South show that it unexpectedly has a relatively stronger positive relationship with manufacturing employment shares. In contrast to provided evidence in many previous studies, it seems that manufacturing imports from the Southern countries do not contribute to deindustrialization.

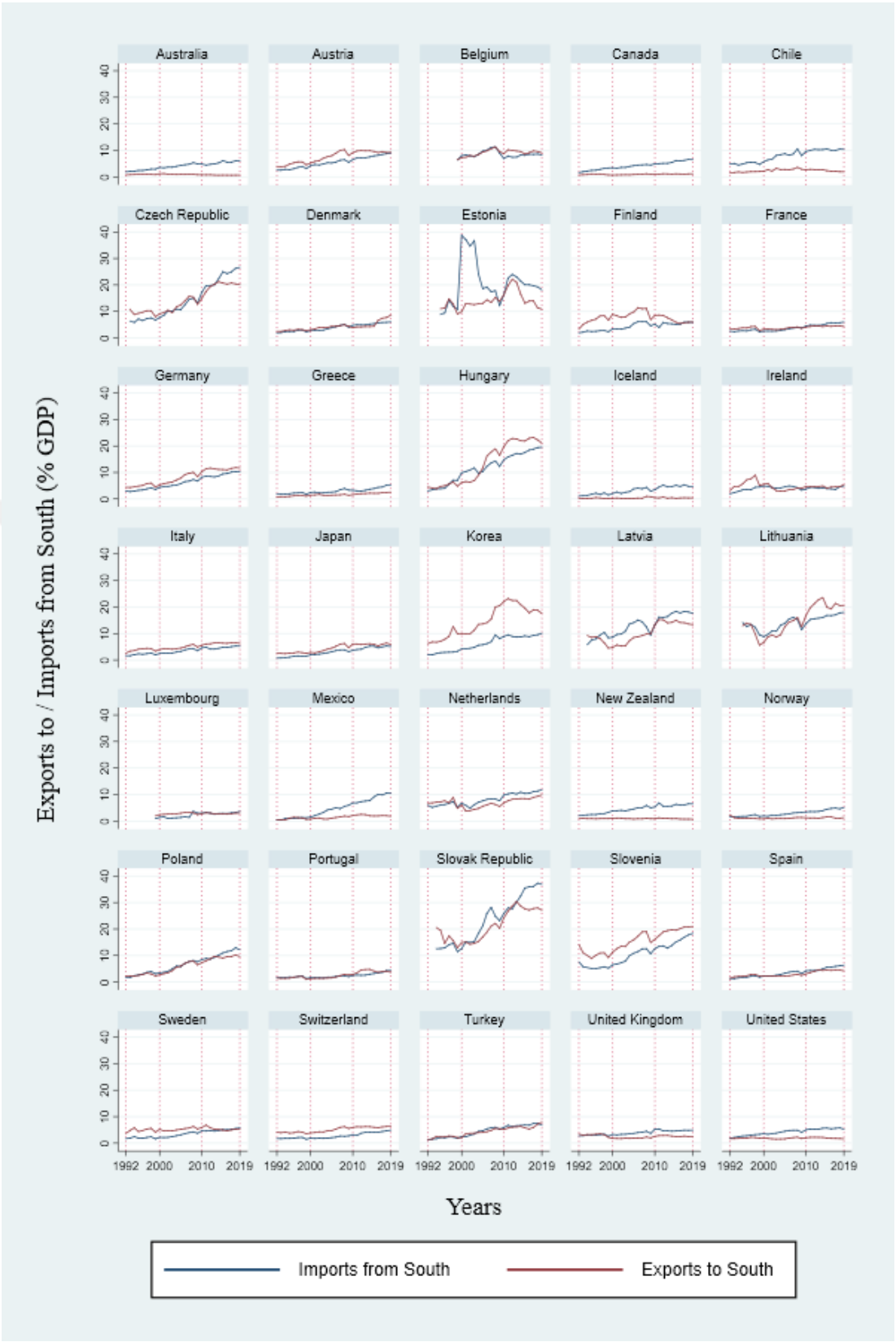

Figure 4.5: Trade with South

Source: Authors' calculations based on trade flow data extracted from the UN Comtrade database and GDP data extracted from the OECD Annual National Accounts Statistics.

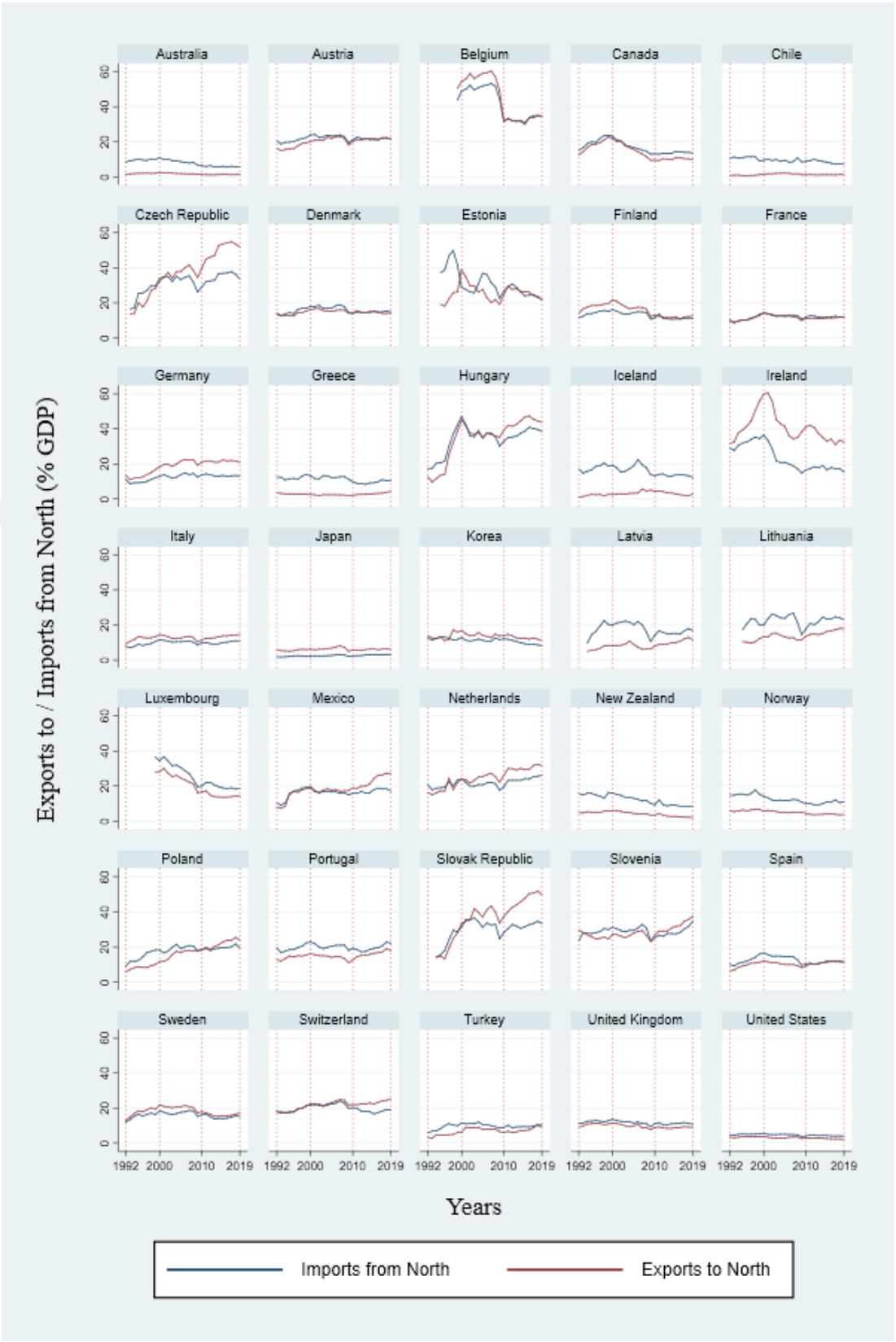

Figure 4.6: Trade with North

Source: Authors' calculations based on trade flow data extracted from the UN Comtrade database and GDP data extracted from the OECD Annual National Accounts Statistics.

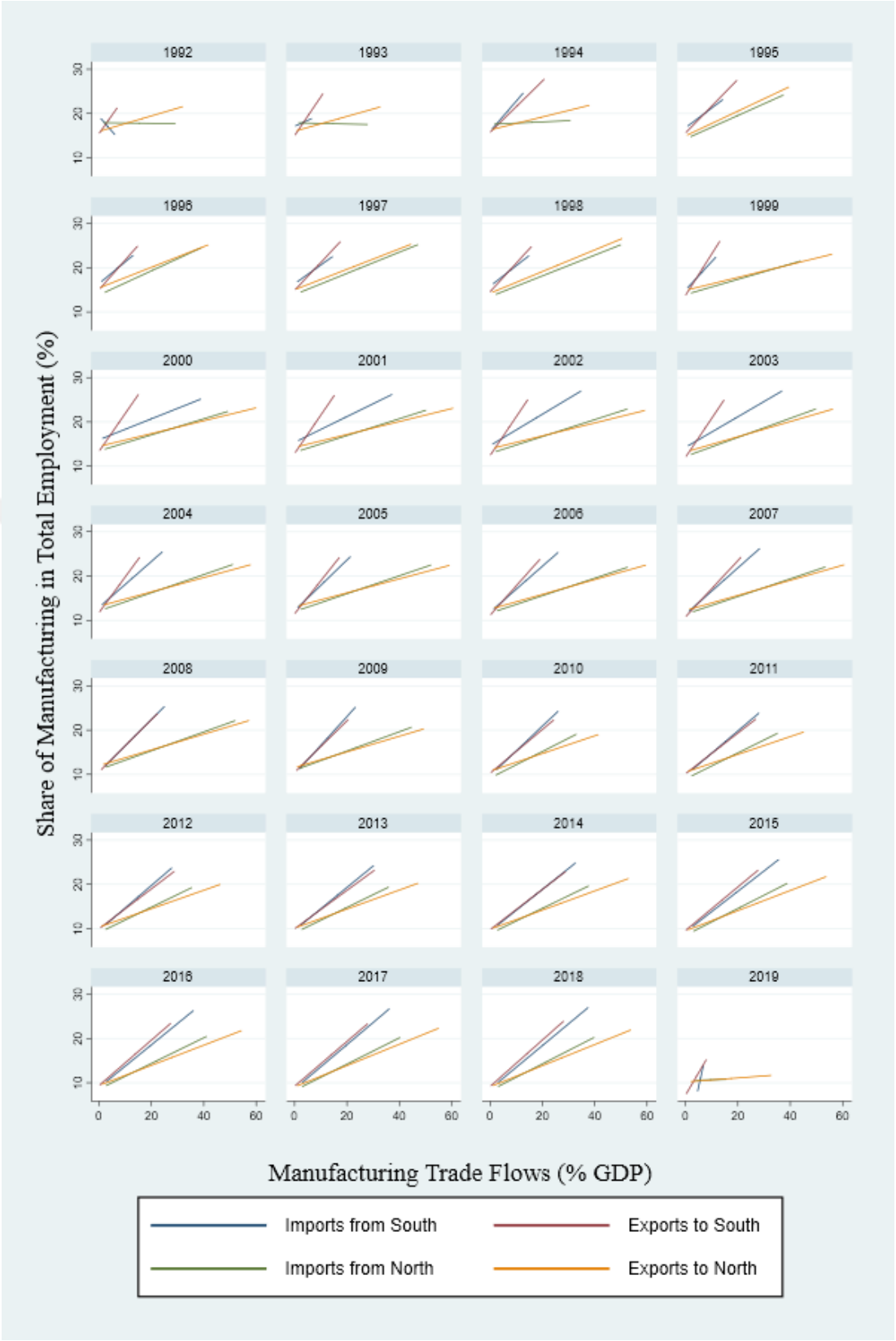

Figure 4.7: Manufacturing Employment Shares and Trade Flows

Source: Authors' calculations based on trade flow data extracted from the UN Comtrade database, GDP data extracted from the OECD Annual National Accounts Statistics, and employment data extracted from the OECD STAN database.

4.2.4. Unemployment and Investment

We consider it appropriate to discuss the variables unemployment and investment together under this title although they are incorporated as separate variables in our analysis. That is because both are used to measure the effects of closely related reasons.

The variable unemployment directly corresponds to unemployment rate. It is extracted from the OECD Annual Labour Force Statistics (ALFS) database. The variable investment denotes the ratio of gross fixed capital formation (GFCF) in current prices to total value added in current prices. It is calculated using the relevant data retrieved from the STAN database.

Both unemployment and investment are widely used variables in the empirical studies on deindustrialization. Unemployment rate is a common indicator for economic policy failures and economic shocks that affect the whole economy. GFCF data is also counted as a similar measure for failure effects. However, it is reputed to be more related with specifically manufacturing industry because the distribution of total fixed capital investments is likely to be highly skewed towards manufacturing investments.

Figure 4.8 shows the pace of unemployment and investment over years by countries. It seems that higher income countries generally experience more stable patterns while developing countries are likely to have more volatile patterns in terms of unemployment and investment changes, as expected. The negative effect of the 2008 Crisis is noticeable for many countries.

Another noteworthy pattern which is noticeable in Figure 4.8 is that changes in unemployment and investment seem to move somewhat symmetrically. This picture prompted us to check the relation between these two variables. However, the relevant scatter plots and the fitted lines depicted in Figure 4.9 demonstrate that there is not a strong negative relationship between these variables for many years.

Figure 4.10 illustrates the linear relationship of the dependent variable manufacturing employment share with unemployment and investment by years. As is seen, while investment has a strong positive relationship with the dependent variable, unemployment exhibits a changing pattern. The different behaviors of the variables unemployment and investment as depicted in Figure 4.9 and Figure 4.10 are consistent with the inference that unemployment is an indicator of general economic failures while investment is likely to demonstrate specifically manufacturing industry failures.

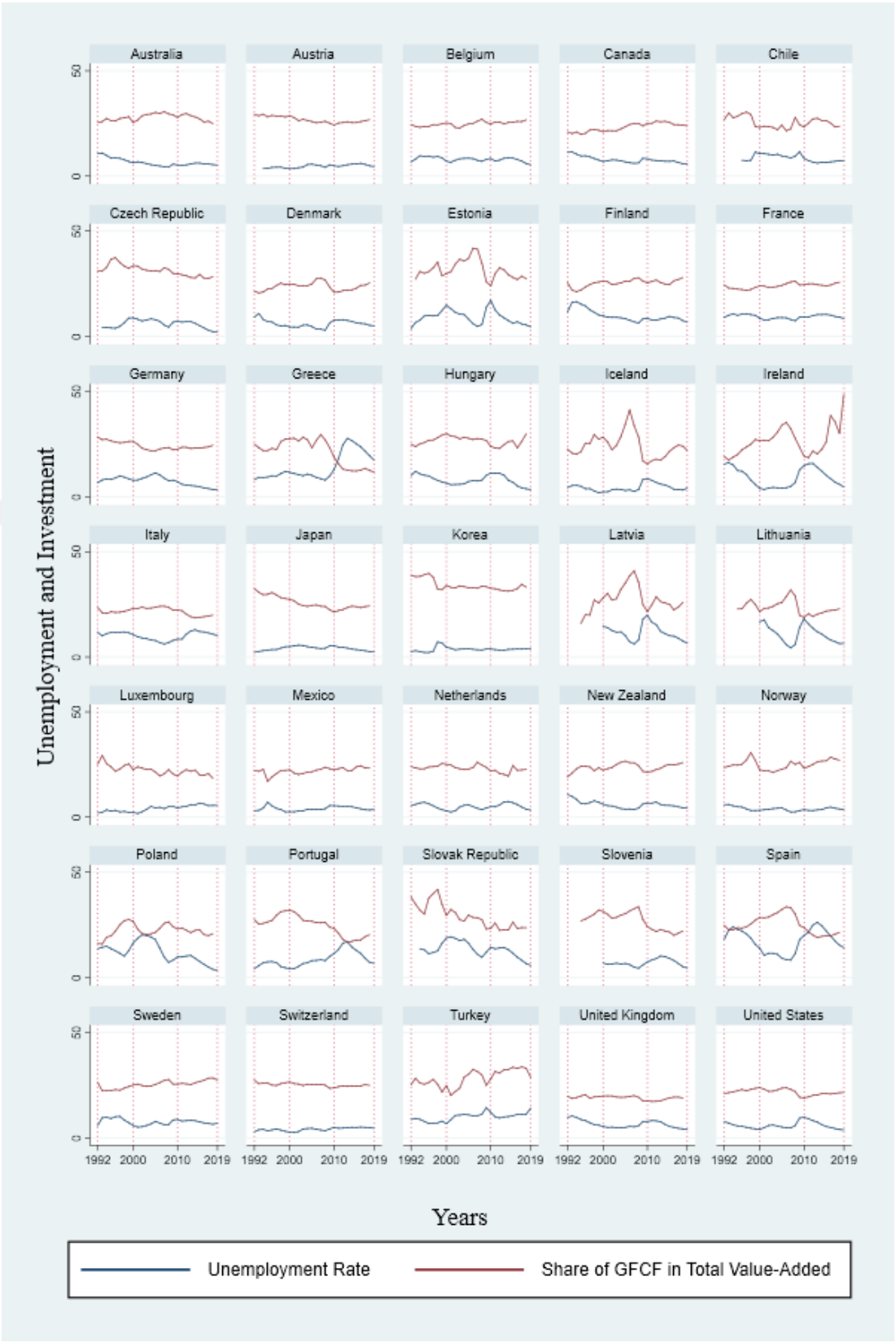

Figure 4.8: Unemployment and Investment

Source: Authors' calculations based on the data extracted from the OECD ALFS and STAN databases.

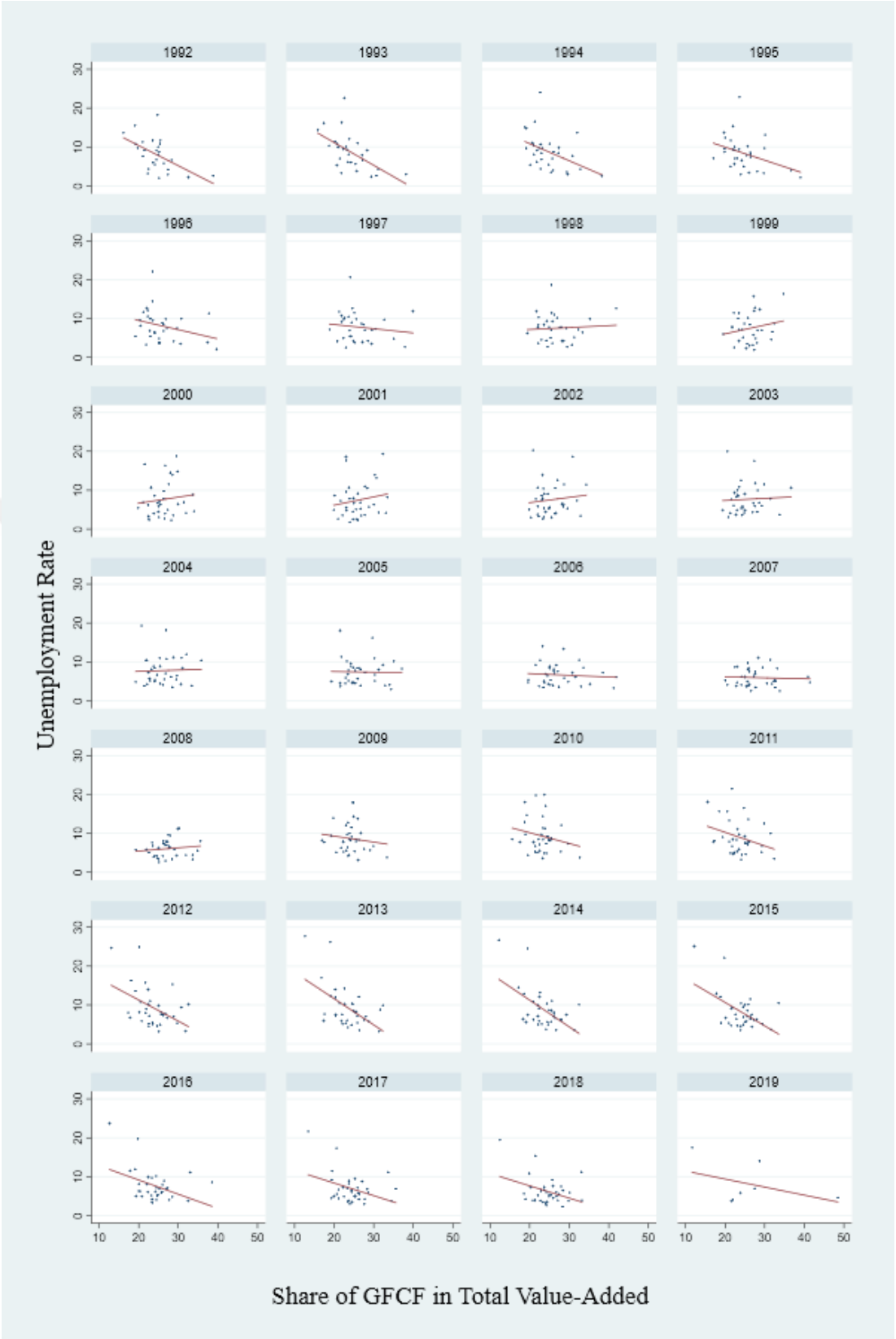

Figure 4.9: Relationship between Unemployment and Investment

Source: Authors' calculations based on the data extracted from the OECD ALFS and STAN databases.

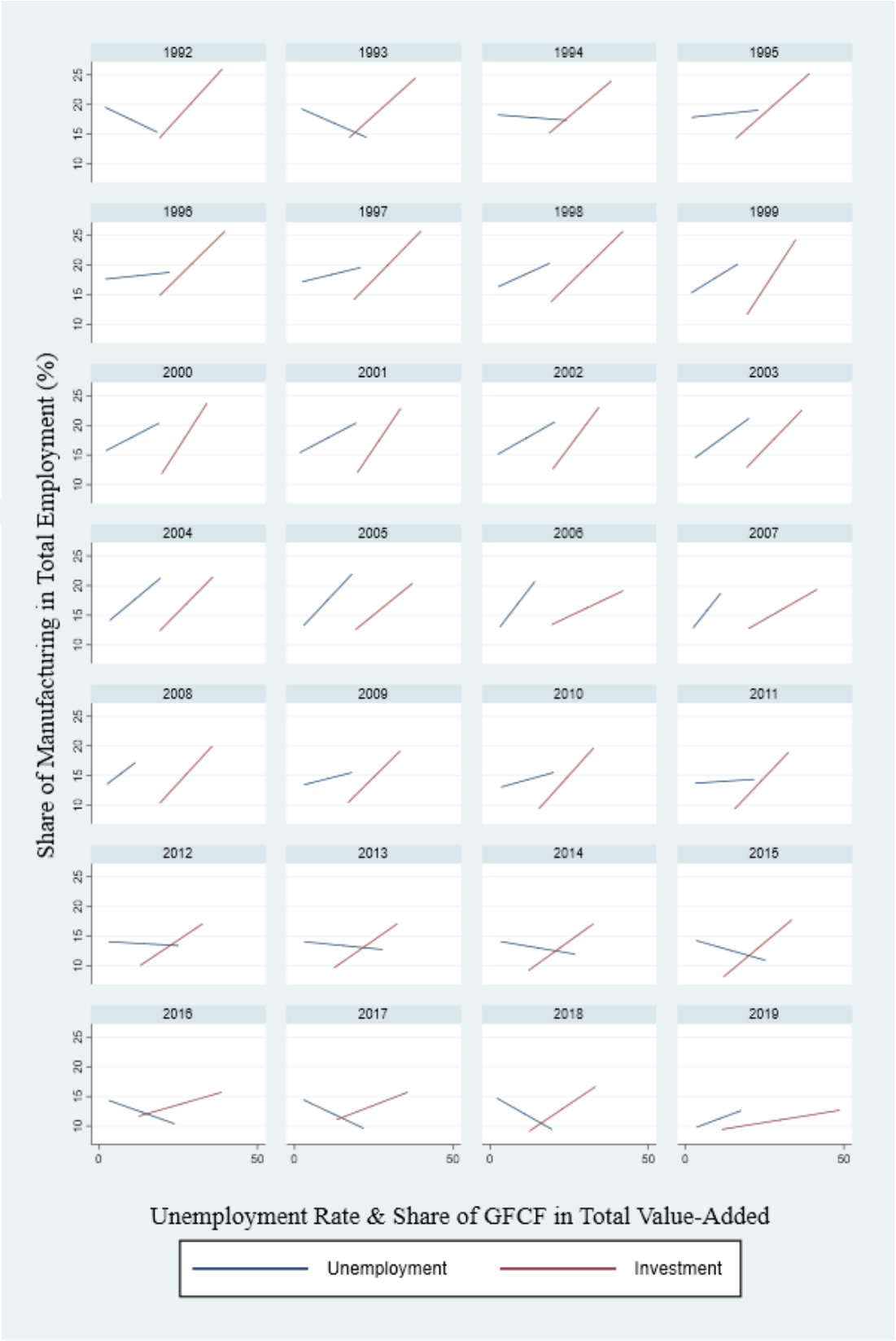

Figure 4.10: Manufacturing Employment, Unemployment and Investment

Source: Authors' calculations based on the data extracted from the OECD ALFS and STAN databases.

5. EMPIRICAL MODEL AND RESULTS

A variety of models are checked using the different combinations of the explanatory variables. Almost all of them show similar results. For the sake of simplicity, however, all models are not presented here.

A baseline model that exhibits a better fit with the data is chosen. The baseline model and a few alternative models that derived from it with minor changes are discussed together. We hope to point out the robustness of certain variables in this way.

The baseline model can be expressed as follows:

$$\begin{aligned} \mathrm{ESoMI}_{it} = {} & \alpha + \beta_1 \mathrm{Income\_per\_Capita}_{it} + \beta_2 \mathrm{Income\_per\_Capita}_{it}^2 \\ & + \beta_3 \mathrm{Relative\_Productivity}_{it} + \beta_4 \mathrm{Relative\_Productivity}_{it}^2 \\ & + \beta_5 \mathrm{Import\_from\_South}_{it} + \beta_6 \mathrm{Export\_to\_South}_{it} \\ & + \beta_7 \mathrm{Import\_from\_North}_{it} + \beta_8 \mathrm{Export\_to\_North}_{it} \\ & + \beta_9 \mathrm{Unemployment}_{it} + \beta_{10} \mathrm{Investment}_{it} + \eta_i + \lambda_t + u_{it} \end{aligned}$$

Although it is preferred to use least squares dummy variables (LSDV) notation when presenting the model for simplicity, the results are estimated using within fixed-effect estimator and the relevant coefficients of determination given in the following tables show within-R^2 values.

The explained variable ESoMI_{it} denotes the employment share of manufacturing industry. α is constant term, u_{it} is idiosyncratic error term, η_i is county-fixed effect, and λ_t is time-fixed effect.

The explanatory variables, their calculation methods and data sources are discussed thoroughly in the previous chapter. To recap briefly, income per capita is the natural logarithm of PPP adjusted GDP per capita in constant 2015 US dollar terms. Relative productivity is the ratio of real value added per person employed in manufacturing industry to that in service sector, at constant 2015 prices. Trade variables represent the GDP shares of manufacturing trade volumes with the specified country groups, at current prices. Unemployment denotes unemployment rate. Investment indicates the ratio of gross fixed capital formation (GFCF) to total value added, in current prices.

The baseline model also includes the quadratic terms for two variables, income per capita and relative productivity. The square of relative productivity is incorporated into the model because it is statistically significant in almost all derived specifications. The square of income is significant only when time fixed effects are excluded. Nevertheless, including the quadratic term of income provides a better discussion ground for the comparison of our analysis with the previous empirical studies.

Table 5.1 shows the descriptive statistics of all variables. It provides the critical numerical details of the dataset. Moreover, the ranges of income and relative productivity variables given in the table are especially important. Because the quadratic terms of these variables are also incorporated into the estimations in addition to their pure forms, it is important to detect whether their turning points stay within their range or not.

Table 5.1: Descriptive Statistics

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
ESoMI	922	15.68	4.84	7.10	30.00
Income	970	10.42	0.45	9.11	11.65
Relative_Productivity	876	1.07	0.43	0.14	4.80
Import_from_South	954	6.55	5.81	0.46	38.70
Export_to_South	954	6.26	5.83	0.15	30.36
Import_from_North	954	17.42	9.16	1.72	53.24
Export_to_North	954	16.29	12.34	0.76	60.49
Unemployment	947	7.78	4.15	1.81	27.70
Investment	942	25.24	4.48	11.69	48.49

The empirical results are presented in two categories of regressions. In the first category, the baseline model is compared with a pooled ordinary least squares (POLS) estimation and a fixed effect estimation without time fixed effects. By this way, we try to figure out how fixed effect dummies affect the significance of the explanatory variables. In the second category, a series of fixed effect estimations all of which involves time fixed effects, is compared with each other to demonstrate the robustness of our findings.

Table 5.2: Baseline Model with Different Estimators

	(1) POLS	(2) without TFE	(3) with TFE
Income_per_Capita	41.280**	84.661***	-5.395
	(17.484)	(16.495)	(18.083)
Income_per_Capita^2	-2.234**	-4.517***	0.322
	(0.832)	(0.829)	(0.913)
Relative_Productivity	-12.507***	-5.547***	-2.760**
	(1.372)	(1.099)	(1.048)
Relative_Productivity^2	1.913***	1.050***	0.342**
	(0.264)	(0.158)	(0.156)
Import_from_South	-0.327***	-0.163**	-0.020
	(0.066)	(0.070)	(0.033)
Export_to_South	0.401***	0.099	0.026
	(0.070)	(0.080)	(0.050)
Import_from_North	-0.251***	-0.071	0.013
	(0.063)	(0.045)	(0.043)
Export_to_North	0.302***	0.170***	0.079**
	(0.041)	(0.048)	(0.038)
Unemployment	-0.231***	-0.210***	-0.077*
	(0.055)	(0.044)	(0.045)
Investment	0.132***	0.073	-0.006
	(0.047)	(0.045)	(0.030)
Constant	-163.039*	-371.835***	42.362
	(91.189)	(82.584)	(89.100)
R^2	0.835	0.784	0.895
Observations	844	844	844
Time Fixed Effects	No	No	Yes
Country Fixed Effects	No	Yes	Yes

Standard errors are given in parantheses. Stars on coefficients denote significance levels as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5.2 shows the estimation results of the first category. Regression 1 is a POLS estimation. All variables have statistically significant effects on manufacturing employment share and their coefficients have expected signs.

While the coefficient on income is positive, the coefficient on the square of income is negative. This result is consistent with the literature, suggesting that there may be an inverted-U relationship between manufacturing employment share and income. However, the turning point of income, which is 37.02, falls into far beyond the range of it. Remember that its maximum value is 11.65, as can be seen in Table 5.1. Thus,

rather than the existence of an inverted-U relationship, it can be said that increase in income has a diminishing but positive effect on manufacturing employment share.

The estimation result for relative productivity in Regression 1 is just the opposite of that for income. The coefficient on relative productivity is negative while the coefficient on the square of it is positive, suggesting a convex relationship between relative productivity and manufacturing employment share. However, the turning point of relative productivity, 13.10, is also much higher than its maximum value, 4.80. That means relative productivity has a diminishingly negative effect on manufacturing employment share.

The coefficients on the other variables have also expected signs. Manufacturing exports and imports have positive and negative effects, respectively. While increase in unemployment contributes to deindustrialization, rise in investment supports manufacturing employment share.

Regression 2 is a within fixed effect estimation without time fixed effects. Apart from the calculation method of their coefficients of determination, the only difference between Regression 1 and Regression 2 is that we get the latter when country fixed effects are incorporated into the former. Therefore, the differences between the results of these two regressions reveal which variables are affected more by time invariant country fixed effects. In other words, the comparison between these models makes it possible to discriminate variables according to the dominant sources of their variances, which means, if they vary more across or within countries.

Relative to the results of Regression 1, the magnitudes of the coefficients on income variables rise more than twofold in Regression 2. However, the turning point, 37.46, is very close to that in Regression 1. On the other hand, the significance level of the coefficients rises from 5% to 1%. Those results suggest that the explanatory power of income is higher when it comes to across country differences relative to within country differences.

The results for relative productivity change in an opposite way. The magnitudes of the coefficients decrease by half, but their significance levels do not change. The turning point, 10.57, is close to that in Regression 1. That means, the explanatory power of relative productivity is lower in explaining across country differences.

Among the trade variables, the significance levels of export to South and import from North decrease below the 10% level. The coefficients on import from South and export to North nearly fall by twice. While the significance level of import from South falls from 1% to 5%, export to North maintains its significance level. It can be said that the explanatory power of all trade variables decreases when it comes to the differences among countries.

Unemployment maintains its explanatory power. The magnitude of its coefficient slightly decreases. Nevertheless, its high significance level does not change. On the other hand, the coefficient on investment decreases by half. Moreover, its high significance level vanishes when country fixed effects are included. It seems that, while the variation in investment has not an explanatory power on the differences across countries, the explanatory power of unemployment covers both across and within country differences.

Although there are some differences, the results of Regression 1 and Regression 2 are mostly in line with the previous empirical analyses in the literature. There is a concave nonlinear relationship between manufacturing employment shares and per capita income levels. Relative productivity, unemployment and imports from South have negative and significant effects on deindustrialization.

However, when time fixed effects are incorporated into the analysis, this consistency with the previous studies disappears. This is not surprising because time fixed effects are not included in the overwhelming majority of the studies.

Regression 3, which is also the baseline model of this study, is a within fixed effect estimation with country invariant time fixed effects. The dramatic change that results from incorporating time fixed effects into the analysis is noticeable in Table 5.2.

The most striking and probably the most important effect of time fixed effects manifest itself on income variables. Besides the big fall in the magnitudes of the coefficients, the signs of the coefficients change and they become statistically insignificant. It seems that income has no explanatory power on deindustrialization when time fixed effects are included in the analysis.

Another important change is that the coefficient on import from South becomes insignificant and its magnitude dramatically decreases. Thus, there is no evidence for the effect of the import penetration of the Southern low-wage countries on

deindustrialization. The variables export to South and import from North are insignificant as is the case with Regression 2. Surprisingly, the only trade variable that still has a statistically significant effect on manufacturing employment shares is export to North. However, the magnitude of its coefficient decreases as such in its significance level. Considering the very low level of magnitude of the coefficient on export to North, it can be said that its effect on manufacturing employment share is insignificant in economic terms. A one percentage point increase in export to North is associated with a 0.08 percentage point increase in the explained variable. Thus, export to North has to increase by 12.5 percentage points to cause a one percentage point increase in manufacturing employment share.

Among the failure variables, the effect of unemployment decreases in terms of both magnitude and significance level. It is still statistically significant at the 10% level, but the very low level of its magnitude casts doubt on its economic significance. Investment is statistically insignificant as is the case with Regression 2.

All things considered, incorporating time fixed effects into the analysis decreases the significance levels of explanatory variables without exception. Furthermore, in addition to their high joint significance level, all time dummies are also separately significant at the 1% level.

It seems that time dummies capture the effect of a component that is not included in the model. It may be the aforementioned statistical illusion aspect that is immeasurable at least for now. Because there is not any variable which can measure this effect in the model, it may be captured by time dummies.

Table 5.3 shows the results of a series of fixed effect estimations which are derived from the baseline model with minor changes. Only the combination of income per capita and relative productivity variables is changed. The remaining variables are preserved. These models should be evaluated together with Regression 3, the baseline model, which is not included in the table due to space constraint.

Because almost all empirical studies in the literature provide evidence for an inverted-U relationship between manufacturing employment share and income per capita in contrast to our findings, we aim to figure out the reason behind the insignificance of income per capita variables in our analysis by trying different combinations of variables.

Table 5.3: Fixed Effect Estimations

	(4)	(5)	(6)	(7)	(8)	(9)
Income_per_Capita	0.935 (0.980)		-8.854 (17.831)	0.783 (0.979)		23.283* (13.739)
Income_per_Capita^2			0.491 (0.898)			-1.166* (0.678)
Relative_Productivity	-2.705** (1.055)	-2.535** (0.971)	-0.993** (0.400)	-0.854*** (0.298)	-0.761*** (0.254)	
Relative_Productivity^2	0.349** (0.152)	0.337** (0.147)				
Import_from_South	-0.023 (0.032)	-0.027 (0.030)	-0.023 (0.035)	-0.028 (0.034)	-0.032 (0.032)	-0.013 (0.037)
Export_to_South	0.024 (0.051)	0.041 (0.046)	0.011 (0.050)	0.009 (0.050)	0.023 (0.043)	-0.016 (0.050)
Import_from_North	0.010 (0.042)	-0.003 (0.039)	0.011 (0.048)	0.006 (0.046)	-0.005 (0.043)	0.020 (0.049)
Export_to_North	0.080** (0.038)	0.089** (0.037)	0.077* (0.040)	0.079* (0.040)	0.087** (0.038)	0.063 (0.039)
Unemployment	-0.080* (0.042)	-0.093** (0.040)	-0.066 (0.049)	-0.071 (0.046)	-0.083* (0.042)	-0.099** (0.040)
Investment	-0.004 (0.032)	0.000 (0.030)	0.006 (0.029)	0.010 (0.031)	0.013 (0.029)	-0.003 (0.029)
Constant	11.338 (9.460)	20.787*** (1.140)	58.699 (88.266)	11.447 (9.809)	19.406*** (1.012)	-96.791 (69.706)
R^2	0.895	0.894	0.892	0.892	0.891	0.887
Observations	844	844	844	844	844	844
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors are given in parantheses. Stars on coefficients denote significance levels as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The only difference between the regressions 3-5 is the combination of income per capita variables. Regression 3 includes both the pure and the quadratic forms, Regression 4 includes only the pure form, and Regression 5 does not include any income per capita variable. The coefficients on variables, their significance levels and R^2 values do not change much between these models. The estimation results of Regression 3 are discussed thoroughly above. Therefore, there is no need to evaluate the results of Regression 4 and Regression 5 separately, which are very close to those of Regression 3. When they are considered together, however, an interesting fact

manifests itself that whether to incorporate income per capita variables into the models does not bring about any important change in the results if other variables are kept the same.

In the regressions 6-8, the quadratic form of relative productivity variable is excluded this time and the same combinations of income per capita variables are tested separately to examine if the quadratic term of relative productivity affects the results for other variables, especially for income per capita. The results are similar to a large extent. Relative productivity has a negative and quite significant effect on manufacturing employment share. Export to North has a positive and statistically significant effect in general. The negative effect of unemployment becomes significant only when income per capita variables are totally excluded from the analysis.

In Regression 9, relative productivity variables are excluded this time. The results reveal an important fact. Finally, we get familiar results in line with the previous empirical studies. The coefficients on income per capita variables are statistically significant and suggest an inverted-U shaped effect on manufacturing employment share. It seems that income per capita variables actually capture the effect of relative productivity when the latter is not included in the analysis. In other words, the inverted-U shaped effect of income per capita demonstrates the effect of relative productivity on manufacturing employment shares.

When all models are considered together, we get the following results. Whenever relative productivity is included in the analyses, the results provide evidence for a robust and significant negative effect of it on manufacturing employment share. The effects of other variables do not exhibit a stable pattern among different estimations. It appears that relative productivity is the most effective factor behind deindustrialization. If relative productivity is excluded from the analysis, income per capita variables capture its role suggesting an inverted-U shaped effect on manufacturing employment share.

6. CONCLUSION

The literature on deindustrialization in the sense of the replacement of manufacturing industry with service sector emerged in the 1970s. The research focus on determining and examining the reasons for deindustrialization has constituted the initial and the central strand of the literature.

Many explanations have been proposed as the reasons for deindustrialization. Although there is not a consensus among researchers, some explanations have become more prominent. Those are economic maturation, productivity growth differences, international trade, and economic failures.

The maturation argument predicts a transition from primary to secondary sectors first, and from secondary to tertiary sectors eventually in the process of economic development. As a result, the share of manufacturing industry in total employment is expected to exhibit an inverted-U shaped pattern during the process of development. The starting point of the fall in manufacturing employment shares corresponds to economic maturity level. As a logical consequent of this argument, deindustrialization is considered as an inevitable result of a successful development process.

The aspect of productivity growth differences specifically represents higher productivity growth rates achieved in manufacturing industry relative to those in service sector. That difference in productivity growth rates on behalf of manufacturing industry is expected to result in deindustrialization because gradually less amount of labour is needed to meet the demand for manufactured products This aspect is sometimes counted as a subcomponent of the maturation argument. On the other hand, some researchers consider it as a different and independent factor under the title of technological advancement.

The effect of international trade on deindustrialization is another reason proposed in the literature. Because manufactured products are highly tradable, the economic role of a country in global production chain is expected to have a substantial effect on the state of its manufacturing industry. In a more specific sense, manufacturing import

penetration of developing low-wage countries is considered as one of the most important reasons for deindustrialization in advanced countries. This aspect is generally discussed under the title of North-South trade.

Finally, economic failures are also considered among the main reasons for deindustrialization, which may realize in the forms of global or domestic failures, and economy-wide or manufacturing industry related failures.

Some researchers also argue that the magnitude of deindustrialization may be exaggerated due to the aspect of statistical illusion, which stems from outsourcing and subcontracting of some activities which had been traditionally registered under manufacturing industry.

The explanations proposed as the reasons for deindustrialization make sense on theoretical ground. However, there are many drawbacks in previous studies that cast doubts on the reliability of empirical results, such as low observation numbers and model misspecifications.

In this study the existing explanations for deindustrialization are reexamined using a much larger dataset and more proper model specifications relative to previous studies. Our dataset is much larger both in quantitative and qualitative terms.

Our findings are partially in line with the previous empirical analyses. Our empirical results show that productivity difference on behalf of manufacturing industry over service sector is the most effective and robust reason that is responsible from the decrease in employment share of manufacturing industry. The effects of other variables do not exhibit a stable pattern among different estimations. If relative productivity is excluded from the analysis, income per capita variables capture its role suggesting an inverted-U shaped effect on manufacturing employment share. On the other hand, there is no evidence for the effect of manufacturing imports from the Southern countries on deindustrialization.

Incorporating time fixed effects into the analysis decreases the significance levels of explanatory variables without exception. On the other hand, in addition to their high joint significance levels, all time dummies are also separately significant. It seems that time dummies capture the effect of a component that is not included in the analyses. It may be the aforementioned statistical illusion aspect that is immeasurable for now.

The discrepancies of our analysis with previous empirical studies probably result from the drawbacks in many previous studies. First, the samples used in the previous studies include only developed OECD countries. Second, as a result of small samples, observation numbers are quite low in many empirical studies. Third, time fixed effects are mostly not controlled. Indeed, we get much similar results with the previous studies when we exlude time fixed effects from our analysis. In conclusion, although the existing explanations for the phenomenon of deindustrialization sound reasonable on theoretical ground, frequently used variables for those explanations in empirical studies seem to be not well-grounded.

REFERENCES

Alderson, Arthur S. 1999. Explaining Deindustrialization: Globalization, Failure, or Success? **American Sociological Review.** Volume 64, Issue 5: 701-721.

Bacon, Robert W., Walter A. Eltis. 1976. **Britain's Economic Problem: Too Few Producers.** London: Macmillan.

Bagchi, Amiya Kumar. 1976. De-industrialization in India in the nineteenth century: Some theoretical implications. **The Journal of Development Studies.** Volume 12, Issue 2: 135-164.

Bell, Daniel. 1973. **The Coming of Post-Industrial Society.** New York: Basic Books.

Clark, Colin. 1940. **The Conditions of Economic Progress.** London: Macmillan.

Dasgupta, Sukti, Ajit Singh. 2007. Manufacturing, Services and Premature Deindustrialization in Developing Countries: A Kaldorian Analysis. **Advancing Development.** ed. George Mavrotas, Anthony Shorrocks. London: Palgrave Macmillan.

Di Meglio, Gisela, Jorge Gallego. 2022. Disentangling Services in Developing Regions: A Test of Kaldor's First and Second Laws. **Structural Change and Economic Dynamics.** Volume 60: 221-229.

Fuchs, Victor R. 1968. **The Service Economy.** New York: National Bureau of Economic Research, distributed by Columbia University Press.

Hansard. 1975. House of Commons Debate. Volume 890. Columns 287-289. April 15.

Kucera, David, William Milberg. 2003. Deindustrialization and Changes in Manufacturing Trade: Factor Content Calculaations for 1978-1995. **Review of World Economics.** Volume 139, Issue 4: 601-624.

Kang, Sung Jin, Hongshik Lee. 2011. Foreign Direct Investment and De-industrialization. **The World Economy.** Volume 34, Issue 2: 313-329.

Kollmeyer, Christopher. 2009. Explaining Deindustrialization: How Affluence, Productivity Growth, and Globalization Diminish Manufacturing Employment. **American Journal of Sociology.** Volume 114, Issue 6: 1644-1674.

Palma, José Gabriel. 2005. Four Sources of 'De-Industrialization' and a New Concept of the 'Dutch Disease'. **Beyond Reforms: Structural Dynamics and Macroeconomic Vulnerability.** ed. José Antonio Ocampo. Stanford University Press: 71-116.

____. 2008. De-Industrialization, 'Premature' De-Industrialization and the Dutch Disease. **The New Palgrave Dictionary of Economics.** ed. Steven N. Durlauf, Lawrence E. Blume. London: Palgrave Macmillan.

Petty, William. 1690. **Political Arithmetick.** London.

Ravindran, Rekha, M. Suresh Babu. 2022. Premature Deindustrialisation and Growth Slowdowns in Middle-Income Countries. **Structural Change and Economic Dynamics.** Volume 62: 377-389.

Rodrik, Dani. 2013. Unconditional Convergence in Manufacturing. **Quarterly Journal of Economics.** Volume 128, Issue 1: 165-204.

____. 2014. The Past, Present, and Future of Economic Growth. **Towards a Better Global Economy: Policy Implications for Citizens Worldwide in the 21st Century.** ed. Franklin Allen, Jere R. Behrman, Nancy Birdsall, Shahrokh Fardoust, Dani Rodrik, Andrew Steer, Arvind Subramanian. Oxford: Oxford University Press.

____. 2016. Premature Deindustrialization. **Journal of Economic Growth.** Volume 21, Issue 1: 1-33.

Rowthorn, Bob. 1986. De-Industrialization in Britain. **The Geography of De-Industrialization.** ed. Ron Martin, Bob Rowthorn. Hong Kong: Macmillan: 1-30.

Rowthorn, Robert. 1995. Korea at the Cross-Roads. **Working Paper No. 11.** Cambridge: Centre for Business Research.

Rowthorn, Robert, Ken Coutts. 2004. Deindustrialisation and the Balance of Payments in Advanced Economies', **Cambridge Journal of Economics.** Volume 28, Issue 5: 767-790.

Rowthorn, Robert, Ramana Ramaswamy. 1997. Deindustrialization: Causes and Implications. **IMF Working Paper No. 97/42.** Washington: International Monetary Fund.

____. 1999. Growth, Trade, and Deindustrialization. **IMF Economic Review.** Volume 46, Issue 1: 18-41.

Rowthorn, Robert, John Wells. 1987. **De-Industrialization and Foreign Trade.** Cambridge: Cambridge University Press.

Saeger, Steven Schaal. 1997. Globalization and Deindustrialization: Myth and Reality in the OECD. **Weltwirtschaftliches Archiv.** Volume 133, Issue 4: 579-608.

Singh, Ajit. 1977. UK Industry and the World Economy: A Case of De-Industrialization? **Cambridge Journal of Economics.** Volume 1, Issue 2: 113-136.

Tregenna, Fiona. 2009. Characterising Deindustrialisation: An Analysis of Changes in Manufacturing Employment and Output Internationally. **Cambridge Journal of Economics.** Volume 33, Issue 3: 433-466.

____. 2013. Manufacturing Productivity, Deindustrialization and Reindustrialization. **Pathways to Industrialization in the 21st Century: New Challenges and Emerging Paradigms.** ed. Adam Szirmai, Wim Naudé, Ludovico Alcorta. Oxford: Oxford University Press.

____. 2015. Deindustrialization, Structural Change and Sustainable Economic Growth. **Inclusive and Sustainable Industrial Development Working Paper Series No. 02|2015.** Vienna: United Nations Industrial Development Organization.

____. 2016. Deindustrialization: An Issue for both Developed and Developing Countries. **Routledge Handbook of Industry and Development.** ed. John Weiss, Michael Tribe. London and New York: Routledge: 97-115.

Wood, Adrian. 1994. **North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driving World.** Oxford: Clarendon Press.

Van Neuss, Leif. 2018. Globalization and Deindustrialization in Advanced Countries. **Structural Change and Economic Dynamics.** Volume 45: 49-6