TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

SAMULI KINNUNEN

# FINANCIAL EFFECTS OF PRODUCTION RELOCATIONS – A LONGITUDINAL AND QUANTITATIVE PERSPECTIVE ON FINNISH MANUFACTURING FIRMS

Master of Science Thesis

Examiner: Professor Jussi Heikkilä and
Associate Professor Teemu Laine
Examiner and topic approved by the
Faculty Council of the Faculty of
Business and Built Environment
on 28th August 2017

# ABSTRACT

**SAMULI KINNUNEN**: Financial effects of production relocations – a longitudinal and quantitative perspective on Finnish manufacturing firms
Master of Science Thesis, 76 pages
September 2017
Master's Degree Programme in Industrial Engineering and Management
Major: Industrial and Business Economics
Examiner: Professor Jussi Heikkilä and Associate Professor Teemu Laine

Keywords: production; offshoring; backshoring; reshoring; relocation; financial performance

Manufacturing companies have actively been looking for new manufacturing locations throughout the last decades, for instance, to enter new markets, to decrease production costs and to increase flexibility to customers' demands. The importance of manufacturing for the economy is significant because of jobs and tax incomes. The decisions to relocate production have been extensively studied in earlier research literature. This thesis aims to fill a gap in the production relocation research by answering the following research questions: *What kinds of factors characterize the companies that are moving their production? and What are the financial effects of production movements?* The study combines survey data and secondary financial data to analyze manufacturing relocation activities of 229 Finnish manufacturing companies between 2010 and 2015.

The structure of the thesis follows the research process. First, the background of the research and data are investigated to formulate the research questions. The second chapter defines the key concepts and constructs propositions based on the reviewed literature. The chapter on research methodology and data builds the methodological base for the analysis. The key statistical tools, operationalization of theoretical concepts and descriptive statistics are examined. The analysis and results are divided according to the research questions. First, the characteristics of production movements are analyzed using logistic regression analysis and second, the analysis of the performance effects is carried out utilizing the propensity score method. The last chapter inferences the results from the empirical and theoretical perspectives and gives suggestions for further research.

The most important finding is a positive relationship between production movement activity and financial performance. Companies with movement activities have been able to maintain their profitability better than companies in their control groups with no movements during a weak economic cycle. The results show that companies who are moving production to achieve cost efficiency or improvements in production and supply chain are not only more profitable but also able to grow. The study could not find statistically significant effects of production movements on operational working capital. A weak evidence was found to point out that less capital-intensive companies would be more active in production movements. However, an effect between financial slack and movement activity was not found. An overall conclusion is that production movements have a very important role in manufacturing strategy and maintaining profitability of Finnish manufacturing companies. Investigating more specific mechanisms behind the positive effects needs more research in the future.

# TIIVISTELMÄ

**SAMULI KINNUNEN**: Tuotannon siirtojen taloudelliset vaikutukset – Tilastollinen pitkittäistutkimus suomalaisista valmistavista teollisuusyrityksistä
Tampereen teknillinen yliopisto
Diplomityö, 76 sivua
Syyskuu 2017
Tuotantotalouden diplomi-insinöörin tutkinto-ohjelma
Pääaine: Talouden ja liiketoiminnan hallinta
Tarkastaja: professori Jussi Heikkilä ja apulaisprofessori Teemu Laine

Avainsanat: tuotanto; tuotannon siirto; tuotannon palauttaminen; taloudellinen suorituskyky

Teollisuusyritykset ovat viimeisten vuosikymmenten aikana aktiivisesti etsineet uusia sijaintipaikkoja tuotannolleen. Syitä ovat olleet muun muassa tarve alentaa tuotantokustannuksia, pääsy uusille markkinoille ja mahdollisuus vastata paremmin asiakkaiden kysyntään. Teollisuuden merkitys kansantaloudelle on merkittävä esimerkiksi työpaikkojen ja verotulojen takia. Siirtopäätöksiä onkin jo aiemmin tutkittu yksityiskohtaisesti. Tämä diplomityö pyrkii täyttämään tuotannon siirtopäätösten tutkimuksessa olevan aukon vastaamalla seuraaviin tutkimuskysymyksiin*: Mitkä tekijät vaikuttavat yrityksen aktiivisuuteen tuotannon siirroissa? ja Mitkä ovat tuotannon siirtojen taloudelliset vaikutukset?* Tutkimus analysoi aineistoa kyselytutkimuksesta sekä tilinpäätöslukuja 229 suomalaisesta teollisuusyrityksestä aikavälillä 2010-2015.

Diplomityön rakenne mukailee tutkimusprosessin kulkua. Ensimmäinen kappale johdattelee aiheeseen taustatiedon ja aineiston esittelyllä, jotka olivat edellytyksiä tutkimuskysymyksien luomisessa. Toisen kappaleen kirjallisuuskatsauksessa määritellään tärkeimmät teoreettiset konseptit, käsitellään keskeistä kirjallisuutta ja esitellään tutkimuspropositiot. Tutkimusmetodologinen perusta luodaan kolmannessa kappaleessa, jossa käsitellään keskeiset tilastolliset työkalut, teoreettisten käsitteiden operationalisointi ja aineistoa kuvailevat tunnusluvut. Tilastollinen analyysi ja hypoteesien testaaminen tapahtuvat neljännessä luvussa. Ensimmäiseksi tutkitaan logistisella regressioanalyysilla mitkä tekijät vaikuttavat siirtoaktiivisuuteen. Tämän jälkeen tutkitaan siirtopäätösten taloudellisia vaikutuksia hyödyntämällä propensity score -menetelmää. Viimeisessä kappaleessa tulkitaan tuloksia empiiriseltä ja teoreettiselta kannalta sekä annetaan suositukset tulevaisuuden tutkimusta varten.

Tutkimuksen tärkein löydös on tuotannon siirtojen ja yrityksen taloudellisen suorituskyvyn välinen positiivinen yhteys. Yritykset, jotka ovat tehneet siirtopäätöksiä ovat pystyneet ylläpitämään kannattavuuttaan paremmin kuin tutkittu kontrolliryhmä heikossa taloudellisessa syklissä. Tulokset näyttävät, että tuotantoa siirtävät yritykset ovat pystyneet kannattavuuden ylläpitämisen lisäksi kasvattamaan liikevaihtoa. Siirtojen vaikutuksista yirtyksen käyttöpääomaan ei pystytty löytämään tilastollisesti merkittäviä tuloksia. Tuotannon siirtoihin vaikuttavia tekijöitä tutkittaessa havaittiin heikko yhteys vähemmän pääomaintensiivisten yritysten ja siirtoaktiivisuuden väliltä. Yrityksen vakavaraisuuden ja sen lisääntyneen investointimahdollisuuden ei havaittu vastoin odotuksia lisäävän siirtoaktiivisuutta. Yleisenä johtopäätöksenä voidaan todeta, että tuotannon siirroilla on tärkeä rooli yritysten strategiassa mikä näkyy positiivisena vaikutuksena kannattavuudessa. Tarkemman mekanismin selvittäminen vaatii lisätutkimusta.

# PREFACE

This Master of Science Thesis finishes my five years studies in Tampere University of Technology. I have had chance to enjoy academic freedom, meet great friends and be part of interesting projects during the past years. Choosing Industrial Engineering and Management for the academic program was a natural choice after finishing the high school and not knowing what to do next. Now after five years of studying, things have not changed significantly. I still do not consider myself ready or know what to do as a grownup.

This is one of few chances to thank the people around me who have supported during the thesis process and my time in the university. First, I want to thank Professor Jussi Heikkilä and Associate Professor Teemu Laine who gave me chance to study this interesting topic and learn the tools it needed. Second, I want to thank all the great friends, from the guild and high school, who have helped me in a way or another during my studies. Especially I want thank Erik, Jesse, Miikka and Sampsa for your great company, and Juuso for your courage to start a business with me. Another thanks go to Timo and Jenni for your great friendship. I also want to thank my family for their support, especially for reminding me about the importance of a graduation party. Last, I want to thank you Józefina for all the support and help you have given me.

Learning is something I have gotten to enjoy more and more during these years. Even if the University have not always provided the most interesting ways or subjects to learn, it has taught me things I might have skipped otherwise. Hopefully, I will enjoy learning even this path ends now.

Tampere, 16.8.2017.

Samuli Kinnunen

# CONTENTS

# LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| CCC | Cash Conversion Cycle |
| NTC | Net Trade Cycle |
| OROA | Operating Return on Asset |
| RBV | Resource Based View |
| TCE | Transaction Cost Economics |
| TCO | Total Cost of Ownership |

# 1. INTRODUCTION

## 1.1 Research background

Throughout the last three decades, globalization has spread the manufacturing networks to be increasingly dispersed and fragmented (Brennan et al. 2015). Production movements to low-cost countries have received a lot of attention, and raised concerns regarding manufacturing jobs in the traditional industrial countries (i.e. FMEE 2014). The offshoring movement has been followed with a reverse movement, which is here called backshoring. Some offshoring companies considered that either the benefits and costs of offshore manufacturing were not as expected or the cost environment in offshore location have changed (Gray et al. 2013). This has led to a reverse movement that has been lately in the interest of manufacturing relocation research (i.e. Heikkilä et al. 2016b; Kinkel 2012; Kinkel & Maloca 2009).

Strategic management theories such as Resource-based view (RBV) and Transaction cost economics (TCE), and Dunning's Eclectic theories have been utilized to explain production relocation decisions (i.e. Massini et al. 2010; Dunning 1998). Empirical research on manufacturing relocation decisions have focused, for instance, to find out the trends and drivers of the production movements (Heikkilä et al. 2016a; Heikkilä et al. 2016b; Kinkel 2012; Kinkel & Maloca 2009) and relation of production movements to manufacturing strategy (Ferdows 2014).

Even though, the researchers, such as Ferdows (1997b), emphasize the importance of the strategic role of manufacturing plants in production movements, the empirical evidence is pointing that companies are focusing heavily on cost related drivers (Heikkilä et al. 2016b; Kinkel & Maloca 2009). The future of cost related offshoring is still open. The rising wages of offshoring countries are eroding the cost advantage (Martínez-Mora & Merino 2014; Pearce 2014). New technologies such as 3D printing and a shift towards "servitization of manufacturing" might bring manufacturing closer to customers in future and lead to further backshoring when labor differences are balanced (Bals et al. 2016).

This thesis is part of Reshoring of Manufacturing (ROaMING) project. The base of the project comes from a questionnaire survey that was conducted in Finland, Sweden and Denmark. The survey has revealed a lot of valuable information about offshoring and backshoring activity and what is driving the relocation decisions (i.e. Heikkilä et al. 2016a; Heikkilä et al. 2016b). This research connects the survey research with the financial statements of the surveyed companies from 2010 to 2015.

Connecting the data about production movements with the financial indicators enables studying production movements from a new perspective. Secondary financial data provides an objective and value-free standpoint to examine production relocation decisions. This research seeks to supplement existing literature on production relocation with the help of the financial data analyses.

## 1.2 Research objective and questions

The objective of this research is to bring new perspective to offshoring and backshoring research by first examining the production movement companies before the relocations and then analyzing the effects of production movements. Examining the movement from the financial perspective aims to answer to the following research questions:

1. What kinds of factors characterize the companies that are moving their production?
2. What are the financial effects of production movements?

Characterizing offshoring companies helps to understand what kind of companies are moving production. Examining the effects of production movements might yield valuable information about the future trends of relocations. The success of production movers might bring new companies to relocate their production. Existing offshoring companies would be more likely to continue in the offshore location if offshoring turns out to be a profitable production strategy.

The research questions are answered by constructing theoretical propositions that can be translated to statistically testable hypotheses. A **proposition** is an argument about the relationship of two theoretical concepts, and a **hypothesis** is the relationship of two empirical concepts that can be measured (Ketokivi 2015). The interest in the analysis of production movement companies is in the financial ratios of production movement companies. The factors are researched if they can be utilized to predict movement activity. The effects of production movements are analyzed regarding financial effects of production relocations. Distinct analyses are performed to compare offshoring, backshoring and any production movements.

## 1.3 Research methodology, process and structure

The idea of this thesis is to have an objective view through the combination of survey and archival research. The focus is on the observable phenomenon and causality. The two most important statistical methods are propensity score method (PSM) and logistic regression model. The method of hypothesis is utilized in the study, which needs both inductive and deductive inference as well as abduction (Ketokivi 2015).

The process started from the literature review and data collection in December 2016. Preliminary research questions were formed during January 2017 based on the examined

literature, data limitations and discussions with more experienced researchers. During the literature review, the initial hypotheses were constructed to find answers to the research questions. These initial hypotheses were fined down during the thesis process. According to Ketokivi (2015), predicting the statistical associations and hypotheses before the analysis based on theory and then finding that the data and analysis support the hypotheses is the recommended approach. Otherwise, nearly any statistical finding could be later reasoned with theory using assumptions that researcher finds supporting the desired results. Basing on theories at first is much harder, but at the same time much more reliable and rewarding. This thesis process aimed to follow this practice, even though, the process included going iteratively back and forth, and finding the balance between theory, data and hypotheses. Especially, operationalizing of the propositions was not a straight-forward process and it required going iteratively through the theory and the limitations of the data. The data analysis took place in the spring 2017. Inferencing the results involved mostly abductive reasoning, because the objective is to inference to the best explanation.

Figure 1 presents the research process and the structure of the thesis that mostly follows the research process. The thesis begins with the introduction of the important concepts and literature review of the topic. This way, the base for the analysis is constructed. The objective in the literature review section is to find gaps in the literature that the data could potentially answer. Four propositions for the further analyses are presented in the end of the literature review.

A shift from theory to empirical analysis is presented in Chapter 3. The methodological choices are gone through including statistical tools that were chosen based on the research problems and data limitations. This chapter of the research includes operationalizing the theoretical concepts and building the hypotheses. In addition, the descriptive statistics are presented.

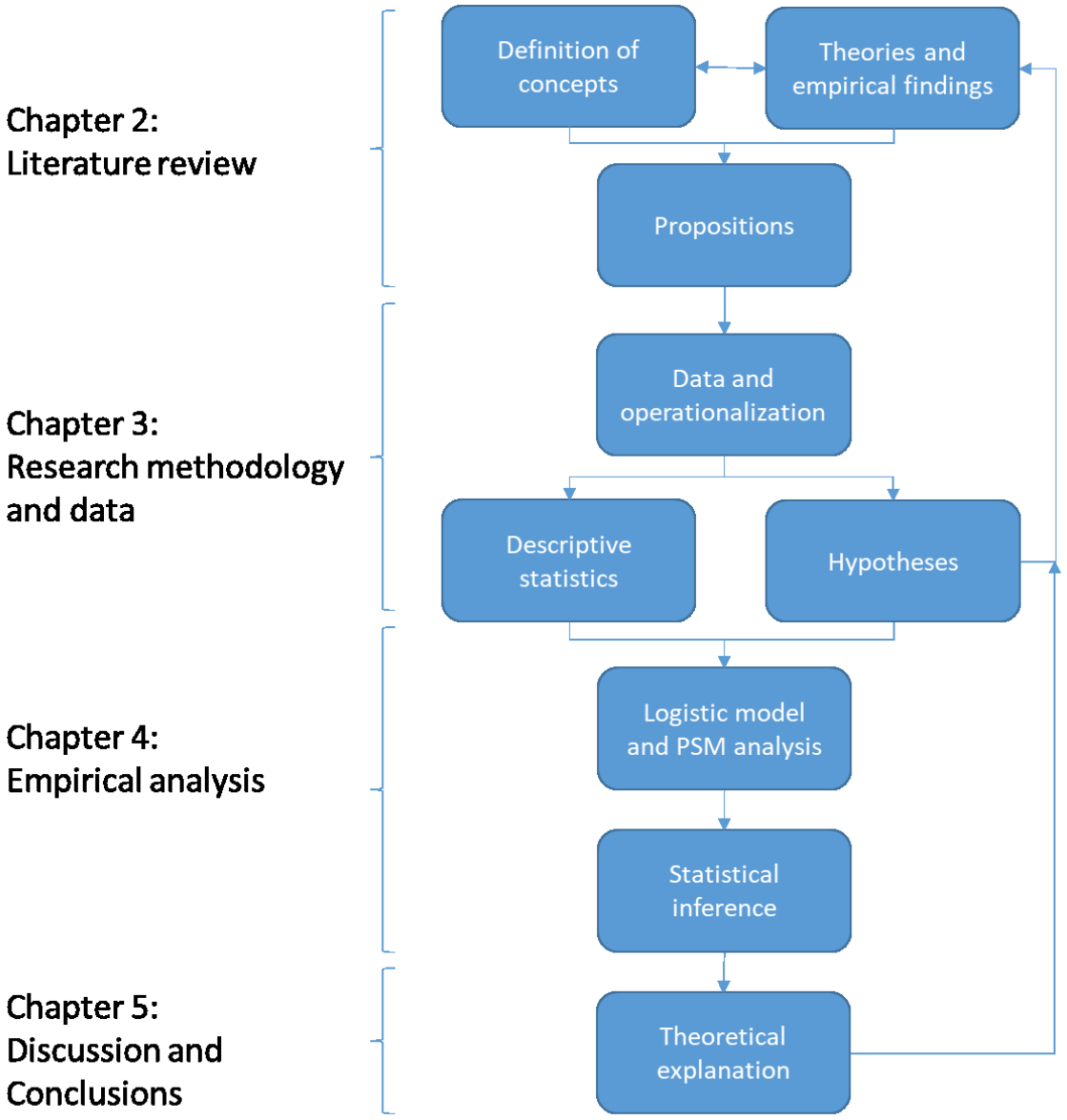


***Figure 1.*** *Structure and research process of thesis*

The empirical analysis has two parts. First, the production movement activity is studied using logistic regression. Hypotheses are tested and the results are statistically inferenced. Second, the text focuses on the effects of production movements using propensity score method. Treated and control groups are formed and compared to find out if production movements influence financial performance or operational working capital. Both analyses are controlled with an industry and company size. The last part of the thesis focuses on reflecting on the empirical results and linking them to the earlier findings and theories. The chapter discovers the findings, limitations, and suggestions for the future research.

# 2. LITERATURE REVIEW

## 2.1 Background of production relocation decisions

Manufacturing reallocation decisions have received increasingly attention during the last decades (Stentoft et al. 2016). At first, the interest has been in offshoring decisions. Moving production to foreign countries was justified often with lower labor cost, but also with proximity to markets and lately with access to skillful workers (Massini et al. 2010). Moving production back to home countries has been a point of interest for many researchers during the last few years. Studies have reasoned the reverse movement to be happening for instance, because of eroding cost advantage (Wu & Zhang 2013), increased need for flexibility and proximity to R&D activities (Bailey & De Propris 2014).

Offshoring started from labor-intensive industries such as textile industry and continued to influence also other industries later on (FMEE 2014). Even if a large number of jobs have been transferred to low-labor countries such as China and Poland, the overall productivity has not been hit with the same force in the developed countries. Manufacturing output has increased in the Nordics mainly because of the rise in automation and transition to knowledge- and technology- intensive sectors (BCG 2013).

One of the reasons why international manufacturing reallocations have received as much attention as they have is their important role in global economies. Developed countries have lost manufacturing jobs that have been a foundation of economy for many countries. For instance, in the USA, the amount of jobs in manufacturing industries decreased from 17,3 million (2000) to 11,5 million (2010) in ten years, but since that the number has slowly recovered to 12,4 million (5/2017) (U.S. Bureau of Labor Statistics 2017). In Finland, manufacturing industry workforce has dropped down by around 90 thousand jobs between 2006 and 2016. It has decreased especially after the start of the global finance crisis in 2008. Now the number of manufacturing industry employees equals around 307 000 (Official Statistics of Finland 2017)

Even though, bringing the production back to home country has been under a lot of discussion, the situation might be tougher than thought at first. In Finland, SMEs are struggling with their exporting, because they have been earlier relying on subcontracting to global firms in Finland (FMEE 2014). Exporting is especially important for the Nordic economies, and the situation cannot be compared to the larger western countries such as USA and Germany. Having small home markets in Finland has been considered increasing logistic costs and not providing any advantage of being close to high demand markets. In contrast to the negative view of Finland, BCG (2013) suggests that backshoring and higher exports could add up to 5 million jobs to the US economy.

The research on manufacturing reallocation decisions has been especially focused on drivers and reasons that makes companies to offshore their production, or later to backshore it. However, different theories are utilized to explain companies' strategic intentions. Resource-Based theory (RBV) (Wernerfelt 1984), Transaction Cost Economics (TCE) (Williamson 1979) and Dunning's Eclectic Theory (Dunning 1998) have been used to enlighten firms' manufacturing strategies. RBV has been interpreted to explain both offshoring (Massini et al. 2010) and backshoring (Canham & Hamilton 2013). Firms focus on their core activities and externalize non-core activities, which allows them to concentrate their limited amount of resources on creating competitive advantage. TCE focuses on make-or-buy decisions from transaction cost point of view. Firms will move their production from higher to lower cost countries if other factors remain the same (Ellram et al. 2013). Dunning's Eclectic Theory finds four factors to explain international production: resource seeking advantage, marketing seeking advantage, efficiency seeking advantage and strategic asset seeking advantage (Ellram el al. 2013). Eclectic theory was originally developed to explain international expansion of the firm. Hence, it has been later applied to explain backshoring (Fratocchi et al. 2014).

Next chapters focus more on the research about drivers and effects of offshoring and backshoring, mostly based on the data from the last few years to ensure the validity. International manufacturing has been researched using various terminology and concepts. To get conceptual clarification, terminology and concepts are analyzed first.

## 2.2 Terminology and key concepts

### 2.2.1 Manufacturing relocations

The examined literature has utilized multiple terms describing international manufacturing relocation decisions. In addition, the same terminology has been used with different meanings. One of the reasons for the confusion might be the multidimensionality of international location decisions. Often, when a firm is moving production to a new location it includes also an ownership decision. Relocated production can be still owned and operated by the company or by an external company to which it was outsourced to. On the other hand, which value chain activities are offshored or backshored, and to which extent is not always clarified adequately. To get the conceptual clearness, this chapter discusses different meanings of the terms based on the literature and aims to make distinction between different meanings and concepts.

The definitions utilized in this thesis related to manufacturing relocations are presented in Table 1. Moving value chain activities to a foreign country is called offshoring. The meaning of offshoring is ambiguous. Arlbjørn and Mikkelsen (2014) define offshoring, as a production movement that stays in the offshoring firm's ownership. On the contrary, Massini et al. (2010) utilizes a wider definition of offshoring. It includes so-called *captive*

*offshoring* where activities stay in the firm's boundaries and so-called *offshore outsourcing* where activities are performed externally. In addition, the literature do not have consensus of what markets offshored activities are serving. Some studies (Massini et al. 2010; Lewin et al. 2009) define that offshored activities serve the home country or global operational requirements. On the other hand, some papers (Manning & Massini 2008; Schmeisser 2013) emphasize that activities are to serve rather global than local demand. Some studies (i.e. Schmeisser 2013) focus on offshoring value-chain activities with a broader scope than this paper. It has led to a definition that internationalization can be offshoring if it is primarily concerned with the input-market side rather than with, for instance, sales activities (Schmeisser 2013).

***Table 1.*** *Definitions of the manufacturing relocation concepts.*

| **Concept** | **Target location** | **Target ownership** | **Definition** |
|---|---|---|---|
| **Offshoring** | Foreign country | Any | Moving manufacturing to a foreign country irrespective of the ownership model |
| **Outsourcing** | Any | External company | Performed by independent parties who are not part of the firm's employee base (Ellram et al. 2008; p.149) |
| **Backshoring** | Home | Any | Decision to move production to home country or decision to supply earlier offshored production |
| **Insourcing** | Any | Internal | Decision to transfer previously outsourced production in-house |

The reversal movement of manufacturing is often called either backshoring or reshoring. Reshoring is understood as moving manufacturing back to the country of its parent company (Ellram et al. 2013). Kinkel and Maloca (2009) use a similar definition for backshoring. However, all authors do not interpret reshoring as moving manufacturing back to the home country (i.e. Tate et al. 2014). Fratocchi et al. (2014) proposes the term reshoring to indicate a generic change of location with respect to earlier offshore location. They propose the use of term back-reshoring to denote the decision to move the production to the home country or to decision to supply earlier offshored production. This widely referred to concept finds three features to characterize reshoring: 1. back-reshoring is a

reverse movement with respect to previous offshoring decision 2. moving part of the offshore production back can be back-reshoring 3. it is a relocating decision irrespective to ownership in the offshore country. This definition is used in this thesis and is in line with Ellram (2013), Gray et al. (2013) and Stentoft et al. (2016).

Concepts and definitions highlighted in Table 2 are the ones used in this thesis. Offshoring and backshoring decisions are fundamentally thought as location decisions. This paper utilizes outsourcing and insourcing if it is needed to make a distinction between ownership models. Clearness in the terminology is inevitable when drivers and effects of relocating decisions are in discussion, because a decision to change a location is often combined with a decision to change an ownership model. The drivers and effects may vary depending on what is the change in both, ownership and location.

***Table 2.*** *Terms for home and offshore production according to ownership. Adapted from Jensen et al. 2017.*

| | **Internal ownership** | **External ownership** |
|---|---|---|
| **Home production** | Domestic in-house | Domestic outsourcing |
| **Offshore production** | Captive offshoring | Offshore outsourcing |

This literature review uses “home production” to refer to production activities in the company’s home country. The term offshore production is utilized to describe companies manufacturing activities in foreign offshore location. This distinction is also the base of the thesis’ structure. A home production can be either domestic in-house or domestic outsourcing depending on the ownership model. An offshore production is also independent of ownership model, both captive and outsourcing models are possible. However, this distinction does not take into account hybrid ownership models such as a joint venture or a long-term partnership (Bals et al. 2016). The fundamental difference between two frameworks Table 2 and Table 3 comes from the different approaches to the phenomenon: The first one focuses on the decisions to move production and the latter one where the production is carried out.

### 2.2.2 Financial indicators

The usage of financial indicators is common, for instance, by investors to predict future cash flows of a company and by researchers to examine a company’s financial performance. Often the source for the financial indicators are the financial statements of public companies. In Finland, financial statement includes at least an income statement and a balance sheet. An income statement reveals a company’s revenue and cost structure over the chosen accounting period. A balance sheet shows where the money has come from

and where it is tied up. It is possible to calculate financial ratios from financial statements to operationalize theoretical concepts. The usage of financial indicators for research purposes includes various problems. For example, Ketokivi (2015) highlights the problems of using the amount of R&D costs as an operationalization to the level of innovation in a company. Using this type of operationalization means that companies with higher R&D costs would have a higher level of innovation. The first problem arises from the fact that companies do not necessary channel R&D costs to a separate R&D budget, which makes R&D costs inaccurate to describe the level of R&D investments. The second problem is related to the logical gaps of the operationalization. If a company manages to build a successful product that increases its revenue rapidly, simultaneously the share of R&D costs drops, because the denominator of the formula increases. Respectively, a struggling company with decreasing sales would seem as a more and more innovative company. To avoid such problems in research purposes, the clear definitions of financial indicators are important as well as an understanding of the weaknesses of using secondary data to reflect a different purpose that it was originally meant to.

Financial statements offer an interesting standpoint to characterize the companies that are making relocation decisions. A company's cost structure might yield information where the companies would benefit the most to find savings. Unfortunately, the breakdown of the costs in the income statements is varying and do not usually go into very detailed level. This might be one of the reasons why researchers have not studied in detail what kinds of companies are relocating their production in terms of cost structure. Here, the interest in the analyses is in the proportion of labor and capital costs, because of the importance of labor costs in production relocation decisions and the sufficient level of accuracy of reporting for this purpose. Also balance sheets can reveal important information regarding the decision making. The amount of cash and equity is connected to a company's ability to make investments and take risk by Daniel et al. (2004) and George (2005). Even though the role of slack is studied in other contexts, this type of financial freedom in decision making was not examined in the literature of this thesis in the context of production relocation decisions.

The effects of production movements are a less studied topic in the manufacturing relocation literature. However, the usage of financial statements as a source for indicators of financial performance is common in the research examining how strategic choices are influencing financial performance. Venkatraman and Ramanujam (1986) examined the choices related to the measurement of performance and found ten different approaches to measure business performance in strategy research. The paper points out the importance of defining the financial performance and understanding the limitation of secondary data sources. The interest in the effects of production movements includes also the effects in working capital. Working capital can be separated to a different sub concepts such as financial working capital and operational working capital (Talonpoika 2016). Here, the focus is on the latter one, because the change of operational working capital could reveal

how production movements are affecting the level of inventories and to efficiency of financial supply chain.

Clear definitions of financial concepts are important, because the operationalization of theoretical to empirical concepts is the base of statistical analysis (Ketokivi 2015). The important concepts to characterize companies are presented in Table 3. In this thesis, they are capital intensity and financial slack. The effects of production movements are analyzed using two concepts. Financial performance and working capital are utilized in order to measure the effects of production movements.

***Table 3.*** *Definitions of financial indicators.*

| **Financial indicator** | **Definition** |
|---|---|
| **Capital intensity** | The amount of capital in relation to labor that company employs for its operations. |
| **Financial slack** | The excess financial resources that describe the degree of financial freedom enabling risk taking, investments and innovations. |
| **Financial performance** | The degree that company is reaching its strategic goals measured by financial indicators such as profitability or growth of sales. |
| **Operational Working capital** | The amount of capital that is tied up in a cash conversion cycle. Shows the efficiency of financial supply chain. |

Capital intensity is defined here as the amount of capital in relation to labor that company employs for its operations. In some cases, companies can choose between capital and labor in their production functions (Canham & Hamilton 2013; Autor 2013). For example, investments in production automation tie up capital but often reduce the need of labor. According to this logic, labor intensity can be measured inversing it from capital intensity (and vice versa). For instance, Autor (2013) points out that novel tasks are often assigned to workers, because of the need of flexibility when adjusting new situations. As these tasks are routinized and formalized, it is possible to substitute human labor with automation to reduce costs.

As operationalizing capital to labor intensity can be challenging, multiple measures have been developed to attempt to do so. For example, Dachs et al. (2006) measured labor intensity as share of labor costs from total costs. This definition is problematic since it reflects the level of outsourcing. A firm that has outsourced most of the work, but is still

doing relatively labor-intensive job, such as assembling, might be treated less labor intensive in this scale. On the contrary, capital intensive production with a low level of outsourcing could be seen as labor intensive. Another option is to measure the level of capital tied up to the machines and facilities. This approach can be biased with the fact that the book values of tangible assets are not in-line with the replacement values of the assets (Barna 1959).

Slack resources have not been under discussion concerning production relocation decisions. The slack can be defined as a difference between total resources and necessary payments. This is the amount of resources, which a firm could utilize either to counter unexpected threats or to exploit opportunities. (Daniel et al. 2004). In addition, slack enables experimentation and risk taking (George 2005) The operationalizing of slack varies depending on the form of the slack. Slack resources can be social or human capital, organizational capabilities or financial slack (George 2005). Here, the concept of slack takes a form of financial slack, which also have multiple definitions. The financial slack is mostly operationalized to measure either amount of liquidity or debt to equity -ratio in the studies measuring the performance effects of slack (Daniel et al. 2004).

Performance is the time test of any strategy (Venkatraman & Ramanujam 1986). The problem comes from different operationalization of performance. Venkatraman and Ramanujam (1986) argue that business performance is a multidimensional concept. The dimensions such as short-term profitability and long-term growth can be in conflict, because achieving these would often need different strategies. The authors warn that these dimensions should not be combined as a single measure because they reflect distinct dimensions. In this thesis, the focus is on short-term profitability, because the data does not include sufficient number of years to study the phenomenon years after the production relocation is being carried out.

The domain of financial performance typically refers to use of outcome based financial indicators that should be describing how company is reaching its economic goals. Typically, the indicators such as sales growth and profitability are accounting based measures for financial performance. Marketing based measures such as market-to-book or stock market returns are alternatives to accounting based measures. If the domain is widened to business performance, which includes also operational performance, potential indicators for operational performance are, for instance, market share, manufacturing value-added and product quality. (Venkatraman & Ramanujam 1986)

Profitability as a measure of financial performance is relevant for the scope of this study, because it can be used as a measure of short term profitability (Venkatraman & Ramanujam 1986). Especially, in the offshoring that is based on cost savings, profitability provides better validity that only analyzing the change of costs, because it also takes into account the changes in revenue. However, there are plenty of measures for profitability such as gross profit, net income, operating profit, return on equity and return on assets.

The strength of ratios such as return on equity and return on assets comes from the fact that they consider the amount of capital that is employed by the company.

Working capital has multiple measures but the most interesting one regarding this study is operational working capital, because it can be used to measure the efficiency of financial supply chain management. Operational working capital measures the efficiency of working capital management. It is designed for managerial decision making to give information about inventories, account receivables and accounts payables. The most common measure for operational working capital is cash conversation cycle that takes into consideration inventories, accounts receivables and payables, as well as possibly cost of goods sold and other expenses. (Talonpoika 2016)

## 2.3 Theoretical lenses for studying production relocation

Offshoring manufacturing can be analyzed using theories from strategy literature. Transaction cost economics and Resource-Based View (RBV) offer theoretical lenses to view benefits and disadvantages of offshoring manufacturing. Dunning's eclectic theory finds three variables that determine multinational firms' foreign direct investment decisions (FDI) (Rugman 2010). **O**wnership**, L**ocation and **I**nternalization advantages construct an OLI-framework. In this thesis, the focus is on the location advantage, because according to the earlier defined concepts, offshoring and backshoring are fundamentally location based decisions.

The main objective of Transaction Costs Economics (TCE) is to minimize firm's transaction costs (Ketchen & Hult 2007). Drawing on TCE, the offshoring production bases on cost savings. Cheaper labor and other costs are managers' tools to enhance operational efficiency (Massini et al. 2010). On the other hand, offshoring production increases complexity and number of transactions, which would suggest increases in the total costs. High coordination costs may challenge the cost savings received from the labor with the respect to the home country (Kinkel & Maloca 2009).

RBV is widely accepted theory to analyze firm's strategic decisions. According to RBV, companies aim to create competitive advantage via collection of unique and inimitable resources that produce value to the customers. A company poses limited amount of resources and from their point of view, allocating those resources is crucial. (Massini et al. 2010) From that angle, externalizing non-core activities to lower cost offshore location is rational. On the other hand, firms can integrate sets of resources to enhance its competences. The drive to get an access the knowledge in offshore manufacturing can be seen as a way to develop competences that are hard to imitate.

Dunning's Eclectic theory of international production (1998) divides drivers into four different advantage-seeking categories: resource, marketing, efficiency and strategic.

Firstly, resource-seeking advantage reflects companies' needs for raw material and infrastructure. Secondly, marketing-seeking advantage considers availability and cost of local talent and suppliers, access to domestic markets and government economic policies. Thirdly, efficiency-seeking advantage combines production cost-related factors, industry clusters and government removal of trade barriers. Lastly, Strategic asset seeking advantage emphasizes knowledge and synergies that could be achieved with a local presence. For example, understanding markets and consumer needs better, as well as intangible and tangible synergies in general scope. These four factors provide a holistic view of possible benefits in offshoring manufacturing. However, Dunning's theory does not consider relative importance of each advantages.

Ellram et al. (2013) use survey research to explore factors affecting manufacturing location decisions. They use Dunning's Eclectic theory to segment drivers, and make three suggestions to advance the understanding about the drivers. Firstly, the study suggests that factors affecting attractiveness of the region change over time, with trade policies increasingly as a differentiator. The study views this suggestion to be closely related to the Dunning's Strategic asset seeking advantage. Nonetheless, it could also be viewed as affecting operational efficiency, if the government is creating incentives than lower operating costs or vice versa.

The second suggestion points out that supply chain-related factors are becoming more important. The idea is based on the broader view of total costs. Earlier companies were overwhelmed by low labor cost, and did not consider the total costs caused to the company. Ellram et al. (2013) emphasize the importance of managing the supply chain. Interruptions in the supply chain increase costs through recovery process and lost revenue. This proposition is in line with Transaction cost economics theory, which emphasizes how increased complexity can challenge the cost savings. An offshore production is balancing between cost savings and added complexity and thereby increased costs.

The third suggestion continues to widen the perspective of location decisions. Companies consider total costs, profitability, and customer value creation when deciding on the manufacturing location. The results of Ellram's et al. (2013) paper proposes that companies use more strategic reasons in their decisions. On the other hand, the third suggestion considers all of the Dunning's advantages some way. This would imply that companies are increasingly aware of the total impact of offshoring production. Hence, strategic decisions would be done with increased amount of information.

The usage of different theoretical perspectives on international production location decisions describe the complexity of these decisions. The theories raise a question how much companies are actually considering each aspects of the location decisions. Balancing strategic and operational motivators highlights the difference between the three theories. RBV provides more strategic view on competences to create advantage when TCE concerns more operational efficiency in terms of transaction costs. Eclectic theory takes a

broader look for the location decisions and considers it from both operational and strategic scope.

## 2.4 Global manufacturing network and plant roles

Manufacturing networks are getting increasingly complicated. Ferdows pointed out already in 1997 in his paper "Made in the world: the global spread of production" that it is difficult to say what is the actual country of origin for a product. Cars are assembled using parts from factories in over two dozen countries. Ferdows (1997b) emphasizes the importance of managing global production network. He questions the idea that manufacturing would be just moving to the foreign countries because of low costs, instead, the main motivation is accessing to a new market. Superior manufacturers are not trying to build collections of disjointed factories that are spread internationally in a chase of low costs, but more likely to be building integrated network that is a complement, not a substitute to the home country's production.

The research on global manufacturing networks has examined how the increased complexity of the networks should be managed. One challenge lies in the constantly changing environment. Multiple factors outside of the firm's control change the structure of a supply chain network constantly (Ferdows et al. 2016). These can vary from changes in technologies to changes in exchange rates or trade agreements. Ferdows et al. (2016) aim to find a way to manage the rapidly growing complexity. Hence, the importance of managing these networks is growing simultaneously. Delayering manufacturing networks into simpler and more manageable subnetworks offers a tool for this challenge. To succeed, these subnetworks must have a coherent manufacturing mission and appropriate competencies to perform it.

Firms should be considering their manufacturing strategy with a wide perspective. Manufacturing strategy should extend to external parties and clarify the level of dependency on long-term suppliers, partners, and other key actors in the industrial network (Ferdows 2014). An important premise is that a firm's manufacturing network can develop competences that go beyond the plant level. Ferdows (2014) presents three main questions that companies face when they produce in more than one plant:

1. Are they producing right things in the right locations?
2. Does each plant have sufficient resources for the expected task?
3. How do they transfer know-how among production sites and that way improve performance?

The first question is difficult to answer because of its *detail complexity*: all the variables affecting to the optimal allocation of products in a plant are difficult to take into account. The second question concerns if a firm does not invest sufficient amount of resources for

its plants they may end up to a vicious cycle of continuously reducing plants' competences and performance. The third question emphasizes the importance of finding ways to transfer know-how between production sites. Companies that produce complex products or have highly sophisticated processes might struggle how to transfer tacit knowledge between plants. (Ferdows 2014)

The second question relates to the manufacturing strategies. Companies that do not consider manufacturing as their competitive advantage are more often outsourcing it and do not invest resources to develop their own global plant network. On the contrary, companies that rely on manufacturing as their competitive strategy tend to invest in their own plants and to develop superior manufacturing competences. (Ferdows 2014) Ferdows (2008) suggests that the former companies are likely to have a "footloose" and the latter "rooted" production network, because staying "footloose" means continuous search of better factories inside or outside the company, in the current or in foreign countries. Their competitive advantage can come from marketing or design, instead of manufacturing. Rooted networks, however, argue for a stability that enables these companies to grow production competences that are unique and create competitive advantage. Both premises are ways to cope with the same uncertainty and volatility of the world.

Figure 2 connects manufacturing networks to manufacturing strategy. Companies with unique products and proprietary production processes are more likely to have rooted manufacturing networks where they are able to develop new products and process technologies. However, for footloose networks the location of the production is not that important, because the complexity of the products or processes are lower. This makes it possible to relocate the production easier. When these cost-oriented companies were analyzed, it was found that the companies have not adopted an offshore strategy that often (Massini et al. 2010). According to Porter and Kramer (2011) some firms that were earlier considering mainly cost advantages are changing their strategy by building a stronger global production network with both capable local and global plants.

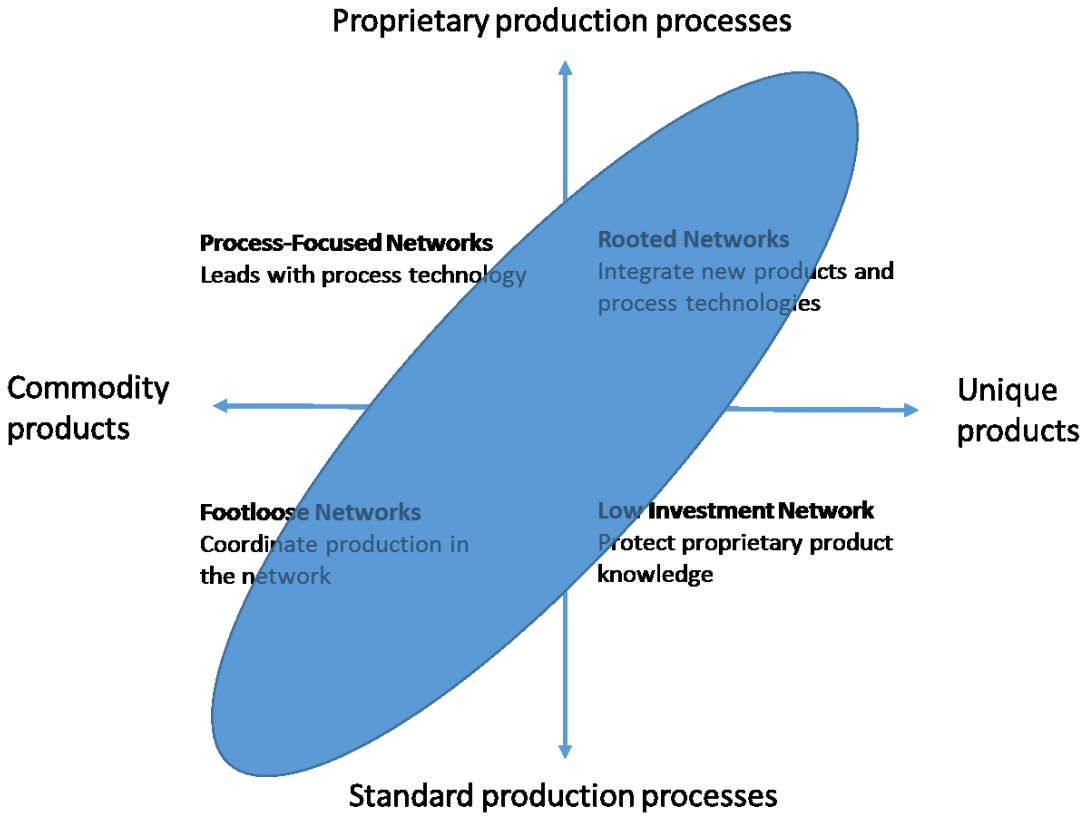


***Figure 2.*** *A firm's manufacturing strategy in relation to its production and processes, adapted from Ferdows (2008)*

Manufacturing networks can have different strategies and subnetworks different roles, but also production plant roles have received academic attention. At first, process or product oriented plant roles were introduced, and later market area and general-purpose plants (Feldmann & Olhager 2013). Ferdows (1997b) introduced the concept of plant's strategic roles. Plant roles have two dimensions: a strategic reason for the location and a competence level for the plant. The reason for a location may vary from low-cost production, to access to skills and knowledge and proximity to markets. As Ferdows treated site competence as a single factor, Feldmann and Olhager (2013) divided competencies into three bundles: production-related, supply chain-related and development-related. The extent, what kind of competences a site poses, can vary from having only production competencies to have all of three possible type of competencies.

Production competence includes production, maintenance and process improvements. Production competences are needed when a plant is building supply chain and development competences, which includes handling logistics, suppliers and purchasing. Respectively, the third type of plant possess both former competences but it also has development competences to introduce new product and process technologies. Empirical evidence supports Ferdows' (1997b) idea that companies should build networks with higher competence plants. Sites with a higher level of all three competencies outperform with

those with just production competences. The research also supports the co-location of production and product development. (Feldmann & Olhager 2013)

Ferdows (1997b) aims to find an answer to a question how a foreign production plant could have more competencies to serve not only in the local market but also in every market. Foreign factories that are based on narrow cost advantages are more vulnerable to a changing environment. For instance, the declining tariffs were affecting companies such as Nissan and Procter & Gamble forcing them to close many of their foreign factories in the 90's, because these factories did not have a suitable role in the plant network after losing their cost advantage. Ferdows (1997b) emphasizes the importance of deciding a specific strategic role for the plant. A company that is just focusing on the cost advantage does not get the full potential out of the location. He is convinced that the companies, which consider their foreign factories as a source of competitive advantage, are more profitable and get higher market share. These companies do not use labor costs or trade barriers as their main drivers for the location decision; instead, they focus on drivers such as advanced infrastructure and skilled workers.

Ferdows (1997b) introduced a framework (Figure 3), where he divided plant into roles: "lead", "contributor", "source", "server", "outpost" and "offshore". Lead factories have a role to serve the whole company by creating new products, processes and technologies. They also have more power to stay in direct contact with their suppliers and partners. Server and contributor plants both serves the national or regional markets. However, contributor role responsibility extends to product development and to co-operation with suppliers. Source factory and offshore factories are both exploiting cost advantages to produce items that are mostly exported for either further work or for sale. Source factory has a broader strategic role in terms of greater authority to production planning, process changes, outbound logistics and customizations. (Ferdows 1997b)

Foreign factories usually start with a lower part of the matrix (Figure 3), which means that the higher strategic role comes with a continuous development. Even though, a plant may start with a minor strategic role, such as an outpost or a server, the possible paths to the higher roles should be already thought of in the beginning. Moving a plant's strategic role to higher in the matrix is a long and resourceful process. For example, Hewlett-Packard's Singapore plant was established in the 70's. It took a decade before the factory was able to become a source plant of calculators and keyboards, and another decade to get the lead position in the production of keyboards and inkjet printers. A change in an operating environment or in a plant's performance can lead to a need to change the strategic role. If the plant is not performing as expected there may be a need for downgrading its strategic position. A plant downgraded to an outpost, server or offshore is not likely to have a long lifecycle. In contrast, improved performance of a plant may lead to a possibility to let the plant take bigger responsibility. (Ferdows 1997b)

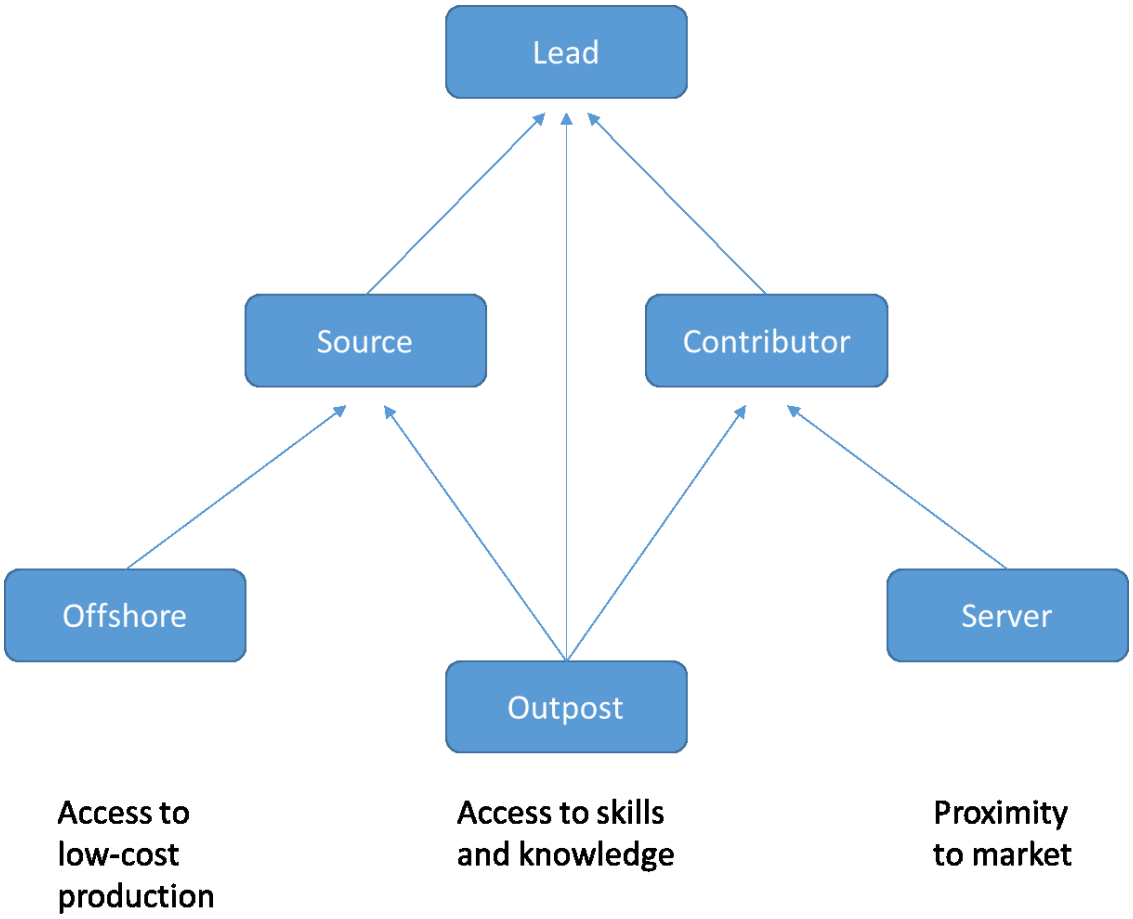


***Figure 3.*** *Paths to higher strategic roles and the primary reason for the site, adabter from Ferdows (1997b).*

A robust plant network will help the company to avoid costs. Firms should have plants with higher strategic roles (sources, contributors and leaders) to achieve the stability. Plant closures and big movements of capacity from plant to plant are expensive and might cause instability to the network. A robust network can cope with changes in an environment without causing major issues. For instance, changes in production input costs might cause a less robust plant network to shift a production from plant to plant in order to maintain the cost advantage. A superior manufacturer with a robust network is able to benefit from smoothly running operations and the significant costs of switching are avoided. (Ferdows 1997b)

Ferdows (1997b) contributes also to the discussion of the drivers for location decisions. Companies that treat manufacturing with a minor strategic role are tend to focus on the tangible benefits. These advantages, such as cheap labor, capital and logistics, are easy to measure. In contrast, benefits such as learning from the foreign customers and suppliers are more difficult to measure. However, when companies increase the strategic roles of the plants, they pay more attention to the intangibles.

Examining plant roles and taking into account the entire manufacturing network, creates a good premise for the further study in manufacturing location decisions. Different plant roles are connected different drivers for the location decisions whether firms are chasing an access to knowledge or to a new market, or if the firm is in a need for low-cost production capacity. Knowledge about the different plant roles helps to distinct what results to expect and how fast. If the cost conditions change in the offshoring location paths to the higher roles are alternatives to backshoring. The perspective of companies basing their strategy either on manufacturing competencies or on something else, offers an interesting approach to examine what will be the future of offshoring and backshoring.

## 2.5 Drivers of production movements

Literature identifies multiple benefits for an offshore and home production. These advantages vary from operational efficiency to strategic advantage. Often, the most found drivers for offshore production are cost related (i.e. Kinkel & Maloca 2009; Heikkilä et al. 2016a). However, researchers have tried to explain relocation decisions also with strategic reasons (i.e. Ferdows 1997b; Martínez-Mora & Merino 2014). Access to knowledge and enabling growth are examples of non-cost related drivers. Rising costs in China, and thereby eroding cost advantage, raises a question if other reasons for offshore manufacturing have increased the importance or is the manufacturing heading back to the domestic plants.

### 2.5.1 Cost efficiency

Labor costs to improve operational efficiency have been the dominant drivers for offshoring in the last years. Eighty percent of the companies in the German study stated that labor cost is the most important motive (Kinkel & Maloca 2009). In the Nordics, labor cost is significantly the most important driver with four points, in a scale from one to five (Heikkilä et al. 2016a). These studies suggest that the firms consider labor cost to be the biggest benefit in an offshore location. However, this is inconsistent with Ferdows' (1997b) thoughts that the main motivation for offshoring is accessing to a new market, not cost reductions.

It appears that conditions are turning against offshore outsourcing (Pearce 2014). The cost advantage is eroding in offshore countries (Martínez-Mora & Merino 2014). For instance in China, the demand has grown for manufacturing labor causing wages to increase by 15 to 20 % a year. BCG expected, that in 2015, total labor cost in China to be only 10-15% lower than for U.S. based manufacturing. (Sirkin et al. 2012) Eastern Europe has been the most common place to offshore between 2010 and 2015 by Nordic companies (Heikkilä et al. 2016a). In countries such as Bulgaria and Romania the overall wage level has nearly tripled between 2004 and 2016. Also in Poland, the wages have nearly doubled during the same time period. (Eurostat 2017) This trend could potentially lead to instability in

manufacturing location plans. According to Ferdows' (2008) framework, companies who are chasing the cost advantages are more "footloose" to relocate manufacturing when the cost environment changes. This idea got support from Kinkel (2012) with a finding that the companies focusing on the price leadership strategy were more active in production relocation activities than companies focusing on the differentiation strategy were.

Evidence from the Spanish footwear industry suggests that also labor intensive industries that were earlier prone to offshore are now bringing production back to the home location. Another factor, which makes offshoring for labor cost savings less attractive, is that the potentially low-wage locations are geographically disadvantageous, which can cause high transportation costs (Pearce 2014). Cost difference in labor costs have reduced and simultaneously transportation costs have increased. (Martínez-Mora & Merino 2014) Moreover, the importance of logistic costs is rising for the East Asian offshore locations (Gray et al. 2013).

Because labor cost comprises only a small portion of firms' overall costs, it is important to pay attention to other costs of doing business (Tate et al. 2014). Other direct costs affecting to firms operational efficiency are, for instance, energy cost, tax structure and currency exchange. Energy costs contribute to an important part of manufacturing cost especially, because energy prices are affecting both manufacturing and transportations costs. Currency exchange rates can have a huge effect on how foreign goods have demand in the market. For instance, when Chinese Yuan rose 35 % against the U.S. dollar it significantly decreased the demand of Chinese product in the United States. Moreover, the importance of the currency stability in the manufacturing location decisions have increased over the past few years. (Tate et al. 2014)

### 2.5.2 Marketing seeking advantage

According to Ferdows' (1997b) plant roles, firms build their plant network on different premises. For some companies the markets are in offshore location but many manufacturer are serving mainly home markets. This means that other companies are moving further and others close when offshoring or backshoring. Shorter product lifecycle (Robinson & Hsieh 2016) and smaller batch sizes (Martínez-Mora & Merino 2014) have increased the importance of getting closer to the customers. Consumers have also become more demanding and are not willing to wait for a long time the product they ordered online (Srai & Ané 2016). Offshore manufacturing means longer response time to customer demands. Products subjective to fast and frequent change in demand are more prone to be backshored (EPRS 2014).

For Velox, a Finnish bicycle manufacturer, seasonality and hard-to-foresee demand fluctuations lead to mismatch between supply and demand (Gylling et al. 2015). Bringing manufacturing closer to customers (from offshore outsourcing to domestic in-house) brought agility to the manufacturing. In the Spanish footwear industry, companies faced

a change to smaller batch sizes. The offshore manufacturing in Asia served mostly large orders. Answering to smaller batch sizes and ensuring quality by controlling the process made companies to backshore their production. (Martínez-Mora & Merino 2014)

Increased numbers of sensors attached to products and machines, competences to collect that data and ability to transform the data into valuable information enables companies to serve customers faster and on demand. Firms can leverage IT and benefits of Big Data to transform the whole network to serve customers and the end users of their product. They can provide more services and use new business models that will produce new revenue streams. (Brennan et al. 2015) In practice, this can mean that companies are selling flight hours for plane motors or taking a cut of the revenue that the product is bringing. Bailey and De Propris (2014) points out that this so-called "servitization of manufacturing" is getting increased amount of attention. Shifting towards "servitization of manufacturing" needs recoupling and closeness of manufacturing and services that drive the movement of manufacturing to be closer to the markets. (Bailey & De Propris 2014)

Another technology that might potentially affect the manufacturing networks is 3D printing. The impacts of 3D printing come from increases in speed and quality of design, lower production costs, reduced processing and better service for the customer. With 3D printing, it is possible to take faster iterations in product development by making prototypes more often. Making customized and tailor-made products is easier with 3D printing, because the same process can be used for different models. In contrast, 3D printing is unlikely to become competitive for high volume production in low labor cost countries. 3D printing can potentially increase backshoring for products that are high value, customized, high quality, and produced in low volumes. (Brennan et al. 2015)

3D printing is still in its infancy and it is not likely that it will change the global manufacturing at this point. More likely, it will follow the history of robotics. It took decades before the automation of factories took place. Even though, the long-term effects of technologies such as 3D printing, big data and industrial internet is potentially significant, it is too early to assess their final impact. (Brennan et al. 2015) Interestingly, Bals et al. (2016) states that the technological development can lead to further backshoring as labor cost differences are balanced.

Companies that are pursuing growth strategy have increasingly a need for highly skilled workers (Lewin & Peeters 2006). Ernst (2006) argues that emerging global markets for knowledge workers has become an important reason for offshore especially for high-tech firms. Similarly, according to Massini (2010) increasing amount of resources that may constrain a firm's growth in home market might be extended by moving to an offshore location. The pressure to increase the pace of product development creates a need for more engineers, scientists and software developers. Increased competences can help companies to exploit market and technological opportunities. (Massini et al. 2010)

Porter (2000) highlighted the importance of geographical concentration of interconnected firms, universities and other institutions in location decisions. These benefits of concentrations of highly specialized skill and knowledge are difficult to be achieved from a distance. Clusters enable innovations and better productivity. Even though, globalization makes transportations and transferring knowledge easier and that way reduces the disadvantages of location, paradoxically, the most enduring competitive advantages are local. (Porter 2000)

To conclude, market proximity is an important factor for many companies considering manufacturing relocation. It can offer companies both access to resources and proximity to customers. Zhai et al. (2016) stated that the companies serving the home markets are more likely to be backshoring. However, the importance of market proximity and access to skills and knowledge are still clearly behind cost advantages based on the survey results of Finland and Germany (Kinkel & Maloca 2009; Heikkilä et al. 2016b).

### 2.5.3 Supply chain and production

The consideration of networks risks, supply chain resilience, social and environmental sustainability have become important network design criteria. (Brennan et al. 2015) To cope with the changing global conditions companies need to apply a dynamic perspective to their supply chain design and develop competences for the global supply chain (Arlbjørn & Mikkelsen 2014). Studies by Bailey & De Propris (2014) and Drauz (2014) highlight the focus on the flexibility of a supply chain that enables adjusting to quick changes. "Structural flexibility" refers to ability to re-configure the supply chain in response to changes in demand or environment, or to disruptions (Brennan et al. 2015). For instance, outsourcing part of the production and still holding the production competences within the company, it is possible to backshore production as a response to lower demand (Drauz 2014).

The biggest problem in making relocation decisions is taking into account the changing environment. Earlier, the decision makers thinking considering location factors have been too static. (Tate et al. 2014) These changing factors are affecting to a location's attractiveness and therefore are continuously making companies to reconsider their manufacturing location choices (Ellram et al. 2013). To cope with the dynamic environment, ability to exploit and explore simultaneously is crucial. This means that companies must be able to allocate resources to enable daily operations and development at the same time. (Arlbjørn & Mikkelsen 2014) In addition to "structural flexibility", term "dynamic flexibility" refers to how existing factors are able to be agile and cope with the dynamic environment. Results of backshoring support the importance of flexibility: seventy percent of the Danish manufacturing companies indicated that their flexibility has increased because of backshoring (Stentoft et al. 2015).

Offshoring manufacturing often means that distances in the supply chain are getting longer. This can affect to the ability to control the production quality. For luxury clothing company Burberry, backshoring enabled it to have a better control of the supply chain. Made in England – messaged customers a high promise of quality and heritage that Burberry possess. Better managerial controls and co-locating design and manufacturing helped the company to hold the promise. (Robinson & Hsieh 2016) Additionally, manufacturers have to tie up more working capital to the inventory that is needed for slow ocean transits and safety stocks (Tate et al. 2014). The longer supply chain is fertile ground for hidden costs and risks. Avoiding these risks is one of the key arguments for backshoring. (Sirkin et al. 2012)

Quality risk should be taken into consideration when making offshore decisions. Gray et al. (2011) found that drug firms' Puerto Rican plants operated with significantly higher risk than the plants in the mainland U.S., on average. The challenge was to transfer between plants the knowledge that is needed for high quality. Compromising quality has been considered a barrier of making offshore decision. Similarly, quality has been seen as a reason to make backshoring decisions. (Canham & Hamilton 2013) In contrast, Olhager and Feldmann (2012) find that site competences are not location related.

Survey research in Finland from 2010 to 2015 showed the importance of supply chain and production related factors when companies are making backshoring decisions. Flexibility, logistics costs, quality and lead time were the four most important drivers for backshoring (Heikkilä et al. 2016b). This indicates that Finnish manufacturing firms consider offshoring location challenging in terms of supply chain and production related factors.

The complexity of supply chains is not going to diminish in the near future. Brennan et al. (2015) argue for the growing complexity saying that offshoring and outsourcing are the strongest forces affecting to the global manufacturing networks. This argument supports the importance of supply chain related drivers. Flexibility, both in supply chain and in production, is increasing its importance if demand gets more volatile, batch size gets smaller and consumer are more unpredictable.

## 2.6 Production relocation decisions

The fundamental question in making offshoring decision is whether manufacturing activities are located at the current locations or in a foreign location. The actual decision is made by weighting the possible benefits of the foreign location against costs and risks associated with managing across geographical and cultural limits. (Mihalache & Mihalache 2015) Presuming that the product and processes have not changed significantly after the offshore decision is done, backshoring takes place because of either changes in the cost drivers in the two locations (home and foreign) or because of changes in managerial valuation of actual total cost of offshoring compared to home location (Gray et al. 2013).

Miscalculations of costs are common in offshore decisions (Gylling et al. 2015; Gray et al. 2013; Moser 2013; Kinkel & Maloca 2009). Moser (2013) suggest that 25% of the companies that offshored from U.S. to China would come back if they used total cost of ownership (TCO) instead of price as a decision criteria. TCO takes into account all the relevant cost for making or sourcing a product home or offshore. The idea is to calculate the total cost of ownership taking into account all the important direct factors such as cost of labor, currencies and other factors such as a risk of natural disaster or impact on innovation. (Moser 2013) As companies begin to understand the total cost of ownership, including capital tied up in the working capital in the form of inventory, and effects of increased lead times, they tend to consider home location more attractive (Tate et al. 2014).

Changing cost environment is the second alternative mentioned by Gray et al. (2013) as a reason to reverse the original offshore decision. Firms are considering backshoring because of the rising costs in the offshore location (Wu & Zhang 2013; Bailey & De Propris 2014) This view is based on an idea that it is not possible to estimate accurately how important location factors will develop over time (Kinkel 2012). Companies that are making offshore decisions should use different scenarios to show the uncertainty in future development (Kinkel & Maloca 2009).

Analyzing backshoring should not be isolated from the original offshoring decision. Companies that offshore manufacturing motivated by efficiency seeking reasons such as labor cost are more likely to be repatriated. Vice versa, investments that are motivated by access to a new market are expected to be more permanent. (Ferdows 1997b; Fratocchi et al. 2014) In addition, the extent of the backshoring is linked to initial offshoring decision. (Fratocchi et al. 2014)

Considering production strategy is important when the offshoring and backshoring decisions are made. Ferdows (1997b) brought up that a plant role should be decided already when the new factory is established. The planned plant roles define what is the idea and determinants behind the offshoring decision. For instance, cost advantages might not be relevant for the companies that are basing their production strategy on quality and fast adaption to customer demands. Instead, these companies might focus on the location and accessing to new talent. Each company has different characteristics, situations and objectives regarding the production. Respectively, the decisions need understanding regarding the current situation and objectives of the company.

## 2.7 Synthesis of relocation decisions

Empirical findings about offshoring and backshoring phenomena are supported with theoretical background. Different theories, such as RBV, TCE and Eclectic Theory, have been utilized to explain manufacturing relocations. These offer a perspective on how companies should view manufacturing in their strategic decisions. RBV emphasizes focusing

on core competencies. Therefore, offshore outsourcing non-core activities can be explained with RBV. Transaction cost point of view takes into consideration how transaction costs change when geographical, cultural and linguistic distance increases. Eclectic theory assesses four different types of location advantages that take into account both tangible and intangible advantages of manufacturing relocations.

In Figure 5, benefits for home and offshore locations are distinguished (according to the earlier chapters) into cost efficiency, supply chain and production, marketing seeking advantage. The theoretical perspective and empirical drivers for offshoring and backshoring are connected to the benefits of production movements. The empirical drivers follow the survey results from the Finnish manufacturing companies that are in the scope of this thesis. Companies were asked about the importance of relocation drivers using a scale from one to five. Only the drivers with an average value more than three were chosen to the figure. Connecting drivers is not self-evident, and for example, flexibility is connected both with marketing seeking advantage, and to supply chain and production, because flexibility can mean, for instance, dynamic flexibility or structural flexibility.

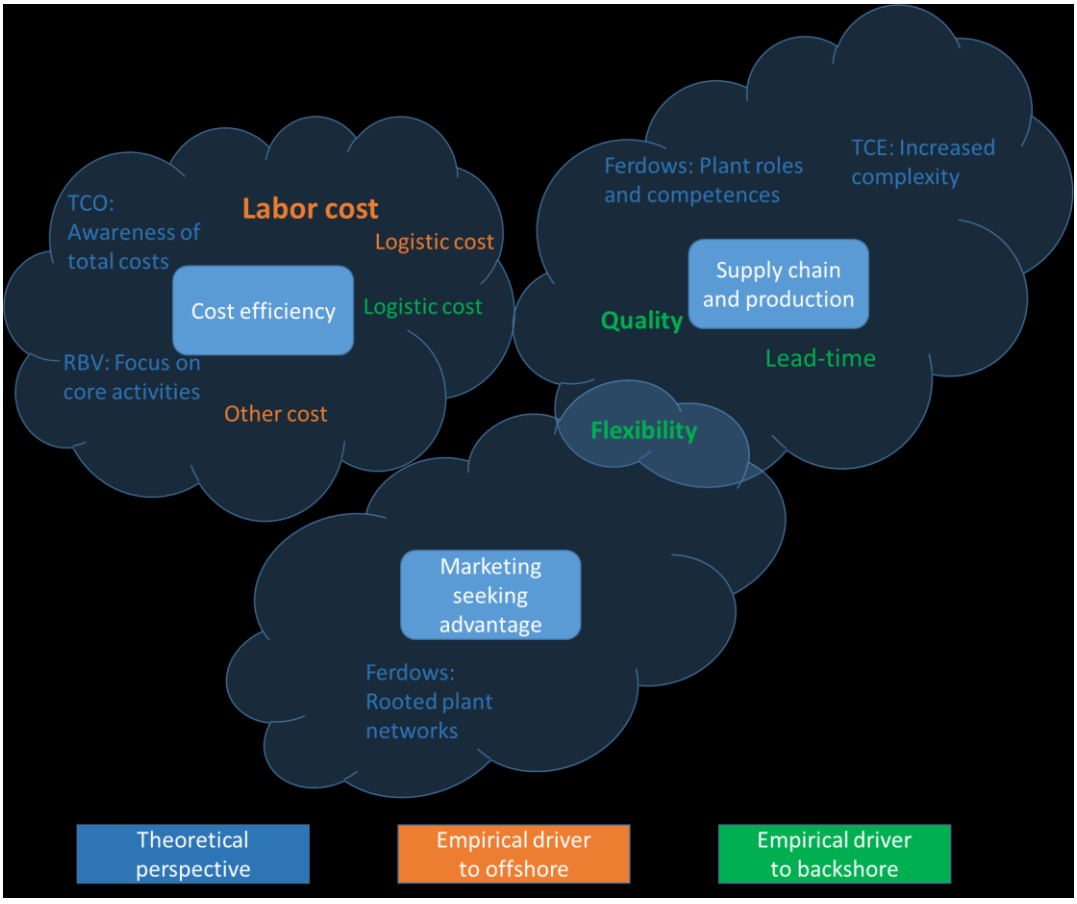


***Figure 4.*** *Advantages of production movements, empirical drivers and theoretical perspective.*

Companies offshore to achieve cost advantage, which is considered to be prone to new movements if the cost environment changes. However, companies bring production to be more flexible, reduce lead-time and increase quality. In future, the interest is in whether or not cost driven offshoring companies are looking for new places to offshore when the cost environment is changing. According to Ferdows (1997b) companies could also increase the role of the offshore plants by investing in their competences. That might change the role of these plants to be more dependent on access to skills and knowledge, as well as proximity to markets. This approach could be more natural for export driven firms, which do not have strong home market in Finland. Since, the drivers of relocation decisions are still cost driven, it is easy to argue that short-term profitability is the right tool to analyze the success of the current relocation movements. The success of the latest production relocations might be one of the key factors defining production movement activity in future.

## 2.8 Gaps in literature and construction of propositions

### 2.8.1 Characteristics of production movement companies

Why do some companies move production and some do not is a question that has been tried to explain with company characteristics. First, determinants for offshoring and backshoring decisions might vary systematically across industrial sectors. (Canham & Hamilton 2013) Second, the bigger companies seem to offshore and internationalize their production more often (Heikkilä et al. 2016b; Wagner 2010). Third, whether a firm operates in a consumer or in an industrial market, might have an effect on some of the offshoring tendencies. Consumer serving manufacturing firms in New Zealand offshored more often than those serving industrial firms.

The role of financing in production movements has not received much attention. Bailey and Propris (2014) mention the lack of financing as a barrier of backshoring. The barrier arises question if financial slack constrains production movement activity in general. Financial slack has been found enhancing the risk taking and innovation in other context (George 2005). Companies with larger amount of slack have often more degrees of freedom in their strategies, which brings to a following proposition:

***Proposition 1:*** *Financial slack enables production movements.*

Examining the drivers of offshoring, leads to examine what kind of companies are able to leverage the cost advantage better. Clearly, the companies are considering that the savings from labor costs are significant enough to justify the costs of the movement. One might conclude that labor intensive companies are more active in production movements than the capital intensive ones, because the cost of labor varies more than cost of capital according the location (Canham & Hamilton 2013).

The findings claiming that labor-intensive companies are more active in production movements are contradictory. In New Zealand, reduced labor costs were the biggest reason for an offshore movement. Still, there was no evidence found that especially the labor intense production would have been offshored. (Canham & Hamilton 2013) The study examining offshoring of production in Europe revealed that labor intensity is surprisingly reducing production activity (Dachs et al. 2006).

Both of the studies used survey results to characterize companies. However, different approaches were chosen to operationalize capital intensity. Canham and Hamilton (2013) asked companies to answer the dependence of physical capital compared to dependence on highly skilled labor with a Likert scale from one to seven. Dachs et al. (2006) used the share of labor costs to measure labor intensity. Both of the operationalization are problematic in their own ways, the former restricts labor intensity to cover only highly skilled labor, whilst the latter is subjective to the respondents view, whether it takes into account level of outsourcing reducing labor costs or not. This study examines the relationship of labor and capital in production movements using financial statement analysis to offer a different viewpoint:

***Proposition 2:*** *Lower capital intensity (higher labor intensity) enables production movements.*

The presented propositions are important, because the topics have received less attention in the literature. Moreover, the financial slack and labor intensity seems to get various operationalization, which makes it difficult to compare the results. Further studies around the concepts not only clarifies their role in production movements but also helps to find suitable operationalization in this context.

### 2.8.2 Effects of production movements

The impacts of offshore manufacturing on business performance is a less studied topic. Although, the studies concerning the level of offshoring (i.e. Kinkel & Maloca 2009; Heikkilä et al. 2016a) versus backshoring give some insight how firms consider their offshoring performance, because if an offshoring is unsuccessful due to changing cost environment or miscalculation of costs it is more likely to be backshored later (Gray et al. 2013).

The drivers of production movements can be thought also to be the potential effects. Figure 4 shows the possible effects of production movements in relation to strategic to operational dimension. Some of the effects are more strategic such as structural flexibility. Potential effects could be realized only in case of a fast change of demand, which would need a quick adaption from the supply chain. Operational effects such as cost savings are likely to be seen faster, because companies can utilize benefits such as lower labor costs when the production is established. When the nature of effects differ, also the measuring

of the effects should vary. Venkatraman and Ramanujam (1986) point out that measuring the possible effects should differ depending on the dimension of performance that is in the scope. The company's strategy may differ whether a company is pursuing for a growth or cost savings. For instance, profitability might suffer from investments to a fast growth. Therefore, also the measurement of the effects should be different. Indicators such as profitability and growth of sales should not be combined into a single measure.

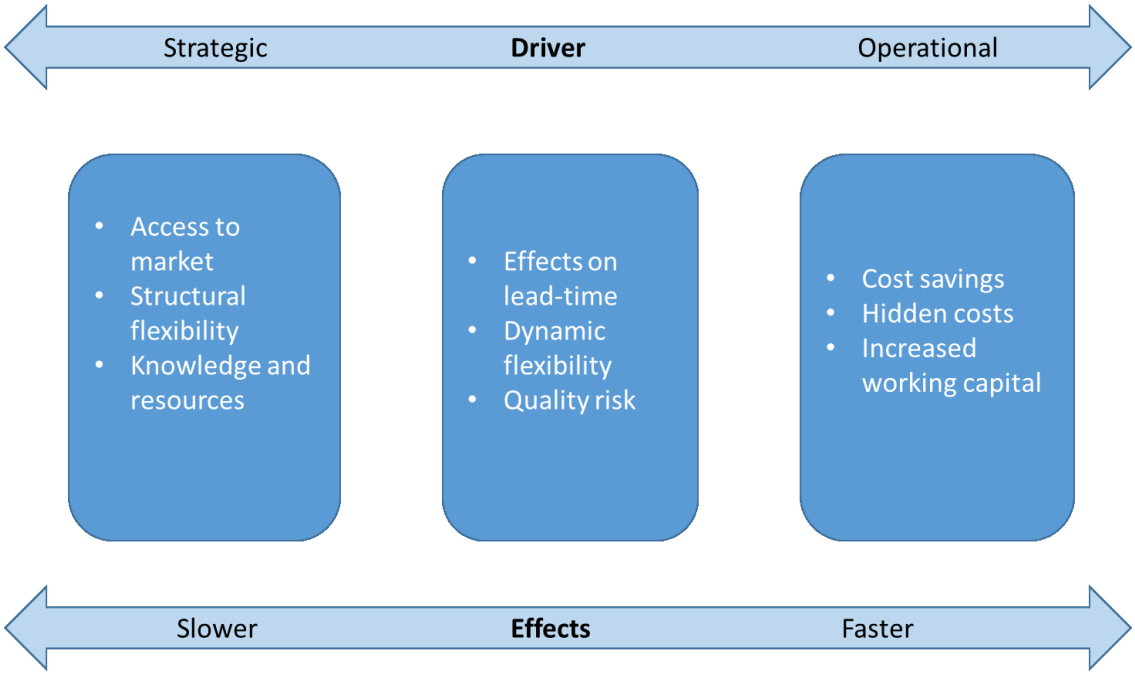


***Figure 5.*** *Strategic to operational effects of production movements synthesized from the examined literature.*

Studies concerning the performance of production movements have mainly focused on business performance measures such as productivity or export performance. The evidence from Germany suggest that active companies in relocation decisions are already larger, more productive and have a higher share of exports in the total sales (Wagner 2010). The findings of Moser et al. (2009) support the better business performance of offshoring companies in terms of higher productivity and bigger market share. These findings make studying the causal effect of offshoring difficult. If the potential offshoring companies are already the better performing ones, they cannot be directly compared to the non-offshoring ones. Wagner (2010) controls this effect using propensity score matching, but does not find significant causal effects of offshoring. However, the feared negative impacts for employment of offshoring do not seem to exist.

Other studies examining offshoring performance focused mainly on offshore outsourcing. The findings on offshoring performance are varying from zero to positive effect on performance. Jian et al. (2006) found that offshore outsourcing of Japanese manufacturing

companies have enhanced their market value in core business-related outsourcing, however, not in non-core business-related outsourcing. The study concerning French manufacturing shows an impact of offshore outsourcing on export performance (Bertrand 2010). The evidence concerning captive offshoring from Japanese manufacturing companies suggests that when foreign direct investments start, the effect is negative, but a greater level of investments increases the performance (Lu & Beamish 2001).

The absence of offshoring studies focusing on the financial performance is a gap in the offshoring and backshoring research. Leveraging the more attractive cost environment is driving the production relocation activity. The possible positive effect of offshoring and competitive advantage in comparison with their competitors can be analyzed measuring the performance of production movers.

The proposition to be studied here is based on the drivers of production movements of the respondent companies. Companies benefit from the production relocations with increased cost efficiency, improvements in production and supply chain and accessing to new markets. In production movements, companies focus on core activities and drive for cost saving in non-core activities (Massini et al. 2010) The cost driven production movements are aiming for an increased profitability. The fact that the most of companies are staying in the offshoring location speaks for the success of the movements, because the companies can reverse the production movement if costs are bigger than cost savings.

Some companies aim for the improvements in their production, for example, in form of improvements in lead time, quality, or flexibility. Being closer to market can benefit a company that gets a stronger position in a new market or an access to new resources. Whatever the motives are, cuts in costs or improvements in sales or production, companies are aiming them to result in the improvements in their financial performance. Therefore, the following proposition is constructed:

***Proposition 3:*** *Production movement activity has a positive effect on financial performance.*

The effects of production movements in the manufacturing network come up when discussed what drives companies to backshore their production. It is pointed out that a longer supply chain is more fertile ground for hidden costs (Sirkin et al. 2012). Tate (2014) specifies that complexity can be seen in the amount of capital tied into working capital, because of slow ocean transits and safety stocks.

Operational working capital has been sometimes called process-related working capital, because it shows how much capital is tied into operational processes (Talonpoika 2016). Therefore, it is predicted that the complexity and a longer supply chain increase the amount of operational working capital:

***Proposition 4:*** *Production movement activity increases the amount of capital tied up in operations.*

Both of the propositions 3-4 focus on the operational effects. Therefore, the analysis focuses on the short-term effects. Propositions are later translated to statistically testable hypotheses. The next chapters focus on finding right methods to test the hypotheses and on the analysis of the results.

# 3. METHODOLOGY AND DATA

## 3.1 Overview of Methodology

The premise for this study is to find an objective view on the performance of companies relocating their production. This study reflects positivism as research philosophy. From ontology point of view, researcher's view is objective and independent of actors (Saunders et al. 2012, p. 140). The focus is on the observable phenomenon and causality, which is different compared to earlier studies from the same survey data. From epistemology point of view, this is supported by using credible data and reducing the phenomenon to statistically testable elements. The aim is to keep the researcher independent from the data and to maintain an objective stance. (Saunders et al. 2012, p. 140) Independence is achieved using also archival data that was collected for official reporting. Some analyses need the use of pragmatism. Analyzing the effects of manufacturing relocations need an iterative and practical approach. Data limitations are taken into account in the analyses and when controlling the effects from external factors.

The method of hypothesis is utilized in this study, which includes inductive, deductive and abductive phases. In practice, new alternative hypotheses are formulated and tested statistically against the null hypotheses. The research problems are approached by starting with a literature search and concluding what had been found earlier regarding manufacturing relocations. Theories such as TCE and RBV are reviewed to understand the underlying strategic management theories. Propositions, and later hypotheses for quantitative analysis are structured based on the prior knowledge about the topic taking into account the limitations in the data. Later, these hypotheses are tested. A hypothesis is accepted and the null hypotheses is rejected if the p-value is less than conventional risk level of 5 %. As already pointed out in the introduction, the order of constructing the hypotheses first before the data is examined is important to maintain the objective stance.

The study combines survey and archival research strategies. From the point of view of this study, the survey research answers the question: which companies have relocated production? The cross-sectional survey strategy is not optimal in analyzing the effects over time. Answers regarding the reasons behind the decisions are not always clear after the decision has already been made some years ago. Archival research strategy on financial statements offers an additional data that is not prone to respondent's attitudes, inaccurate memories or insufficient knowledge. However, the original purpose of the data constrains the use of administrative records. The purpose of financial statements is to offer stakeholders an understanding about the company's situation. They are not originally meant for researchers to examine the reasons behind the decisions or the consequences of the decisions. This makes it more difficult to find suitable measures that would illustrate the examined phenomenon properly and to be in-line with theory.

The study is based on two data sources. The data regarding manufacturing relocations came from a survey conducted by ROaMING project in Tampere University of Technology in the autumn of 2015. The second data source, financial statements of the respondents yielded information what are companies' characteristics and performance from the financial point of view. Because of the two different data collection techniques, the methodological choice can be considered as multi-method quantitative study (Saunders et al. 2012, p. 165). Examining financial statements from 2010-2015 (six years) brings a longitudinal time horizon into this study. An advantage of the longitudinal research is the possibility to study change and development (Saunders et al. 2012, p. 190). Multiple researchers have identified the need for longitudinal approach when studying effects of offshoring (i.e. Wagner 2010; Arlbjørn & Mikkelsen 2014).

## 3.2 Quantitative Methods

### 3.2.1 Logistic Regression

The problems that call for the analysis and prediction of a binary outcome were earlier solved using ordinary least squares regression or linear discriminant analysis. Logistic regression started to get more popular with the spread of statistical software. (Peng et al. 2010) Logistic regression is utilized for analyzing relationships between categorical outcome variable and one or more categorical or continuous explanatory variables.

The goal of the logistic regression model is the same as in any regression model, that is, to describe relationship between an outcome variable and a set of explanatory variables. Logistic regression is optimal for describing relationships of binary outcome variable, because the extreme values do not follow a linear trend and errors are neither normally distributed nor constant (Peng et al 2010).

Production relocation activity can be separated into two categories: companies who have moved production (offshore, backshore or both) ($Y = 1$) and companies who have kept production home ($Y = 0$). Analyzing which factors affect production activity can be done using logistic regression equation:

$$\ln\left[\left(\frac{P(Y=1)}{1-P(Y=1)}\right)\right] = a + bx, \quad (1)$$

where $P(Y = 1)$ is a probability for $Y$ to get the value 1, $a$ is a constant, $b$ is a regression coefficient and $x$ is a value for an explanatory variable. Because the left side of the equation is logarithmic and the relationship between explanatory and outcome variables is not linear, interpreting the results is more complex. In normal regression models, a change of one unit in an explanatory variable moves the outcome by one unit. In logistic regression, taking antilog from the both sides is needed to find out what is the relationship between explanatory and outcome variable.

In experimental research, it is often possible to isolate the effects of researched variables. Non-experimental studies do not give the same freedom and researchers are forced to control the effects other ways. Using control variables to distinguish the effect of the variables to be studied from the external factors that might explain the results is essential to get credible results. Choosing what control factors to add is an important but not an easy decision for a researcher to make. Adding a control variable reduces the variance of the control variable from the analysis. Preferable, a control variable reduces the effect of the external factors such as effect of company size. This gets problematic if an outcome variable has an effect on a control variable, and no other way around. In this case, adding a control variable is actually reducing the variance under examination. (Ketokivi 2015)

Evaluation of a logistic regression model should be based on the overall model evaluation, statistical tests of individual explanatory variables, goodness-of-fit statistics and validations of predicted probabilities (Peng et al. 2010). In the overall model evaluation, this study utilizes likelihood ratio test to find out if a logistic model has better fit to the data than the intercept-only model, which serves as a good baseline because it has no explanatory variables included (Peng et al. 2010). The individual explanatory variables are tested using the Wald $X^2$ statistics. An explanatory variable interpreted to be significant if the p-value is less than 0,05. SPSS offers goodness-to-fit statistics to assess if the model fits to the actual data. The tested null hypothesis is that the model fit is good, meaning that with insignificant $X^2$ values ($p > ,05$) the fit of logistic model is sufficient. The validation of predicted probabilities is done by comparing observed outcomes to predicted ones.

### 3.2.2 Propensity Score Matching

Propensity score matching (PSM) is a statistical method to overcome the problem of a 'selection bias' in non-random sample selection. Treated units can be understood as companies who have relocated production (offshoring, backshoring or both movements) and untreated units as companies without production movements. The parameter for analyzing the effect of treatment is average treatment effect on treated (ATT) compares the difference between expected outcome values with or without treatment for those who actually participated in treatment. Here, the definition introduced by Caliendo and Kopeinig, (2008) is applied.

The parameters for ATT are the examined units, a binary variable for the treatment and potential outcomes. Binary treatment variable *D* equals zero if units are treated and zero otherwise. Potential outcome is defined as *Y (D)*. The equation (1) for expected value of ATT is

$$\tau_{ATT} = E(\tau|D = 1) = E[Y(1)|D = 1] - E[Y(0)|D = 1], \quad (2)$$

where *E [Y (1)|D = 1]* denotes for an expected outcome value for treated units and *E [Y (0)|D = 1]* for untreated units, which are still units that the program was intended. According to this, ATT can be understood as difference of average performance between those who moved production and those who stayed home. Average performance of the former group is easily accessible, but comparing it directly to the non-movement group *E [Y (0)|D = 0]* is usually not a good idea, because the performance of these groups would probably differ even without the manufacturing relocations. This is known as a 'selection bias' and for ATT it can be noted as

$$E[Y(1)|D = 1] - E[Y(0)|D = 0] = \tau_{ATT} + E[Y(0)|D = 1] - \mathrm{E}\,[\mathrm{Y}\,(0)|\mathrm{D} = 0]. \quad (3)$$

The left side of Equation 2 could be understood as a difference of an expected outcome for those who moved production and who did not. An unbiased value for ATT is identified if

$$\mathrm{E}\,[\mathrm{Y}\,(0)|\mathrm{D} = 1] - \mathrm{E}\,[\mathrm{Y}\,(0)|\mathrm{D} = 0] = 0. \quad (4)$$

In the context of this study, this would mean that the companies who chose production relocations are equal to those who do not, before the movements happened. This assumption is rarely true as was shown in a study by Wagner (2010). The firms who started offshoring were larger and more productive, and had a higher share of exports already before the offshoring happened.

To overcome the problem of 'selection bias', it is possible to match production movement companies to the similar companies without production movements. PSM is a way to select untreated units, which would match on treated units on given parameters. This is a way to imitate a situation where companies would have been examined both with and without the production relocations over the same time period, which is of course not possible in practice.

In this paper, propensity score is the probability for a company with observed characteristics to be part of production relocations group. In a general form, the propensity score can be defined as a probability of receiving a treatment based on the chosen covariates:

$$e(x) = P(D = 1|X), \quad (5)$$

where *e(x)* denotes for propensity score, *P* for probability and *D* is a binary indicator for treatment. *X* is a set of covariates that this probability conditionally applies. Probabilities can be calculated using logit or probit models where the chosen parameters are set as independent variables and the binary variable denoting if company have moved production is set as a dependent variable. After propensity scores are calculated, the matching is executed to create the control group that is similar to production movement group on given parameters. The different steps taken in using PSM are justified in the analysis.

Comparing means of change of chosen measures for two samples is done by using independent samples t-test. The test utilizes Student's t-distribution that allows comparing the arithmetic means for two samples without knowing the population variance (Melin 2006). Whether the ATT:s differ significantly from zero, can be tested using the test for treated and control group.

According to a general hypothesis of t-test the observations in both of the samples are normally distributed. However, two independent sample t-test is not sensitive for violating the assumption. The test is safe to use if the sample size for both of the samples are more than fifteen, if the distributions are not clearly skewed or have outliers. When sample sizes are greater than forty, two independent sample t-test is a robust even for clearly skewed distributions. (Melin 2006)

## 3.3 Data

### 3.3.1 Survey data

Researchers working for the ROaMING project collected the survey data that is used in this thesis. The survey was designed by researchers from Finland, Sweden and Denmark. The survey was planned in English and then translated to the respective languages. This study takes information only considering the Finnish companies. Respondents had an opportunity to answer the survey either in English or in Finnish.

The survey targeted manufacturing companies with at least 50 employees from all of the manufacturing industries (SIC 10-33). In Finland, 949 companies met the requirements and the response rate was 24.1 %. The data was collected during September and October 2015. The survey was web-based and sent to upper and middle-level managers related to production.

The respondent companies (Sample) are compared to the total population of Finnish manufacturing companies (Population) in terms of industry in Table 4. SI-coded industries (1-33) are classified into six different parent industries. The respondent sample has less companies from the food product, beverage and tobacco industries (SIC 10-12). The bias towards metal industry can be explained with a higher number of machinery and equipment industry companies (SIC 28).

***Table 4.*** *Distribution of companies across industry (Official Statistics of Finland 2015).*

| Distribution of companies across industry | Population | Sample |
|---|---|---|
| 10-12 Manufacture of food products, beverages and tobacco | 12 % | 7 % |
| 13-15 Manufacture of textiles, wearing apparel, leather and leather related products | 2 % | 1 % |
| 16-17 Forest industry | 10 % | 8 % |

| | | |
|---|---|---|
| 19-22 Chemical industry | 13 % | 14 % |
| 24-30, 33 Metal industry | 52 % | 59 % |
| 18, 23, 31, 32 Other manufacturing | 12 % | 11 % |
| Total | 100 % | 100 % |

The respondent sample is heavily towards large companies. Table 5 shows that the companies between 50 and 99 employees are under-represented in the sample and the large (over 500 employees) are clearly over-represented.

***Table 5.*** *Distribution of company size (Official Statistics of Finland 2015).*

| Distribution of company size | Population | Sample |
|---|---|---|
| 50-99 employees | 51 % | 32 % |
| 100-249 employees | 30 % | 32 % |
| 250-99 employees | 11 % | 12 % |
| Over 500 employees | 9 % | 25 % |
| Total | 100 % | 100 % |

Thirty percent (68 companies) of the companies responded that they have moved production permanently to another country (offshoring) during the last five years. Respectively, thirteen percent (30 companies) of the companies answered that they have brought production permanently back to Finland (backshoring). About half of the offshoring cases were to Eastern Europe (53 %). and to a quarter Western Europe (24 %). Even though, offshoring to China has received a lot of publicity, it only represents 13 % of the offshoring cases. Production has been brought back mostly from other Nordic countries, Eastern Europe or China.

Companies were also asked if the offshoring cases were made to their own plants or to an external supplier's plants. 23 out of the total number of 68 reported offshoring cases were offshore outsourcing and the rest were captive offshoring. Half of the reported backshoring cases were movements from the companies' own foreign plants and half from the external suppliers' plants. In the analysis, offshoring is considered as a single group regardless of the ownership model. Both moving production back from the external supplier's and own plant are considered backshoring.

### 3.3.2 Financial statements

Analyzing production movements with financial data from secondary source are often limited by the differences in accounting policies and difficultness to compare companies from different industries (Venkatraman & Ramanujam 1986). In this study, the problems are avoided by studying only Finnish companies (similar accounting policies) and controlling the industry in the analysis.

The financial statements of the respondents are the source for the financial performance indicators. The financial statements from 2010 to 2015 were downloaded from Finnish Patent and Registration Office's Virre-database. After downloading, the chosen financial figures were manually converted from pdf to excel format. Typing mistakes were minimized by using Excel filters during the typing process and by checking the outliers for possible mistakes after the typing was done.

The objective in collecting the financial performance indicators was that they would reflect a company's financial state and effects for production movements. The data set includes both single business companies and multi-business concerns. The respondent answered the survey either regarding an entire company in case of single business firm or regarding a business area in case of multi-business company. The financial statements from the concerns were selected if the company was a single business company or the examined business area was significantly bigger than other businesses, otherwise the respondent company figures were used. If the concerns' financial figures would have been left out from the analysis, in some cases, effects of relocations could have been left out of the analysis as well. For instance, if company moves part of its production to another country (in case of captive offshoring), the ownership of relocated production would be often transferred to subsidiary. This means that it would not be seen in the parent company's financial figures. Similar way, some companies might try to hide unprofitable businesses under foreign subsidiaries to strengthen their parent company's financial performance.

In average, the financial measures for the statistical testing were possible to be calculated in over 90 % of the cases. Adjustments were needed to overcome varying in fiscal years. The figures were placed to a year that most of the fiscal year took place. For instance, 9/2012-9/2013 fiscal year were equal to 1/2013-12/2013 in the data set. If some fiscal years were shorter or longer, they were scaled to match with a standard 12 months fiscal year. The missing financial statements or missing figures in the statements were common. The reasons for missing data are the differences in the charts of accounts that do not include all the figures and the statements that companies had not been delivered to Virre database. Descriptive statistics of financial indicators are presented later in Table 7.

## 3.4 Theoretical concepts to empirical measures

### 3.4.1 Principles of operationalizing theoretical concepts

In quantitative research, arguments are presented using theoretical concepts. To be able to analyze the arguments, theoretical concepts have to be defined and operationalized. (Ketokivi 2015) In this thesis, the concepts are defined in the chapter 2.1 and hypotheses later based on the operationalized theoretical concepts. To test the hypotheses, theoretical

concepts need to be connected with empirical concepts and measures. Figure 6 shows the correspondences that are clarified ensure the validity of the research.

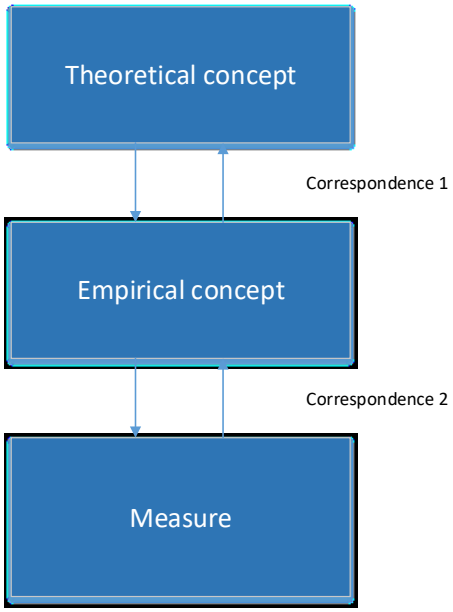


***Figure 6.*** *Correspondence of theoretical and empirical concepts.*

According to true score theory, measurements supporting the hypothesis do not automatically mean that the hypothesis should be confirmed. When the hypothesis is tested, a researcher is not only testing the main theory but also the auxiliary theory that connects theory to empirical concepts and measures. This leads to situation that if results support a theory, they are simultaneously supporting the main theory and the auxiliary theory. On the contrary, if the results are not in-line with hypotheses the problem can be in the main theory, in the auxiliary theory or in both of them. (Ketokivi 2015)

### 3.4.2 Company characteristics to predict movement activity

As the theoretical concepts were introduced earlier, problems in their operationalizing were discussed. Figure 7 shows the choices that were made to move from the theory to empirical level. These choices are inevitably data-oriented, since the form of financial statements are fixed and the time limit of the thesis constrains the possibility to find complementary data sources.

Financial slack is defined to portray the excess financial resources that company poses. According to George's (2005) operationalization of financial slack, the level of total debt to measure financial slack is utilized. This so-called low-discretionary slack represents the amount of financial freedom the managers have for re-allocating resources or raising additional debt. The level of debt is calculated by dividing total debt by total assets.

Capital intensity is defined here as an amount of assets in relation to labor needed for operations. Labor intensity is assumed to be the inverse of capital intensity. Capital intensity is operationalized by comparing total assets to revenue. This operationalization assumes that all the company's assets are needed to generate the revenue. The differences between tangible and intangible assets have not been taken into account.

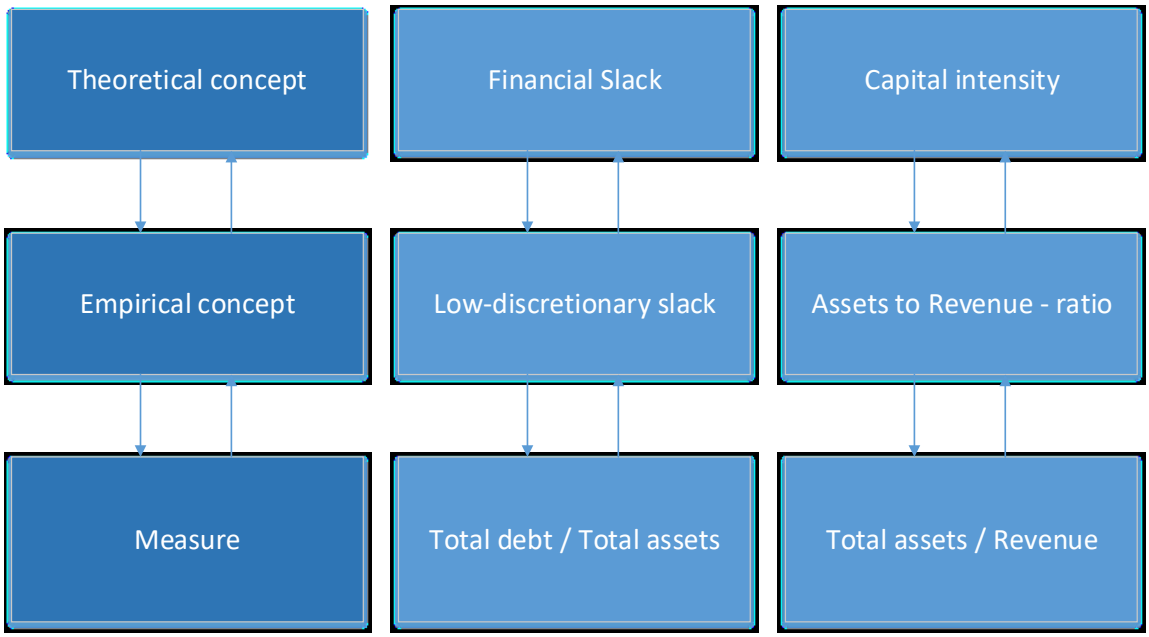


***Figure 7.*** *Correspondence of theoretical and empirical concepts in company characteristics.*

Connecting theoretical to empirical concepts enables translating propositions to statistically testable hypotheses. Table 6 presents the hypotheses that are studied later to answer to the first research question.

***Table 6.*** *Research question 1, and following propositions and hypotheses.*

| **Research question 1** | **Which factors characterize the companies that are moving their production?** |
|---|---|
| Proposition 1 | Financial slack enables production movements. |
| Hypothesis 1 | Companies with low-discretionary financial slack are more active in production movements. |
| Proposition 2 | Lower capital intensity (higher labor intensity) enables production movements. |
| Hypothesis 2 | Companies with less total assets to revenue are more active in production movements. |

### 3.4.3 Measures for the effects of production movements

Operationalizing theoretical concepts regarding the effects of production relocations are shown in Figure 8. The chosen domain for the performance analysis is financial performance. The concept focuses on the use of simple financial measures that are assumed to reflect if a company is reaching its economic goals (Venkatraman & Ramanujam 1986). The focus on financial performance is partly data-driven approach but it can be also justified with the fact that analyzing more strategic effects with a broader domain would be difficult since strategic changes might need more time to show results.

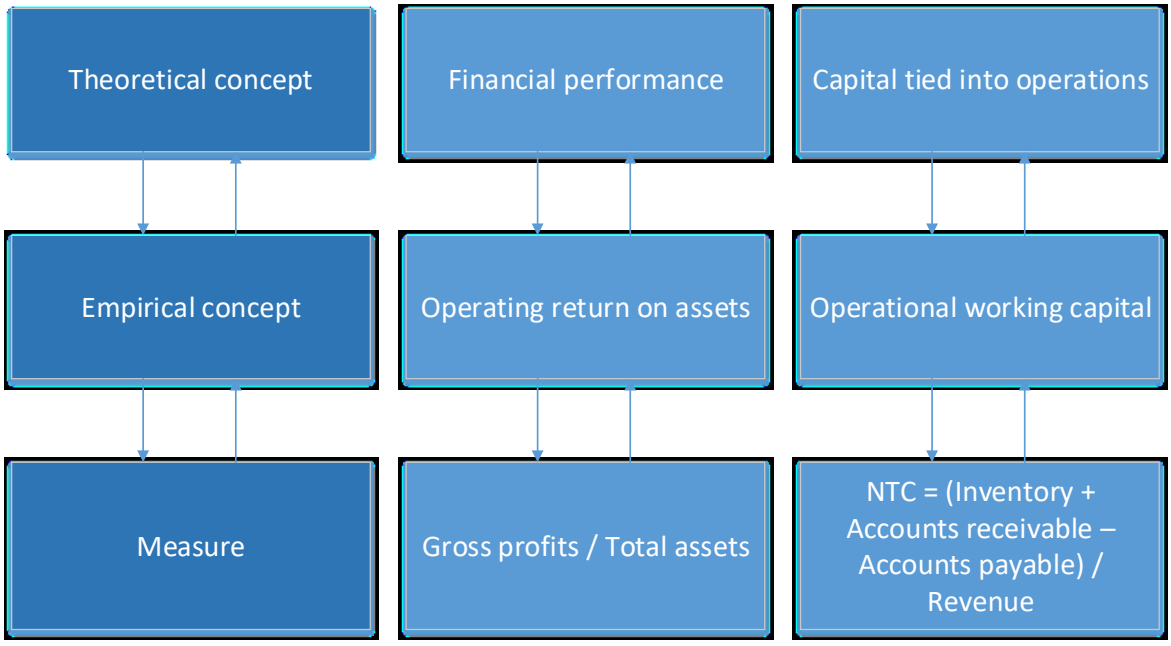


***Figure 8.*** *Correspondence of theoretical and empirical concepts in financial performance.*

Focusing on profitability as an operationalization of financial performance can be justified with the operational drivers of production movements and with the short time scale of this study. Drivers of the production movements were mostly related to cost efficiency and to supply chain and production. For instance, increased efficiency in production and cost savings in the labor could be seen relatively fast in profitability.

The chosen measure for profitability is so called operating return on assets (OROA). The definitions of operating return on assets differ slightly from the traditional version of return on assets (ROA), because gross profit is utilized instead of net income. The advantage of gross profit is that it is taken before the taxes and interests, and therefore, it is neutral for different tax policies. Another advantage of operating return of assets is that gross profit is compared to total assets. Therefore, it is neutral for differences in capital structures. Operating return on asset can be divided into gross profit and asset turnover. These measures, as well as, revenue was used to yield additional information what factors caused the change in OROA.

Operational working capital represents the amount of capital that is tied up in operations. As the hypothesis stated, the objective of the analysis was to examine how production movements affect the capital tied up, for instance, in inventories and shipments. Net trade cycle is the simplest version of cash conversion cycle (CCC), which is the basic measure of operational working capital. It takes inventories, account receivables and account payables as the numerator and revenue (normally net sales) as the denominator. (Talonpoika 2015) Because the mean values of other measures varies between 0 and 1, also NTC was decided to keep in a similar scale and not to multiply it with 365 to get number of days in the cycle. In the results section, inventories and the change of absolute working capital (not in relation to revenue) are reported to understand the reasons for the changes in the net trade cycle.

Operationalization of theoretical concepts allows to translate propositions to hypotheses. The correspondences are shown in Table 7. Hypotheses 3-4 are tested in Chapter 5 using propensity score method.

***Table 7.*** *Research question 2, and following propositions and hypotheses.*

| **Research question 2** | **What are the effects of production movements on performance?** |
|---|---|
| Proposition 3 | Production movement activity has a positive effect on financial performance. |
| Hypothesis 3 | The change of profitability (Operating return on assets) is more positive for companies that have moved production. |
| Proposition 4 | Production movement activity increases the amount of capital tied into operations. |
| Hypothesis 4 | The change of operating working capital (Net trade cycle) is more positive for companies that have moved production. |

### 3.4.4 Descriptive statistics

Descriptive statistics were calculated to show the basic features of the data. Table 8 shows descriptive statistics for financial performance indicators for each year. Measure for OROA has the least of missing values because gross profit and total assets are included in financial statements no matter what chart of accounts were used. The missing values

in the labor cost to revenue ratio can be explained with the activity based chart of accounts, which does not differentiate labor costs. In contrast, calculating NTC needs disaggregation of current assets, which was not always available.

***Table 8.*** *Descriptive statistics on financial indicators.*

| **Total debt to total assets** | | | | | |
|---|---|---|---|---|---|
| **Year** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| 2011 | 209 | 0,13 | 1,80 | 0,61 | 0,26 |
| 2012 | 209 | 0,05 | 1,39 | 0,59 | 0,25 |
| 2013 | 218 | 0,05 | 1,53 | 0,60 | 0,27 |
| 2014 | 214 | 0,05 | 3,19 | 0,62 | 0,32 |
| 2015 | 220 | 0,07 | 1,53 | 0,61 | 0,27 |
| **Total assets to revenue** | | | | | |
| **Year** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| 2010 | 202 | 0,26 | 3,32 | 0,80 | 0,46 |
| 2011 | 207 | 0,14 | 3,52 | 0,72 | 0,43 |
| 2012 | 208 | 0,18 | 3,71 | 0,72 | 0,45 |
| 2013 | 217 | 0,16 | 5,79 | 0,76 | 0,58 |
| 2014 | 213 | 0,17 | 6,87 | 0,76 | 0,59 |
| 2015 | 219 | 0,25 | 7,36 | 0,77 | 0,61 |
| **Operating return on assets (OROA)** | | | | | |
| **Year** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| 2010 | 203 | -0,88 | 0,90 | 0,07 | 0,17 |
| 2011 | 208 | -0,58 | 0,60 | 0,08 | 0,13 |
| 2012 | 209 | -1,30 | 0,74 | 0,07 | 0,15 |
| 2013 | 218 | -0,42 | 0,74 | 0,07 | 0,12 |
| 2014 | 214 | -0,49 | 0,54 | 0,07 | 0,13 |
| 2015 | 220 | -0,36 | 0,83 | 0,06 | 0,12 |
| **Net trade cycle (NTC)** | | | | | |
| **Year** | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| 2010 | 196 | -0,12 | 0,67 | 0,22 | 0,13 |
| 2011 | 203 | -0,07 | 0,94 | 0,21 | 0,13 |
| 2012 | 202 | -0,05 | 0,77 | 0,21 | 0,13 |
| 2013 | 211 | -0,17 | 0,80 | 0,20 | 0,13 |
| 2014 | 201 | -0,05 | 0,75 | 0,21 | 0,12 |
| 2015 | 208 | -0,15 | 0,80 | 0,21 | 0,13 |

The mean values of debt to assets and total assets to revenue ratios varied only little during the six years. However, the standard deviation of the ratios was bigger in the total assets to revenue ratio, because the revenues varied much more than the debt levels. Profitability of the Finnish manufacturing companies decreased little between 2010 and 2015. The means of operating return on assets (OROA) dropped from 7 % to 6 % being 8 % (2011)

at its best. The trend was similar in net trade cycle (NTC) dropping only one percentage in six years.

# 4. EMPIRICAL ANALYSIS AND RESULTS

## 4.1 Analyzing relocation activeness

Analyzing drivers of the production relocation has been in the heart of offshoring and backshoring research. The topic has been analyzed mainly using survey research, which often are conducted even years after the original decision was made. It can be argued whether or not the answers would have been the same at the time of the decision-making. Even if companies respond truthfully about the drivers of the decision, it rarely gives financial information what kind of companies are more active in production movements. Analyzing the financial indicators potentially reveals if there exist factors that predict production relocations.

Logistic regression analysis is performed to find out if financial slack or capital intensity are connected with relocation activity. Financial slack is operationalized to show if low amount of external capital (low-discretionary slack) would enable investments in production movements. Respondents stated that savings in labor costs were the most important reason to offshore. This would imply that labor costs are significant part of companies cost structure and savings in there would be significant enough to justify production movements. Finding out if more labor and less capital-intensive companies move production more often would be in-line with survey results. The earlier presented theoretical propositions are operationalized to following hypotheses:

***Hypotesis 1.*** *Companies with low-discretionary financial slack are more active in production movements.*

***Hypotesis 2.*** *Companies with less total assets to revenue are more active in production movements.*

Testing different measures for the empirical concepts is relatively easy. However, including multiple measures for the analysis describing a single empirical concept is avoided, because adding highly correlating measures would have weakened the effects of the explanatory variables. The problem of collinearity is avoided by selecting the most potential variables based on theory and limitation of the data set.

Analysis is performed using SPSS binary logistic model. The chosen explanatory variables are total assets to revenue for capital intensity and total debt to total assets for financial slack. The financial indicators from the beginning of the examined period (2010) are used. The assumption is that bigger companies and some industries are moving production more often. Controlling effects of industry and company size is done using control variables from the survey data. Companies answered to which industry their focal plant

primary belongs. The industries are classified into a 1 to 5 scale based on the technology intensity. What is the total number of employees in their company is operationalizing company size in the analysis.

The production movements are separated into four different analysis. Table 9 presents the outcomes (Y = 1) that the logistic regression model aims to predict. The probability for offshoring, backshoring and any production movement are compared to no production movements group. A separate analysis is conducted to predict backshoring activity from any movements group. The limit for the sample sizes is often 50 or 100 with minimum observation-to-predictor ratio of 1:10 (Peng et al. 2010). All of the analyses fulfill the criteria of 50 observations with adequate observation-to-predictor ratio, and the first three analyses have more than 150 observations. The only assumption for logistic regression analysis is that the conditional mean of the binary outcome is binomial distributed (Peng et al. 2010). It is assumed that the production movements are independent of each other, even though, some companies might be following an example of its competitors when they are offshoring. Thus, the assumption of the binomial distribution is robust (Peng et al. 2010).

***Table 9.*** *Prediction values and sample sizes for the logistic regression analysis.*

| **Outcome of interest and sample size for each analysis** | **Y = 1** | **Y = 0** |
|---|---|---|
| **Analysis 1** | Offshoring (N = 52) | No movement (N = 131) |
| **Analysis 2** | Backshoring (N = 27) | No movement (N = 131) |
| **Analysis 3** | Any movement (N = 69) | No movement (N = 131) |
| **Analysis 4** | Backshoring (N = 27) | Only Offshoring (N = 42) |

The analysis is conducted to predict offshoring activity of 183 companies. Table 10 presents that the likelihood ratio test of full model against an intercept-only model is statistically significantly different, indicating that the model with the set of predictors could reliably distinguish between offshoring and no movements companies ($\chi 2 = 33{,}88$, $p < {,}000$ with $df = 4$). The results are similar also for analyzing backshoring (Table 11) and any movements activity (Table 12) against no movement companies. Model 4 in Table 13 showed different results suggesting that the model is not significantly different from the intercept-only model ($\chi 2 = 4{,}33$, $p = {,}364$ with $df = 4$).

The null hypothesis of Hosmer and Lemeshow's Goodness-of-fit test is that the examined model is well-fitting. There is no evidence to fail the null hypothesis in any of the models. Thus, the test is indicating that the overall fit of the models is good. Pengt et al. (2010) suggests that Nagelkerke and Cox & Snell $R^2$ are treated as supplementaries to other tests. The purpose of estimated $R^2$ values is the same that in the OLS regression, to

estimate how much from the variance of an outcome variable the model is explaining. However, the case in the logistic regression is more complex and the statistics do not directly render the meaning of variance explained (Pengt et al. 2010). Nagelkerke and Cox & Snell $R^2$ statistics for the models are supporting the likelihood ratio test yielding higher values for the first three models than for the fourth one (Models 1-3: Nagelkerke $R^2 > 0,22$ and Model 4: Nagelkerke $R^2 = 0,08$).

***Table 10.*** *Logistic regression model for predicting offshoring activity.*

| **Model 1 - Offshoring and no movement** | | | | | | |
|---|---|---|---|---|---|---|
| **Variables in the equation** | B | S.E. | Wald | df | Sig. | Exp(B) |
| Total assets to revenue | -0,52 | 0,42 | 1,57 | 1 | 0,210 | 0,59 |
| Industry classification | 0,51 | 0,21 | 5,73 | 1 | **0,017** | 1,67 |
| Number of employees | 0,83 | 0,17 | 23,17 | 1 | **0,000** | 2,30 |
| Total debt to total assets | 1,03 | 0,64 | 2,57 | 1 | 0,109 | 2,80 |
| Constant | -5,21 | 0,97 | 28,78 | 1 | **0,000** | 0,01 |
| **Testing the model** | | | | | $\chi 2$ | df | Sig. |
| Overall model evaluation | | | | | | | |
| | Likelihood ratio | | | | 33,88 | 4 | ,000 |
| Goodness-of-fit test | | | | | | | |
| | Hosmer and Lemeshow | | | | 8,782 | 8 | ,361 |
| Model Summary | | | | | | Cox & Snell | Nagelkerke |
| | $R^2$ | | | | | 0,169 | 0,243 |

Based on Model 1 (shown in the Table 10), the industry classification and number of employees are statistically significant predictors in the model. According to the model, an increase in the industry classification increases probability for offshoring 1,7 times and an increase in number of employees increases probability 2,3 times. The model also suggests that a decrease in the total assets to increases probability for offshoring, but based

on the Wald statistic it is not statistically significant. In contrast to the expectations, amount of external capital actually increases the probability of offshoring, not decreases as the alternative hypothesis 1 stated. However, the Wald statistic is not statistically significant with 5 % risk level (p = 0,11).

The results for Model 2 (shown in the Table 11) are in-line with Model 1. Backshoring companies seem to be similar that offshoring companies in comparison to no movement companies. The difference in predicting backshoring is the impact of industry and company size for the production movement activity. The impact of industry classification (Exp(B) = 2,7) is now bigger than number of employees (Exp(B) = 1,8).

***Table 11.*** *Logistic regression model for predicting backshoring activity.*

| **Model 2 – Backshoring and no movement** | | | | | | |
|---|---|---|---|---|---|---|
| **Variables in the equation** | B | S.E. | Wald | df | Sig. | Exp(B) |
| Total assets to revenue | -0,91 | 0,61 | 2,19 | 1 | 0,139 | 0,40 |
| Industry classification | 1,00 | 0,31 | 10,06 | 1 | **0,002** | 2,71 |
| Number of employees | 0,59 | 0,22 | 7,16 | 1 | **0,007** | 1,80 |
| Total debt to total assets | 1,21 | 0,81 | 2,25 | 1 | 0,134 | 3,35 |
| Constant | -6,09 | 1,28 | 22,53 | 1 | **0,000** | 0,00 |
| **Testing the model** | | | | $\chi 2$ | df | Sig. |
| Overall model evaluation | | | | | | |
| | Likelihood ratio | | | 22,36 | 4 | ,000 |
| Goodness-of-fit test | | | | | | |
| | Hosmer and Lemeshow | | | 9,96 | 8 | ,268 |
| Model Summary | | | | | Cox & Snell | Nagelkerke |
| | $R^2$ | | | | 0,132 | 0,220 |

The significances of the predictors differ slightly when analyzing any production movements in Model 3 (Table 12). Total debt to total assets ratio is now statistically significant with 5 % risk level indicating that companies with more debt are actually moving their production more often. This is relatively strong evidence against the argument that financial slack (low-discretionary slack) would be enabling these kinds of investments.

***Table 12.*** *Logistic regression model for predicting any production movement activity.*

| **Model 3 – Any movement and no movement** | | | | | | |
|---|---|---|---|---|---|---|
| **Variables in the equation** | B | S.E. | Wald | df | Sig. | Exp(B) |
| Total assets to revenue | -0,62 | 0,39 | 2,50 | 1 | 0,114 | 0,54 |
| Industry classification | 0,60 | 0,20 | 9,30 | 1 | **0,002** | 1,82 |
| Number of employees | 0,72 | 0,16 | 21,64 | 1 | **0,000** | 2,06 |
| Total debt to total assets | 1,13 | 0,57 | 3,90 | 1 | **0,048** | 3,10 |
| Constant | -4,72 | 0,86 | 30,02 | 1 | **0,000** | 0,01 |

| **Testing the model** | | $\chi 2$ | df | Sig. |
|---|---|---|---|---|
| Overall model evaluation | | | | |
| | Likelihood ratio | 36,55 | 4 | ,000 |
| Goodness-of-fit test | | | | |
| | Hosmer and Lemeshow | 9,12 | 8 | ,332 |

| Model Summary | | Cox & Snell | Nagelkerke |
|---|---|---|---|
| | $R^2$ | 0,167 | 0,231 |

The purpose of the last model is to find out if backshoring companies (includes companies with also offshoring activity) could be distinguished from the companies that were only offshoring during the examined period. The significances of the predictors is far from 5 % risk level for all of the variables except industry classification ($p = 0,08$). The model fails to predict backshoring activity with the given explanatory variables

***Table 13.*** *Logistic regression model for predicting which offshoring companies are backshoring.*

| **Model 4 - Backshoring and only offshoring** | | | | | | |
|---|---|---|---|---|---|---|
| **Variables in the equation** | B | S.E. | Wald | df | Sig. | Exp(B) |
| Total assets to revenue | -0,30 | 0,70 | 0,19 | 1 | 0,665 | 0,74 |
| Industry classification | 0,59 | 0,34 | 3,02 | 1 | 0,082 | 1,81 |
| Number of employees | -0,14 | 0,22 | 0,41 | 1 | 0,522 | 0,87 |
| Total debt to total assets | 0,10 | 0,84 | 0,01 | 1 | 0,908 | 1,10 |
| Constant | -1,31 | 1,53 | 0,73 | 1 | 0,393 | 0,27 |

| **Testing the model** | $\chi 2$ | df | Sig. |
|---|---|---|---|
| Overall model evaluation | | | |
| Likelihood ratio | 4,33 | 4 | 0,364 |
| Goodness-of-fit test | | | |
| Hosmer and Lemeshow | 4,32 | 8 | 0,828 |

| Model Summary | Cox & Snell | Nagelkerke |
|---|---|---|
| $R^2$ | 0,061 | 0,082 |

Table 14 shows how Models 1-4 manage to predict the production movement activity. The total false positive and false negative rates were from 41 % to 17 %. The best was Model 2 (Backshoring and No movement) with 83 % overall percentage. However, looking only at the overall percentage often misleads (Ketokivi 2015). Classifying all the cases into the no movement companies would have reached close to the same overall percentage. Models 1 and 3 manage to predict also the production movements relatively well with 37 % (Model 1) and 41 % (Model 3) accuracies. Even if the statistics for the Model 4 were not that promising, it reaches better accuracy than only predicting all of the cases into backshoring would have.

***Table 14.*** *The observed and the predicted frequencies for Models 1-4 with the 0,5 cutoff.*

| | | | Predicted | | |
|---|---|---|---|---|---|
| | Observed | | No | Yes | |
| Model 1 | No movement | No | 117 | 14 | 89,3 |
| | Offshoring | Yes | 33 | 19 | 36,5 |
| | | Overall Percentage | | | 74,3 |
| Model 2 | No movement | No | 128 | 3 | 97,7 |
| | Backshoring | Yes | 24 | 3 | 11,1 |
| | | Overall Percentage | | | 82,9 |
| Model 3 | No movement | No | 113 | 18 | 86,3 |
| | Any movement | Yes | 41 | 28 | 40,6 |
| | | Overall Percentage | | | 70,5 |
| Model 4 | Backshoring | No | 36 | 6 | 85,7 |
| | Only offshoring | Yes | 22 | 5 | 18,5 |
| | | Overall Percentage | | | 59,4 |

Overall, the prediction of production activity is difficult with the information from the given financial measures. The models in the study strongly disagree with the fact that the financial slack would enable production movements (Hypothesis 1). The evidence on the effects of labor intensity to production movement activity is less clear (Hypothesis 2). The Wald statistics arguing that capital intensive companies move production less is relatively close to be significant in the Models 1-2 and is significant in the Model 3. The

number of employees and the technology seem to be relatively good predictors for production activity. Larger and higher-technology companies move production more often in the sample.

## 4.2 Analyzing effects of production movements

### 4.2.1 Overview of analyzing causality

When analyzing effects of offshoring and backshoring, it is not possible to examine the same company with and without production relocations using the same time period. This forces researchers to use different approaches. Companies with production movements are compared to no-movement companies. The problem is that companies who offshore are not selected randomly. For instance, bigger companies seem to offshore more often. This leads into a setting where studied groups are different already before the examined action happens.

The problem is a potential source of bias in the analysis of the effects of production movements (Wagner 2010). Some drivers for manufacturing relocation decisions might cause certain types of firms to relocate production more often. Situation where uneven selection of the participation makes treated and control group different and therefore affect the analysis is called selection bias. In this study, the companies who move production are significantly bigger and they are unevenly distributed across the industries. The bias rises from the possibility that size and industry type affect heavily on the financial performance of the companies. For example, if an industry would be over-represented in the offshoring companies and the industry would face unexpected challenges, the change in the performance would be seen more in the offshoring group. To balance the effects of the industry and size the control group needs to be as similar as possible compared to the offshoring group. To do this, each offshoring company need to be matched with a similar non-offshoring company (ideally, identical) at the time before offshoring (Caliendo & Kopeinig 2008).

Production movement companies can be matched to its no-movement pairs by using propensity score method. It has become a popular approach to examine causal effects in situations where selection bias is a potential problem. It is widely applied in analyzing labor market policies but it has become popular in analyzing treatment effects in many fields. (Caliendo & Kopeinig 2008) Propensity score method has been also applied in examining effects of offshoring. Moser et al. (2009) and Wagner (2010) analyzed effects of offshoring using PSM focusing on the effects in employment and productivity.

In propensity score method selection, bias is eliminated by creating a control group, which is similar to the treated group in the characteristics that affect both on a selection to a treatment and on an outcome. Taking into account relevant differences between units when selecting the control group can yield an unbiased estimate of the treatment impact.

(Dehejia & Wahba 2002) According to Caliendo and Kopeinig (2008) propensity score method should include five steps:

1. Propensity score estimation
2. Choose matching algorithm
3. Check overlap/common support
4. Matching quality/effect estimation
5. Sensitivity analysis

Step 1 includes choosing propensity score model, which can be either probit or logit model. The models calculate probability for a unit to be selected in the treatment group. However, when the final purpose of the product is to select a suitable control group, not to estimate accurate structural coefficients, the given models yield similar results (Caliendo & Kopeinig 2008). In this study, the chosen statistical computing program (SPSS) uses logistic regression to calculate propensity scores.

The second and more critical decision is to choose which variables to include in the model. Variables that affect simultaneously the selection and the outcome should be chosen. (Caliendo & Kopeinig 2008) On one hand, all the relevant variables that satisfy this should be chosen. On the other hand, inclusion of insignificant variables may lead to increased variance that might cause situation where more treated units are excluded or some control units need to be included more than once. In addition, the economic theory and prior knowledge of previous studies should guide the decision. However, only the variables that are unaffected by the participation should be included. (Caliendo & Kopeinig 2008)

In this study, the chosen variables are company size (number of employees) and industry (two-digit SI-codes). The attempt is to keep the number of variables as low as possible due to the small sample size and because of the object to minimize the variance in propensity scores. Other considered variables are profitability and company's financial leverage. Profitability is excluded, because firstly the data set did not include prior years' numbers (before 2010), secondly it is assumed that the autocorrelation of change of OROA is relatively small and lastly company size and industry already take into account most of it (as it can be seen from the balanced control groups later). A risk level is controlled in some of the studies concerning company's financial performance. However, if amount of debt is used as a proxy variable it does not reflect risk level in all of the cases. For example, a company operating in relatively low risk business could take more cheap loan and increase its leverage. Respectively, a high-risk business does not always get more debt and is forced to get money from its owners. Furthermore, the chosen measure for the profitability (OROA) is not sensitive to company's capital structure. In addition,

financial leverage might be affected by the treatment if company has had increased the amount of debt when investing in offshoring.

In Step 2, the researcher's decisions can still affect the results significantly. After an estimation of propensity scores, the actual matching treated units to untreated pairs takes place. Matching can be performed in many different ways but one of the most common and straightforward (also used by Wagner (2010) and Moser et al. (2009)) way is to use nearest neighbor matching (Thoemmes 2012). A single treated unit is matched to the closest untreated unit based on the estimated propensity score. If there are significantly more untreated units than treated, it is possible to match each treated units to more than one untreated unit. On the contrary, if there are less untreated units it is possible to use untreated control unit more than once. This would possibly decrease bias but simultaneously increase variance. These decisions can be considered as trade-offs between bias and efficiency. Here due to relatively small sample size but still sufficient number of untreated control units 1:1 matching was applied. The caliber shows how far the nearest neighbor had to be chosen. Increasing caliber adds chance for weaker matches. Increasing causes bias but choosing small caliber can cause units to be excluded from the analysis. Here the analysis is performed using different calibers to validate the sensitivity of the results. If the results differ, the reason for the differences should be analyzed. (Caliendo & Kopeinig 2008)

The purpose of Step 3 is to ensure that for each treated unit a close untreated unit can be found. This assumption is called common support. In a lack of common support, observations could be discarded if the chosen caliber is small and some regions of the propensity score distribution consist only treated or non-treated units. If the proportion of lost units is small, this posses few problems (Caliendo & Kopeinig 2008). However, when the number of discarded units is increasing, rises a question if the remaining individuals are representing the sample anymore.

In Step 4, matching quality is ensured by comparing distributions of the selected variables and means of estimated propensity scores. Independent t-test is performed in order to compare the difference between the means of the estimated propensity scores for the movement and control groups. There should not be found any statistically significant differences in the mean after the matching is done or otherwise the matching quality is inadequate. At this point, it is still possible to go back to step 1 and try different variables or matching methods. If the matching quality is sufficient, it is possible to calculate ATT. The treatment effect is here considered as the difference of the arithmetic means using independent t-test, even though, the variance might be underestimated due to variance caused by matching method that is not taken into consideration here (Caliendo & Kopeinig 2008). However, other researchers such as Thoemmes (2010) advices to use statistical methods such as t-test or ANOVA. When using matching method without replacement and the amount of discarded units at step 3 is small, we assume that p-values from the t-test are approximately correct.

The objective of Step 5 is to verify assumptions that all the covariates (also not observed) are taken into account and the results are not sensitive to discarded units because of lack of common support. The first assumption is strong and difficult to test. The rest of the analysis it is assumed that all of the relevant covariates that affect matching are taken into account. The assumption of common support is tested by including also bigger calibers in matching (if possible) to ensure that discarded units do not significantly affect the results.

Next, the effects of production relocations are tested for offshoring, backshoring and any relocations. Offshoring companies were compared to companies without any movement in the chosen time period (2010-2015). Respectively, the effects of any relocations decision (offshoring or backshoring) are tested against companies without any movements. Backshoring companies are compared to the companies that have only offshored.

As discussed in the literature review, cost savings are a significant reason for making relocation decision and the most important driver for offshoring according to the answers from the survey of this study. Studies cited in the literature review found positive and neutral effects of offshoring for company's performance. In-line with the discussion in literature review the hypothesis to be tested in this study:

***Hypothesis 3.*** *Production movement activity has a positive effect on financial performance.*

There is reason to believe that production movements affects to the amount of capital tied into inventories and accounts receivables. Production could potentially make a firm's production network more complicated and therefore increase the amount of working capital tied up in operations:

***Hypothesis 4.*** *The change of operating working capital (Net trade cycle) is more positive for companies that have moved production.*

Next, the hypotheses are tested for offshoring, backshoring and any production movements groups.

### 4.2.2 Effects of offshoring

Analyzing effects of offshoring, this study utilizes PSM to control the effects of industry and company size. Propensity scores are calculated using logit regression and the matching is done using 1:1 NN-matching with 0,1 and 0,2 calibers. The results of matching are reported in Table 15 and 16.

***Table 15.*** *Distribution of company size for offshoring and no-movement control group.*

| **Number of firms across company size** | **Caliber 0.1** | | |
|---|---|---|---|
| | Offshoring | No movements | Total |
| **51-100 Employees** | 7 | 7 | 14 |
| **101-250 Employees** | 14 | 11 | 25 |
| **251-500 Employees** | 4 | 7 | 11 |
| **Over 500 Employees** | 15 | 15 | 30 |
| **Total** | 40 | 40 | 80 |

Matching quality can be assessed by comparing the means of the estimated propensity scores. No significant difference between the offshoring and control groups can be found for caliber 0.1. However, the difference for caliber 0.2 is statistically significantly different (p-value < 0.05) and therefore the results for caliber 0.2 are excluded from the further analysis.

Matching quality can also be assessed by examining distribution for offshoring and control group across industry and size. Matching discards thirteen offshoring companies but it achieves quite evenly balanced distributions for size and industry. The biggest difference in the industry distribution is the number of electrical equipment companies. Offshoring group has slightly more 101-250 employees companies and less 251-500 employees companies than the control group.

***Table 16.*** *Distribution of industry for offshoring and no-movement control group.*

| **Number of firms across industry** | **Caliber 0.1** | | |
|---|---|---|---|
| | Offshoring | No move-ments | Total |
| **Food industry (10)** | 4 | 4 | 8 |
| **Beverage industry (11)** | 0 | 0 | 0 |
| **Textile and clothing industry (13, 14)** | 0 | 0 | 0 |
| **Paper industry (17)** | 1 | 1 | 2 |
| **Graphical industry (18)** | 0 | 0 | 0 |
| **Chemical industry (20)** | 3 | 4 | 7 |
| **Pharmaceuticals Industry (21)** | 1 | 0 | 1 |
| **Rubber and plastics industry (22)** | 2 | 2 | 4 |
| **Other non-metallic mineral products industry (23)** | 1 | 1 | 2 |
| **Fabricated metal products, except machinery and equipment (25)** | 7 | 6 | 13 |
| **Computer, electronic and optical products (26)** | 2 | 3 | 5 |
| **Electrical equipment (27)** | 6 | 2 | 8 |
| **Machinery industry and equipment (28)** | 12 | 13 | 25 |
| **Motor vehicle, trailer and semi-trailer industry (29)** | 0 | 1 | 1 |
| **Transport equipment industry (30)** | 0 | 1 | 1 |
| **Furniture industry (31)** | 0 | 1 | 1 |
| **Other manufacturing (32)** | 1 | 1 | 2 |
| **Repair and installation of machinery and equipment (33)** | 0 | 0 | 0 |
| **Total** | 40 | 40 | 80 |

The assumption for the matching is that company size and industry control amounts of financial leverage and profitability. Tables 17 shows results of independent t-test for means of OROA, financial leverage and revenue. No statistically significant differences could be found for the variables.

***Table 17.*** *Means of discarded variables for offshoring and no-movement control group (t-test).*

| **Means of discarded variables** | **Caliber 0.1** | | |
|---|---|---|---|
| | Offshoring | No movements | p-value (2-tailed) |
| **ROA (2010)** | 8,0% | 7,3% | 0,80 |
| **Financial Leverage (Equity-to-debt (2010))** | 1,11 | 1,27 | 0,65 |
| **Revenue (2010)** | 199 MEUR | 181 MEUR | 0,87 |

Table 18 shows the results of independent t-test for the offshoring and control group. The change of OROA is 5,25 percentage points more positive for offshoring group than for the control group. The result supports hypothesis 3 with 5 % risk level (one-tailed p = 0,015). In addition, the change of revenue for the offshoring group is 19,58 % higher, even though, it is not statistically significantly due to high standard deviation. Surprisingly, even the increased revenue is not enough to turn asset turnover positive. The difference in OROA between the offshoring and control groups can be explained with the development of gross profit. The difference in gross profit is statistically different from zero (one-tailed p = 0,019).

***Table 18.*** *Treatment effects for offshoring.*

| Effects of Offshoring | N | Offshoring | No movement | ATT | p-value (2-tailed) |
|---|---|---|---|---|---|
| **Caliber 0.1** | | | | | |
| **Operating return on assets %** | 75 | -0,49 | -5,74 | 5,25 | 0,03 |
| Revenue | 75 | 25,35 % | 5,77 % | 19,58 % | 0,20 |
| Gross profit % | 75 | -0,17 | -3,68 | 1,67 | 0,04 |
| Asset turnover % | 75 | -3,77 | 0,93 | 4,70 | 0,77 |
| **Net trade cycle (NTC) %** | 71 | -1,90 | 0,57 | -2,47 | 0,28 |
| Absolute operational working capital (trimmed) | 67 | -0,70 % | 5,40 % | -6,08 % | 0,64 |
| Inventory to Revenue | 74 | -0,27 % | -1,33 % | 1,05 % | 0,44 |

Hypothesis 4 is tested comparing the change of NTC between the groups. In addition, absolute working capital and inventory to revenue are reported. The measure for absolute working capital gives values for the level of working capital that does not take into account if business grows (or vice versa) over the examined time period. Change of working capital is trimmed by reducing the top and bottom 4% from the sample, to reduce outliers that would have affected heavily because of the small sample size. The trimming is not

necessary for NTC, because if a business grows the change is not seen only in working capital but also in revenue, which is the denominator. The results do not support the hypothesis 2. In contrast to the researcher's expectations, offshoring companies have been able to decrease their net trade cycle while the control group's NTC has increased.

### 4.2.3 Effects of backshoring

The research methods are similar to the analysis of effects of offshoring. PSM is utilized to control the effects of industry and company size. Propensity scores are calculated using logit regression and the matching was done using 1:1 NN-matching with 0,1 and 0,2 calibers. Bigger calibers are not needed to find pairs to all of the backshoring companies. The results of matching are reported in Table 19 and 20. No significant difference between the backshoring and control groups can be found for calibers 0.1 and 0.2 when propensity scores were compared. The distribution of company size is similar for both groups with caliber 0,1 and 0,2 in Figure 17.

***Table 19.*** *Distribution of company size for backshoring and no movement control group.*

| **Number of firms across company size** | **Caliber 0.1** | | | **Caliber 0.2** | | |
|---|---|---|---|---|---|---|
| | Backshoring | No movements | Total | Backshoring | No movements | Total |
| **51-100 Employees** | 6 | 5 | 11 | 6 | 7 | 13 |
| **101-250 Employees** | 8 | 7 | 15 | 8 | 7 | 15 |
| **251-500 Employees** | 3 | 5 | 8 | 4 | 5 | 9 |
| **Over 500 Employees** | 11 | 11 | 22 | 11 | 10 | 21 |
| **Total** | 28 | 28 | 56 | 29 | 29 | 58 |

The distribution for industry differs little for backshoring and no movement groups in Table 20. The biggest differences can be found on Electrical industry, which is overrepresented in backshoring group with both calibers.

***Table 20.*** *Distribution of industry for backshoring and no movement control group*

| Number of firms across industry | Caliber 0.1 | | | Caliber 0.2 | | |
|---|---|---|---|---|---|---|
| | Back-shoring | No move-ment | Total | Back-shoring | No move-ment | Total |
| **Food industry (10)** | 1 | 2 | 3 | 1 | 3 | 4 |
| **Timber Industry (16)** | 0 | 1 | 1 | 0 | 1 | 1 |
| **Paper industry (17)** | 1 | 1 | 2 | 1 | 1 | 2 |
| **Chemical industry (20)** | 3 | 3 | 6 | 3 | 4 | 7 |
| **Pharmaceuticals Indus-try (21)** | 0 | 0 | 0 | 1 | 0 | 1 |
| **Rubber and plastics in-dustry (22)** | 1 | 1 | 2 | 1 | 1 | 2 |
| **Other non-metallic min-eral products industry** | 0 | 0 | 0 | 0 | 2 | 2 |
| **Basic metals industry** | 1 | 2 | 3 | 1 | 1 | 2 |
| **Fabricated metal prod-ucts, except machinery and equipment (25)** | 4 | 4 | 8 | 4 | 4 | 8 |
| **Computer, electronic and optical products (26)** | 3 | 3 | 6 | 3 | 2 | 5 |
| **Electrical equipment (27)** | 3 | 0 | 3 | 3 | 0 | 3 |
| **Machinery industry and equipment (28)** | 10 | 8 | 18 | 10 | 8 | 18 |
| **Motor vehicle, trailer and semi-trailer industry (29)** | 0 | 1 | 1 | 0 | 1 | 1 |
| **Transport equipment in-dustry (30)** | 1 | 1 | 2 | 1 | 1 | 2 |
| **Total** | 28 | 28 | 56 | 29 | 29 | 58 |

Raising caliber from 0,1 to 0,2 does not have big effect on matching quality. Number of excluded variables drops from one to zero with caliber 0,2. Table 21 shows how controlling industry and company size affect variables that are discarded from the model. No significant differences with 5 % risk level can be found for variables. However, the differences are bigger than in the analysis of offshoring effects. Financial leverage is bigger for the no movements group and backshoring companies are more profitable in year 2010.

The results for the ATT:s are shown in Table 22. The ATT for the change of OROA is 1,7-2 percentage points. The ATT:s are nearly the same for both of the calibers. The difference in the ATT:s indicate that the null hypothesis might not be true. However, the

ATT:s are not statistically significantly different from zero with 5 % risk level and hypothesis 3 cannot be confirmed. The backshoring companies have increased their revenue 10-12 % more. With higher caliber, the asset turnover ratio is nearly seven percentage points higher for the backshoring companies (p = 0,07).

***Table 21.*** *Means of discarded variables for backshoring and no-movement control group (t-test).*

| **Means of discarded variables** | **Caliber 0,1** | | | **Caliber 0,2** | | |
|---|---|---|---|---|---|---|
| | Back-shoring | No Move-ments | p-value (2-tailed) | Back-shoring | No move-ments | p-value (2-tailed) |
| **OROA (2010)** | 10,9 % | 7,0 % | 0,39 | 11,7 % | 6,4 % | 0,21 |
| **Financial Leverage (Equity-to-debt (2010))** | 0,87 | 1,53 | 0,12 | 0,88 | 1,26 | 0,30 |
| **Revenue (2010)** | 169 MEUR | 114 MEUR | 0,43 | 190 MEUR | 183 MEUR | 0,96 |

***Table 22.*** *Effects of backshoring.*

| Effects of Backshoring | N | Backshoring | No movement | ATT | p-value (2-tailed) |
|---|---|---|---|---|---|
| **Caliber 0.1** | | | | | |
| **Operating return on assets %** | 51 | -1,92 | -3,97 | 2,05 | 0,34 |
| Revenue | 51 | 12,54 % | 2,58 % | 9,95 % | 0,43 |
| Gross profit % | 51 | -1,99 | -2,38 | 0,39 | 0,80 |
| Asset turnover % | 51 | 1,86 | -1,07 | 2,93 | 0,76 |
| **Net trade cycle (NTC) %** | 43 | 0,51 | 1,75 | -1,24 | 0,65 |
| Absolute operational working capital (trimmed) | 42 | -0,22 % | 8,73 % | -8,51 % | 0,64 |
| Inventory to Revenue | 50 | 1,93 % | -1,66 % | 3,60 % | 0,04 |
| **Caliber 0.2** | | | | | |
| **Operating return on assets %** | 54 | -2,24 | -3,92 | 1,68 | 0,42 |
| Revenue | 54 | 12,57 % | 0,26 % | 12,31 % | 0,30 |
| Gross profit % | 54 | -2,09 | -2,31 | 0,22 | 0,88 |
| Asset turnover % | 54 | 1,05 | -5,87 | 6,92 | 0,07 |
| **Net trade cycle (NTC) %** | 46 | 0,64 | 1,75 | -1,10 | 0,67 |
| Absolute operational working capital (trimmed) | 45 | 1,73 % | 13,35 % | -11,62 % | 0,43 |
| Inventory to Revenue | 53 | 1,99 % | -1,27 % | 3,26 % | < 0,05 |

Backshoring has a negative ATT for the change of NTC. The amount of operating working capital has decreased 9-13 percentages and NTC around one percentage point depending on the caliber. Interestingly, the change of inventories to revenue is bigger for the backshoring than the control group. The ATT:s for NTC are not statistically significantly different from zero with 5 % risk level and thereby do not confirm hypothesis 4.

### 4.2.4 Effects of any production movement

Analyzing effects of any movement category differ from offshoring and backshoring analyses that the treated group is bigger and there are relatively less companies to be used for control group. The challenge in matching is that with the smaller caliber more companies are excluded from the analysis. Increasing caliber from 0.1 to 0.2 decreases the number of excluded companies but also reduced matching quality. When calculated propensity scores were compared between any movement and control group statistically significant differences were found for calibers 0,2 and 0,3. Examining results from these analyzes would have been misleading, because the treatment effect could not be separated from the effects of an industry and size.

Table 23 shows that any movement group has slightly smaller companies. The total number of companies in both groups is reduced to 55 companies.

***Table 23.*** *Distribution of company size for any production movement group and no production movement control group.*

| **Number of firms across company size** | **Caliber 0.1** | | |
|---|---|---|---|
| | Any movement | No movement | Total |
| **51-100 Employees** | 13 | 12 | 25 |
| **101-250 Employees** | 20 | 19 | 39 |
| **251-500 Employees** | 8 | 8 | 16 |
| **Over 500 Employees** | 14 | 16 | 30 |
| **Total** | 55 | 55 | 110 |

In Table 24, Electrical industry is over-represented in the any movement group and SI-codes 25-26 are over-represented in the no movement group. The overall distributions are relatively even for both groups and balancing was this way successful considering the low number of no movement firms.

***Table 24.*** *Distribution of industry for any production movement group and no movement control group.*

| Number of firms across industry | Caliber 0.1 | | |
|---|---|---|---|
| | Any movement | No movement | Total |
| **Food industry (10)** | 4 | 4 | 8 |
| **Textile and clothing industry (13,14)** | 1 | 1 | 2 |
| **Paper industry (17)** | 2 | 1 | 3 |
| **Graphical industry (18)** | 1 | 1 | 2 |
| **Chemical industry (20)** | 4 | 5 | 9 |
| **Pharmaceuticals Industry (21)** | 0 | 1 | 1 |
| **Rubber and plastics industry (22)** | 3 | 2 | 5 |
| **Other non-metallic mineral products industry** | 1 | 2 | 3 |
| **Basic metals industry** | 2 | 1 | 3 |
| **Fabricated metal products, except machinery and equipment (25)** | 6 | 8 | 14 |
| **Computer, electronic and optical products (26)** | 3 | 5 | 8 |
| **Electrical equipment (27)** | 8 | 4 | 12 |
| **Machinery industry and equipment (28)** | 17 | 17 | 34 |
| **Transport equipment industry (30)** | 1 | 1 | 2 |
| **Furniture industry (31)** | 0 | 1 | 1 |
| **Other Manufacturing (32)** | 1 | 1 | 2 |
| **Total** | 55 | 55 | 110 |

Mean of discarded variables in Table 25 support that matching quality is sufficient even for the variables that were left out of the matching. No statistically significant differences between the groups can be found, even though, any movement companies have more debt and are bigger in terms of revenue.

***Table 25.*** *Means of discarded variables for any production movement group and no-movement control group (t-test).*

| Means of discarded variables | Caliber 0,1 | | |
|---|---|---|---|
| | Any movement | No Movement | p-value (2-tailed) |
| **OROA (2010)** | 7,68 % | 7,17 % | 0,87 |
| **Financial Leverage (Equity-to-debt (2010))** | 2,37 | 2,83 | 0,64 |
| **Revenue (2010)** | 220 MEUR | 137 MEUR | 0,48 |

Table 26 presents the results for effects of any production movements in terms of profitability and operational working capital. The ATT value for change of OROA (4,30 percentage points) imply that any movement group has been able to maintain the profitability much better than the no movement control group. Hypothesis 3 is supported with 5 % risk level in one-way testing ($p < 0,023$).

***Table 26.*** *Effects of any production movement.*

| Effects of Production movement | N | Any movement | No movement | ATT | p-value (2-tailed) |
|---|---|---|---|---|---|
| **Caliber 0.1** | | | | | |
| **Operating return on assets %** | 103 | -0,24 | -4,54 | 4,30 | 0,06 |
| Revenue | 103 | 24,59 % | 5,86 % | 18,73 % | 0,13 |
| Gross profit % | 103 | 0,23 | -3,07 | 3,29 | 0,03 |
| Asset turnover % | 103 | -7,23 | 1,51 | -8,74 | 0,46 |
| **Net trade cycle %** | 92 | -0,24 | -0,24 | 0 | 1,00 |
| Absolute operational working capital (trimmed) | 99 | 0,72 % | 6,60 % | -5,88% | 0,62 |
| Inventory to Revenue % | 102 | 1,20 | -1,35 | 2,55 | 0,04 |

The effects in operating working capital are seen in the absolute change of operating working capital (-5,88 %) but the effect disappears when the change in revenue is taken into account in NTC. The change of inventories shows a statistically significant change in the ATT. The results for the change of inventory are more reliable in terms of more companies included in the analysis. However, NTC was chosen to be the main indicator and Hypothesis 4 is rejected with no evidence that the ATT:s would differ from zero.

# 5. DISCUSSION AND CONCLUSIONS

## 5.1 Empirical findings

The thesis used combined data from a survey and financial statements to study characteristics and effects of production movements. In the data set, companies relocating production between 2010 and 2015 were compared to their control groups using financial indicators from the respective period. Two research questions were answered by statistically testing the hypotheses constructed earlier.

### 5.1.1 What are the effects of production movements?

The most significant finding of the thesis is the positive relationship of production movements and financial performance. The results are statistically significant for offshoring and any movement groups with 5 % risk level. The magnitude of the found difference is bigger than expected. Four to five percentage points difference can be enough to separate a healthy growing business from a one on its way to bankruptcy. Offshoring companies were able to maintain their financial performance when the economic situation of Finland was challenging.

Backshoring companies did succeed well against their control group but not as well as offshoring companies. Two percentage points difference in operating return on assets was not statistically significant. The weaker financial performance of the backshoring companies compared to offshoring ones is in-line with the idea that for backshoring companies, the original offshoring was potentially not as successful as for the companies that decided to stay in the offshore location. This thesis cannot answer whether the reason for backshoring is the miscalculation of costs or changing cost environment that were suggested in the literature or something else.

The results are pointing out that production movement companies are performing better than the ones staying in home locations. What is the mechanism behind the better financial performance cannot be fully explained here. However, it can be argued that firms are probably achieving at least some of the benefits they are seeking with the production relocation. The drivers of the relocation decisions were mostly related to better cost efficiency and to improvements in production and supply chain. Analyzing the success of production movements using short-term profitability is more focused on operational than strategic impacts, which is suitable for analyzing how the operational goals are achieved. The positive difference in operating return on assets compared to non-movers implies that some of the potential benefits are achieved. However, more research is needed to tell what are these benefits and how sustainable this advantage is.

The difference in the change of operating working capital between the production movement and control groups is not statistically significant in any of the analyses. The idea behind the tested hypothesis was that spreading production geographically would also make the manufacturing network more complex and add spatial distances. This might increase the amount of capital tied into stockpiles and slow over-sea shipments. During the thesis process, it became clear that companies could affect in the efficiency of managing working capital in multiple ways, for example, by developing financial supply chain management and re-negotiating payment terms. This makes studying the causal effects difficult. Moreover, offshoring companies might pay more attention to their financial working capital, supply chain, and have more power on negotiating payment terms. To conclude, the analysis cannot confirm that production movement would or would not increase the amount of capital tied up in operations. It is not possible to distinguish whether the problem is in the operationalization of the theoretical concepts (auxiliary theory), or that production movements have no effects on the operational working capital (main theory) or in both of them (Ketokivi 2015).

### 5.1.2 What factors characterize companies that are moving their production?

The characteristics of production movement companies were analyzed by studying how production activity could be predicted using capital intensity and financial slack as predictors. The role of capital to labor intensity in relocation decisions is especially interesting since the labor cost was the most significant driver for offshoring for the same sample. Canham & Hamilton (2013) found that capital intensity did not affect production movements in New Zealand. Our results partly differ from these by finding a weak evidence pointing out that less capital intensive (assets to revenue) companies are moving production more often. The results cannot be directly compared, because Canham and Hamilton used different operationalization for capital to labor intensity. The measure was survey based and compared to role of highly skilled labor in relation to capital. Substitution of highly skilled labor and capital might be problematic for the companies with standard labor-intensive production processes. Here, the operationalization assumes that the total assets in the financial sheets represent the role of capital in the production.

Examining the ability of making offshoring decisions in terms of financial slack had novelty value to offshoring and backshoring research. Against the hypothesis, no evidence was found that less leveraged companies would have been moving production more often. On the contrary, the results show that offshoring companies are more likely to be more leveraged than non-movers were, even though the results were not statistically significant. The results can be explained by questioning how well financial leverage actually illustrate an ability to make investments. Companies can optimize their capital structure to have an optimal amount of equity and debt. Higher amount of debt does not necessarily tell that companies would have difficulties getting funding for possible offshoring investments.

In addition, the amount of debt does not offer information how much more capital its owners are still willing to invest. Respectively, lower amount of debt does not seem to give more freedom to make relocation decisions. The evidence is strongly against that financial slack in this form would enable production relocations.

## 5.2 Theoretical implications and future of production movements

The focus of this study was to characterize production movers using financial secondary financial data and study the financial effects of production movements. The implication from the first objective is that an industry and company size are the main factors predicting which companies are relocating their production. Financial data cannot significantly increase the accuracy of the prediction.

Weak evidence was found pointing out that less capital-intensive companies would be more often making production movements. However, the role of labor and capital in relocation decisions is still unclear. The key assumption in the analysis was that labor and capital are in inverse relationship. Either machines or human labor are utilized for the tasks. In production movements, this assumption is often simplified. When the textile industry was widely offshored to low-cost locations, it was easy to conclude that labor-intensive production was first to benefit from the low-cost labor. The missing piece in the analysis might be the growing complexity of the work and need of highly skilled and experienced labor. This type of labor is more difficult to offshore, because finding right people and developing competences takes time. A connection to Ferdows' (1997b) plant roles is easy to find. It takes time for a factory to take a broader role in the production network.

The role of financial slack, at least in this form, seems small in production relocation decisions. The key implication is that financial slack is extremely difficult to be measured only based on the debt ratios or other financial ratios, that do not consider how much the owners or investors are willing to finance the business. It might be more successful to widen the definition of slack to include also other type of surplus resources that could be addressed for unexpected threats or opportunities. However, extending the analysis of slack resources would need different research methods and data sources.

Comparison after controlling with an industry and a company size showed better performance for production movers than their control group. The success of production movement companies leads to questions what is the mechanism behind it and how sustainable is the edge. However, the complexity of the mechanisms makes studying the true benefits difficult. The success of production movements can be explained with the drivers of production movements stated by the companies themselves. However, companies looking for a low-cost location can end up losing their cost advantage, and instead, start pursuing for the new growing market with the edge of near location. The changing environment

forces companies to re-adjust actively, which can be one of the reasons why some companies have decided to also backshore their production.

Assuming that the survey results about the drivers of relocation decisions reflect the benefits of the production movements allows to study which production relocation strategies are profitable. These benefits were earlier classified to three different groups: cost efficiency, supply chain and production, and marketing seeking advantage. Theoretical perspectives were found to support these drivers.

One of the possible explanation of the results is the cost advantage of offshoring location. According to RBV, offshoring allows firms to focus on their core activities and to externalize their non-core activities (Ellram et al. 2013). Survey results show that the cost related drivers were the most important for respondent companies especially regarding offshoring decisions. These companies are not basing their competitive advantage on the production that is relocated (Ferdows 1998). Results support the positive effects of cost driven offshoring strategy. The competitive advantage might not be sustainable, since the competitors can easily follow the strategy. Chapter 2 discussed the effects of offshoring on transaction costs. Increased geographical and cultural differences could add costs and overcome the cost savings. This argument does not get support from the effects of offshoring on financial performance. Moreover, the thesis could not find that the effects of increased distances would have had effect on capital tied into inventories and transports.

According to the theory, production movements that are not based only on narrow cost advantages are more permanent (Ferdows 1997b). Especially the drivers of backshoring were more related to supply chain and production. Positive short-term profitability of the companies who are investing in their plants' competences is encouraging, because developing plants to higher roles in production network needs time and resources (Ferdows 1997b). The rising costs of developing countries can be actually benefiting these companies. Raising labor costs increase the buying power of the consumers, which can be beneficial for the companies basing their production location strategy on marketing seeking advantage. Being early in an offshoring location is also a chance to establish their position in the market.

Alternatively, the success of production movements can reflect that the active decision makers in production movement decisions are also actively looking for new sources of edge from other directions. Their management can be more aware of the changing environment, which reflects not only activeness in production movements but also ability to make decisions to adjust to changing business environment in other matters. These types of alternative explanations reflect the complexity of finding what the exact mechanism is behind the success of production movement companies. In this way, this thesis raises more questions than it answers. What are the real advantages and disadvantages of production movements cannot be answered only analyzing the drivers and the success of

production relocations, because the environment is constantly changing and especially offshoring decisions include a lot of uncertainty.

The results considering the effects of production movements are important, also in wider perspective, for at least two reasons. First, if offshoring helps a company to maintain its financial performance during difficult times it can actually save jobs in Finland. Second, the success of earlier production movements is likely to define atmosphere towards future decisions. If the so called "bandwagon effect" exist in production relocation decisions, competitors might try to find the same edge by following the existing offshoring companies. Sometimes in public discussion it can be heard that companies should be focusing on growth instead of cutting costs. Our results show quite the opposite. Some companies focusing on cost efficiency and on the efficiency of production in their production movements are not only able to improve their profitability but also to grow their business.

Between 2010 and 2015, offshoring has been a profitable production strategy. In future, rising costs in the current offshoring locations might force these companies to either find a new low-cost location, bring production back to Finland or develop plant competences to be able to utilize the access to new market and skills. First, relocated production is more likely to be characterized by standard processes and commodity products, because they are based on cost advantage (Ferdows 2008). Second, for the ones who stays improving competences of a production plant needs a lot of time and resources (Ferdows 2014). Third, backshoring can be considered a low-risk option, since the amount of uncertainties is lower.

Backshoring to Finland is the only option to relatively few companies. Low production costs have given companies time to establish and develop their production competences. This has possibly lowered the risks in the offshore location. If the costs continue rising, bringing production back to Finland is an attractive option for those companies who have free production capacity or strong home markets. If the economy of Finland is finally starting to get on its feet, the first option is less likely. It is good to remember that the potential of the offshore market is growing faster than home markets. However, situations differ significantly between offshore outsourcing and captive offshoring. The barriers of new relocations are usually much lower for offshore outsourcing, because the committed investments are smaller.

## 5.3 Limitations

The research was based on the survey results and on the financial statements reported by the companies themselves. The weakness of the approach is that examining only the business unit that the production movement affects is difficult due to company structures. This results in two problems: a production could be moved to another company that is not anymore reported in the parent company's reports, and the production movements might be too small to be seen in the whole company's financial data. It was possible to mitigate

only one of these problems. Choosing the financial statements from company groups (not only parent company) when it was possible alleviated the problem of missing the information of the production movement. The decision was trade-off between bias and variance. Choosing company group information included more often information from other business unit minimized the risk of losing the effect of production movement but added variance to the analysis.

Choosing to examine production movement activity using variance explanation of company groups, and not the correlation of a single movement and the following performance, was necessary because of the limitation of the survey data. The idea for this research topic came when the data was already collected and the survey could not be customized for the purpose of this thesis. Companies reported the timing of the last significant movement and total number of movements. It was not possible to distinguish the actual size of the last movement from the earlier ones. Clearly, if the company would have moved production several times between 2010 and 2015, only knowing that the last significant movement was in 2013 would not be enough to analyze the effect of a single movement, because its relative importance would be still unknown.

Analyzing the effects of movement activity left space to alternative explanations. It is difficult, if not impossible, to control the effects from all of the possible explanations. For example, movement activity could be only telling that a company believes future to be bright. This way the change of financial performance could be more positive for these companies even without the movements (selection bias). In addition, the change of measures was not controlled for the years before the examined period. Comparing the means of the change for two groups cannot take into account if the change would be autoregressive. If the positive development tends to continue, production movers could be already in a positive cycle before the examined period. Moreover, production movements could be seen as a proxy for an active and performing management that would itself result in a positive effect on performance.

The data in the financial statements limited what kind of measures were possible to be operationalized. The operationalization was not only theory-driven but also data-driven. The measures were often static, describing the situation at the end of a fiscal year. For example, operational working capital was operationalized to reflect the complexity of the manufacturing network. The measure of net trade cycle measures the amount of working capital tied up in operations. Problems arise from the fact that the calculated measure reflects the situation from only the last day of the fiscal year. If the business is cyclic, as many of them are, the measure might yield a biased estimate of the average amount of capital tied up in operations.

## 5.4 Further research

Changing cost environment and technology can quickly change what is the best location for production. In the future, research needed to continue to discover relocation activity and the drivers of it. The trends of relocation decisions can show how competent it is to manufacture in Finland and in other countries. Drivers of the relocation decisions discover what can be done to enhance competitiveness. This information has also potential to be utilized by policy-makers. Using secondary financial data to validate the effects of production relocation helps to validate the results from the surveys.

One of the most important results of this thesis is the lesson it gave on how to study the effects of production movements using secondary financial data. Using longitudinal data is needed also in the future. Studying causality would be more accurate if the magnitude and timings of the relocations would be known better. If the secondary financial data is used, then also the data should be from the entire company and not only business unit level (Venkatraman & Ramanujam 1986). These improvements would help to isolate the effects of relocations, and therefore increase the sufficiency of statistics that are utilized to estimate the effects. Optimally, it would be possible to identify the most significant movements and to study the effects using time series analysis.

An important premise for the future research would be the distinction between offshore outsourcing and captive offshoring. Understanding offshoring as a location decision simplifies the analysis and enables sufficient sample sizes, but it also hides valuable information. Making separate analyses for both forms of offshoring could reveal better what are the mechanisms behind offshoring performance. The nature of offshore outsourcing and captive offshoring is different. Offshore outsourcing companies lose the control of the production but take smaller risk than in captive offshoring.

Future studies on the performance of production movements could combine stock market based measures with accounting based measures. This would help to take into account the risk that is taken in the production movements. This would also lower the effects of different accounting policies if the analyses are extended to cover other countries than only Finland.

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