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Foreign direct investments and income inequality: an empirical investigation

The impact of sectoral foreign direct investments (FDI) on income inequality within Europe

Master thesis

UU Utrecht University

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Abstract

Most research on the effect on foreign direct investments (FDI) focuses on the influence on economic growth and productivity. Much less attention is paid to the possible effects of FDI on income inequality. In order to get a better understanding of the effect of FDI on income inequality and if all people in a country benefit to the same extent, it is necessary to fill this gap. This research analyses the relationship between FDI and income inequality in a panel of 15 European countries from 2003 to 2012. In particular, it estimates the effect of FDI from a sectoral perspective, identifying two major sectors: the manufacturing and services sector. This research uses a panel fixed effects model (FEM) to control for all time-invariant unmeasured (or latent) variables that influence the relationship between FDI and inequality. This paper finds that there is a negative association between FDI and changes in income inequality. However, this paper did not find evidence for a non-linear relationship between FDI and inequality. In fact, only empirical evidence is found that FDI inflows in the manufacturing sector tend to reduce income inequality. This paper argues that the relationship between FDI and income inequality is (sub)sector specific and employments patterns associated with these sector investments can help explain these findings.

Keywords: Foreign Direct Investments (FDI), Globalization, Income inequality, Skill-biased-technical-change, General equilibrium trade model, Endogenous growth model, Liberalization, Economic growth, Employment, Europe.

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List of abbreviations

EU	European Union
ECM	Error Correction Model
FDI	Foreign Direct Investments
FDI stock	The inward FDI stock is the value of foreign investors' equity in and net loans to enterprises resident in the reporting economy
FEM	Fixed Effects model
GDP	Gross Domestic Product
GINI	The Gini measures the extent to which the distribution of income among individuals within an economy deviates from a perfectly equal distribution
GLS	Generalized Least Squares
GMM	Generalized Methods of Moments
ILO-LABOURSTA	International Labour Organization – Labour statistics
LIS	Luxembourg Income Study
MNEs	Multinational Enterprises
N	Amount of cases
NACE	Statistical classification of economic activities in the European Community
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
REM	Random Effects Model
SUR	Seemingly Unrelated Regressions
SWIID	Standardized World Income Inequality Database
UNESCO	United Nations Educational, Scientific and Cultural Organization
VAR	Vector Auto Regression
WIID	World Income Inequality Database
WLS	Weighted Least Squares

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I
Introduction

In the recent decades there have been numerous investigations into the relationship between FDI in host countries and other variables. Most research concerns itself on the effects on growth, or more specifically, economic growth and productivity at both micro and macro level (e.g. Bruno & Cipollina, 2017; Rojec & Knell 2017; Javorcik, 2004; Kugler, 2006; Borensztein & Lee, 1998). While the recent literature widely suggests that FDI may have a favourable impact on the host economy and, hence, welfare development, what is generally neglected is the issue of equality (Figini & Görg, 2011). This is particularity remarkable in the context of Europe where public concerns about globalization and the widening inequality between poor and rich population groups have become evident, both in the political and economic discourse (OECD COPE, 2017; European Commission, 2018; ERPS, 2018).

This paper attempts to tackle this issue by providing an extensive analysis of the effect of FDI on inequality from a sectoral perspective, identifying two major sectors: the manufacturing- and services sector on inequality in the receiving country. In other terms, this paper investigates whether inward FDI benefits everyone in the exact same way in terms of income by determining if certain forms of FDI are more or less associated with income inequality.

The literature indicates that inequality has been rising in many countries since the 1970s. In fact, the number of studies examining inequality has increased in line with the rise of inequality. There is supporting evidence for both developed and developing countries for the increase in inequality between skilled and unskilled workers (Gottschalk & Smeeding, 1997; Acemoglu, 2003). The recent widening of income inequality has been attributed by some to skill-biased-technical-change and by others to trade liberalization. Both will shift the demand away from low-skilled activities, while raising relative demand and incomes of the higher skilled (Chennells & Van Reenen, 1999; Krugman, 2000; Feenstra & Hanson, 2001; Markusen & Venables, 1997).

Compared to this literature, less research has been carried out to deal empirically with the role played by multinational enterprises (MNEs) and more in general with FDI and inequality in advanced host countries. In the recent economic literature, evidence is found for a varying number of developed and developing countries, but without a consensus. Feenstra and Hanson (1997) used industry level data for Mexico and found that FDI is positively correlated with the relative demand for skilled labour. Jensen and Rosas (2007) also studied Mexico and found that FDI significantly reduces inequality. A similar study for the US done by Blonigen and Slaughter (2001) failed to find any significant effects of FDI on income inequality between skilled and unskilled workers in the US.

In a cross-country framework, Tsai (1995) used data on 33 developing countries in Asia and found that a growth of FDI increased inequality in some Asian countries. Gopinath and Chen (2003) also did a cross-country analysis for 11 developing and 15 developed countries and found that FDI only widens the income gap between skilled and unskilled workers in developing countries. Basu and Guariglia (2007) used a panel of 119 countries and found that inward FDI promotes economic inequality in developing countries.

Evidence on the distributional consequences of FDI in host countries is particularly scarce in the European context. In a within country framework, Figini and Görg (1999) and Taylor and Driffield (2005) used data on Ireland and the UK and found that there is a connection between income and FDI. The authors found that this effect is non-linear; inequality increases with FDI inward stock but this effect diminishes with further increases in FDI. Herzer and Nunnenkamp (2013) studied 10 European countries and found a positive relation with inequality in the short-run, but a negative relation in the long-run. Consequently, the empirical and theoretical findings fail to provide a clear-cut consensus on the impact of FDI on income inequality. For this reason, it may prove relevant to analyse the effect of FDI on inequality from a sectoral distribution. Especially because foreign investments tend to go to different industries within the economy depending upon their characteristics and attraction of each economy (e.g. cheap labour, level of technology or institutional and fiscal benefits). In fact, the sectoral distribution of FDI within European economies varies greatly by country. According to data from OECD, in 2003 the manufacturing FDI (measured in stock) accounted for an average of 27% of the sectoral total, being more concentrated in the former transition economies of Europe including: Czech Republic (41%), Hungary (39%), Slovakia (38%) and Poland (35%). In many other European countries, the services sector accounted for a large share of all foreign investments, for example: Germany (88%), France (81%) and Austria (77%). The services sector has taken on an increasing dominance in the more recent years accounting for 72% on average in 2012 at the expense of FDI in the manufacturing sector.

Against this background, this paper estimates the impact of inward FDI on inequality in Europe. The absence of literature studying the effect of FDI in Europe together with the shift of FDI from manufacturing to services and major trends (investment policies, persistent inequality and increased FDI flows) are the main reasons for this study.

The empirical approach of this research is inspired by the theoretical frameworks by Aghion and Howitt (1998), Feenstra and Hanson (1997) and Markusen and Venables (1998). The theoretical considerations of Aghion and Howitt (1998) lead us to expect a non-linear effect of FDI on inequality. The latter two frameworks are based upon general equilibrium trade models with endowment driven comparative advantage, where the findings are mixed and consequently the impact of FDI on inequality can be either positive or negative.

In this research, two hypotheses will be tested to gain a better understanding of the FDI processes and channels through which FDI can affect inequality. The hypotheses put forward in this paper will be tested on the aggregate level and for the manufacturing and services sector with specific attention to subsector effects. The theories used for this research are highly influential and played an important role in the discussion among scholars over the past decades. These theories will be discussed in detail in the following section. Ultimately, this research will conclude by arguing which of the theories possesses the highest relative strength regarding the effect of FDI on inequality. To do so, this paper conducts three types of analyses. First, it estimates the effect of FDI at the aggregate level on inequality, while in the second analysis it estimates the effect separately for the main sectors of FDI. At last, it tests the effect of FDI at tripartite division of economic activities, respectively, subsectoral specific effects. The research question that is conducted is as follows:

"What is the impact of foreign direct investments (FDI) on domestic income inequality for a sample of 15 European countries over the period 2003-2012? "

In other words, this paper addresses the question whether inward FDI has an effect on domestic income inequality by using a panel of 15 European countries for the period 2003-2012 (See Table A.1 of Annex A). In particular, this paper estimates the effect of FDI from a sectoral perspective as these might affect inequality in different ways. This approach allows a complete and fine-grained theoretic specification for the relationship between FDI and inequality.

Societal relevance

Over the last years, policymakers have decided to liberalise capital inflow policies in order to attract investment from foreign MNEs seeking to stimulate growth on a larger scale (Unctad, 2015). Through this renewed interest in FDI, MNEs attempt to lower entry barriers through regulatory changes in the form of new implemented policies of partial or complete exemptions of corporate taxes and import duties (Meunier, 2017; Unctad, 2006). In 2014, more than 80% of investment policy measures aimed to improve entry conditions and reduce restrictions (Unctad, 2015). In other words, policymakers recognise the importance of FDI in host countries given the increasing body of evidence of how knowledge brought in by foreign firms could spillover into domestic firms by strengthening the skills of the local workforce, upgrading their technological capabilities and consequently increasing the global competitiveness of the host economy (Brewer & Young, 1997; World Bank Group, 2010; Unctad, 2015). On the other hand, inequality within Europe has been growing in the last decades. In the 1980s, the average income of the richest 10% was seven times higher than the average income of the poorest 10%. Today, it is around ten times higher. To put it differently, the recovery of the economy has not reversed the long-term trend towards increasing income inequality since it is at an all-time high (OECD, 2017). With increasing concerns over what happens when the gap between the rich and the poor further increases, this development not only threatens the social but also the political stability of Europe (World Inequality Report, 2018). In relation to inward FDI, concerns are primarily linked to the issue when related productivity-enhancing spillovers come along with widening inequality due to shifts in the relative demand for labour towards higher skilled labour (Herzer & Nunnenkamp, 2011). However, empirical evidence is lacking for Europe and therefore this paper tries to close this gap. Furthermore, the results of this paper can be valuable in regard to today's debate that revolves around the understanding which part of Europe's lower inequality level can be attributed to redistributive policies.

Scientific relevance

The contribution of this research is three-fold. First, this paper addresses the methodological limitation of many studies by testing for a non-linear relationship, since most studies treat FDI as uniform. This research goes beyond this approach by differentiating the effects of FDI by sector in which it takes place. Secondly, this paper contributes to the body of knowledge by building a database on income inequality indices using data from OECD and ILO. Thirdly, it contributes to the literature by using a unique European sample to fill the void in analysing the effect of FDI on European income inequality by using a Standardized World Income Inequality Database (SWIDD) that guarantees comparability across countries and time.

Π
Literature review

This section of the paper provides an overview of the literature on the effects FDI on inequality. The considerable body of empirical literature of the effects of FDI on inequality that has developed in the last century has produced mixed empirical results. Economic analyses found positive, negative and ambiguous effects in the sense that FDI has a positive relation with inequality in the short-run, but a negative relation in the long-run. First, the main contributions dealing with the possible channels whereby FDI might influence income inequality will be highlighted. In the second and third paragraph, the empirical work will be summarised. The empirical work identifies two types of analysis: a within country framework and a cross-country framework.

2.1 Distributional effects of FDI

The latest development is that global foreign investments rose sharply after having dropped significantly due to the global financial crisis (Eurostat, 2017a; OECD database). These FDI trends and their micro- and macroeconomic impacts have attracted substantial research (Bruno & Cipollina, 2017; Rojec, & Knell, 2017). Within the expanding body of literature on the relationship between FDI and economic performance, there is quite a substantial number of empirical studies on European countries (Havranek & Irsova, 2011; Tokunaga & Iwasaki, 2017). Conversely, the effect of FDI on income inequality, particularly in European context, has received less attention, most probably because of data limitations and the absence of literature studying possible theoretical links between the two variables (Suanes, 2016).

Considering the body of literature, scholars offer conflicting theories and expectations regarding the links between FDI and inequality. Empirical studies often arrive at incompatible conclusions or offer inconclusive results. With regard to trade openness, researchers have concluded that varying channels might affect inequality. Jensen and Rosas (2007) suggest that the premium wage that foreign firms tend to pay for skilled workers can be considered as the main contribution whereby FDI might influence income inequality. As argued by the authors, the channel widens the gap between skilled and unskilled workers and therefore increases inequality. In contrary, if these foreign firms pay a wage premium to unskilled workers, FDI would tend to reduce income inequality. Other works consider more contributions, Velde (2003) pointed towards three channels through which FDI may affect inequality. First, Velde (2003) identified a composition effect, which is the result of a sectoral selection. This selection implies that foreign firms tend to set up in sectors that are more skill-intensive than domestic firms are and thereby improve the position of skilled workers relative to the unskilled labour. This explanation is in line with Feenstra and Hanson (1997), who argue that global outsourcing increases the demand for skilled workers in both developed and developing countries. The authors stress that every firm requires thresholds of skills, even the most basic production processes will require thresholds of skills, especially when these kinds of processes are integrated within multinational production chains. Secondly, FDI might affect the supply of skilled workers via training and specific contributions to general education. Thirdly, FDI can induce labour productivity growth faster in both domestic- and foreign firms due to technology transfer and secondary effects. As emphasized by Bekman, Bound and Machin (1998), this skewed effect of productivity growth towards skilled workers widens the income gap between skilled and unskilled workers. With the increases in inequality in developing and developed countries during periods of economic liberalization, this development has been puzzling for scholars. In the case of FDI, liberalization leads to increased imports of advanced machinery and techniques and since these imports are common in many forms of FDI, these dynamics could affect inequality. In this light, Harrison and Hanson (1999) argue that skill-biased technological change increases the skill premium, as new technologies are not in line with the qualification of the unskilled labour (Agenor, 2003).

2.2 Aggregate FDI and income inequality

Despite a large number of theoretical models highlighting the channels through which FDI can influence inequality, the empirical literature on the relationship between FDI and inequality is not conclusive. In a cross-country framework, many macro studies assert that FDI increases inequality, through different theoretical consideration. Authors such as Reuveny and Li (2003), Choi (2006) Jaumotte, Lall and Papageorgiou (2013), Bogliaccini and Egan (2017) found a positive association between FDI stocks and income inequality. However, Tsai (1995) argues that the relationship between FDI and increased inequality is geographically limited as he only found particularly strong evidence in East Asia in the 1970s. In line with this evidence, Chintrakarn, Herzer and Nunnenkamp (2012) found different findings across the more developed states in the US while others have found it to be negative or have been unable to find any relationship (Firebaugh & Beck, 1994; Milanovic, 2005; Sylwester, 2005).

Furthermore, some indications exist that the distributional effects of FDI differ between developed countries and developing countries. Gopinath and Chen (2003) studied the relationship of FDI and inequality for 15 advanced host countries and 11 developing countries and found that FDI effects differ significantly between developed and developing host countries. A similar study carried out by Figini and Görg (2011) found that FDI increased inequality in developing host countries, but diminishes with further increases in FDI. Simultaneously, the authors found that inequality decreased in advanced host countries (OECD countries).

In addition to the cross-national studies, FDI has been connected to patterns of inequality in a number of within-country studies. A large branch of the literature has found that when FDI is present, the wage gap between skilled and unskilled workers increases, which causes an increase in inequality (Aitken, Harrison & Lipsey; 1996; Mah, 2002; Velde, 2003; Chen, Ge & Lai 2011; McLaren & Yoo, 2017). However, within this body of literature there is also no consensus, especially because most of the case studies deal more specifically with inequality rather than broader cross-national measures of income inequality. For example, Feenstra and Hanson (1997) developed the argument that capital flows from developed countries to developing countries corresponds to the outsourcing activities, implying that developed countries use primarily low-skilled workers and host countries are intensive in skilled labour. The authors tested this hypothesis for Mexico in the period 1975-1988 and found that FDI can account for a large portion of the increase in the skilled labour share of total incomes (Feenstra & Hanson, 1997). Jensen and Rosas (2007) used broader income inequality indexes for Mexico rather than limited wage measures and argued that FDI inflows generate demand for low-skilled labour and therefore FDI reduces income inequality.

In European context, Taylor and Driffield (2005), Figini and Görg (1999) used industry level data for Ireland and the UK and found that there is a positive link between relative wages and FDI. This latter research found that this effect is a non-linear effect in which the expansion of inward FDI increases inequality, but at a decreasing rate over time. The results summarised in Table 1 show that the empirical evidence on developing and developed host countries has so far failed to provide clear-cut evidence.

2.3 Sectoral FDI and income inequality

As mentioned in the introduction, the literature studying the relationship between FDI and inequality has little regard to an important aspect that might be important for the understanding of the effect of FDI on income inequality, namely the sectoral-specific effects of FDI. When summarizing the literature, most of the literature is focussed on aggregate FDI analysis. This type of analysis is not able to determine the effect of its sectoral composition. Moreover, it seems reasonable to assume that FDI will not have the same impact and this is something that might differ from sector to sector. With the varying channels through which FDI can affect inequality, the sectoral approach is important as the effects might differ depending on which sector receives it.

Although there is no empirical evidence for the impact by sector on inequality in European countries, there is evidence for the effect of FDI on sectoral level on economic growth and productivity. Cipollina et al. (2013) found that the effect is stronger in capital intensive and technologically advanced sectors. Vu, Gangnes and Noy (2008) studied Asia and found evidence of different effects across economic sectors. Regarding sectoral effects of FDI on inequality, the existing literature has just begun to scratch the surface of how globalization affects the industry structure, the labour demand and income inequality in developed countries. In fact, empirical evidence is only available for developing countries. Suanes (2016) studied the relationship between FDI and income inequality in Latin America on the primary sector (raw materials), secondary sector (manufacturing) and tertiary sector (services). Using a data panel for 13 developing economies over the period 1980-2009, the author found evidence for a positive effect of FDI on income inequality in the service and manufacturing sectors. Bogliaccini and Egan (2017) found that FDI in services is associated with more income inequality, whereas FDI in the manufacturing sector is not strongly associated with higher inequality. Their findings are based on panel data coming from 60 middle-income countries over a 22-year timeframe (1989-2010). The authors argue that skill-biased technological changes, together with the redistribution of investment and employment away from manufacturing sector, drive the association between FDI and higher inequality in developing countries.

Table 1 **Schematic overview of studies: independent variable; framework; observations; countries; findings; mean of estimated coefficients**

Study	Findings	Data span	Empirical approach	Remarks
Firebaugh & Beck (1994)	FDI reduced income inequality	1965 to 1988 62 developing countries	FEM regressions	
Alarcon & McKinley (1996)		1989 to 1992 Mexico	OLS regressions	
Jensen & Rosas (2007)		1990 to 2000 Mexico	OLS and 2SLS regressions	Controlled for technology and trade
Im & McLaren (2015)		1960 to 2010 65 countries	OLS and TSLS regressions	
Tsai (1995)	FDI increased inequality	1968 to 1981 33 developing countries	OLS regressions	FDI increased income inequality in some Asian countries
Aitken, Harrison & Lipsey (1996)		1977 to 1990 Mexico, Venezuela, US	Logit egressions	
Feenstra & Hanson (1997)		1975 to 1988 Mexico	OLS and IV regressions	FDI using regional data on foreign assembly plants
Alderson & Nielsen (1999)		1967 to 1994 88 countries	REM and GLS regressions	
Mahler, Jesuit & Roscoe (1999)		1985 to 1992 10 countries	OLS regressions	
Dollar & Kraay (2001)		1975 to 1997 73 developing countries	VAR regressions	Trade liberalization does not increase income inequality
Mah (2002)		1975 to 1995 Korea	AR regressions Johansen- Juselius tests	
Reuveny & Li (2003)		1960 to 1996 69 countries developed and less developed	OLS regressions – Pooled time series	Democracy and trade reduce income
Velde (2003)		1985 to 1998 Latin America	OLS regressions	
Zhang & Zhang (2003)		1986 to 1998 China	OLS regressions	
Taylor & Driffield (2005)		1983 to 1992 UK	GMM regressions	
Choi (2006)		1993 to 2002 119 countries	OLS regressions	
Basu & Guariglia (2007)		1970 to 1999 119 developing countries	GMM and FEM regressions	Educational inequality (human capital Gini) as a measure of inequality

Chen, Ge, & Lai (2011)		1998 to 2007 China	OLS regressions Logit regressions Tobit regressions	
Velde & Morrissey (2003) (2004)		1985 to 1998 10 developing countries	Logit and OLS regressions SUR & IV estimation	No strong evidence that FDI has improved inequality
Lipsey & Sjöholm (2004)		1996 Indonesia	FEM regressions	FDI through blue- and white-collar workers
Jaumotte, Lall & Papageorgiou (2013)		1981 to 2003 51 countries	SURE regressions	Trade globalization is associated with a reduction in inequality
Mihaylova (2015)		1990-2012 10 eastern Europe countries	FEM regressions	
Suanes (2016)		1980-2009 Latin America	GMM and 2SLS regressions	Manufacturing and services sector
McLaren & Yoo (2017)		1989 to 2009 Vietnam	OLS and IV regression	The number of employees of foreign establishment as measure of FDI and living standards as inequality
Bogliaccini & Egan (2017)		1989 to 2010 60 developing countries	VAR and ECM regression	FDI in services is more likely to be associated with inequality than other sectors
Santarelli & Figini (2002)	Any effects on inequality	1970 to 1998 54 developing countries	OLS, FEM and REM regressions	Inequality measured through relative and absolute poverty
Blonigen & Slaughter (2001)		1977 to 1994 US	WLS regressions	Different forms of FDI: greenfield investment and acquired establishments
Milanovic (2005)		1985 to 1997 89 countries	GMM regressions	
Sylwester (2005)		1970 and 1989 29 developing countries	OLS and FEM regressions	
Figini, & Görg (1999)	FDI increased inequality, but at a decreasing rate overtime	1979 to 1995 Ireland	GLS Regression	FDI through blue- and white-collar workers
Lee (2006)		1951 to 1992 14 developed countries (Europe)	GLS regressions	Kuznets curve valid
Herzer & Nunnenkamp (2013)		1990-2000 10 European countries	Panel co-integration and causality techniques	

Gopinath & Chen (2003)	Mixed findings	1970 to 1995 15 developed and 11 developing countries	FEM and REM regressions	FDI only widens the income gap between skilled and unskilled workers in developing countries
Figini & Görg (2011)		1980 to 2002 100 OECD and non-OECD countries	GMM regressions non-linear estimation	FDI increased inequality in developing host countries, while inequality decreased in advanced host countries (both Gini and Theil index used)
Chintrakarn, Herzer & Nunnenkamp (2012)		1977 to 2001 48 US states	DOLS regressions (panel co-integration)	FDI at the state level reduced income inequality during the period 1977 to 2001, on average, but the effects proved to be heterogeneous.
Herzer et al. (2014)		Latin America 1980-2000	Panel co-integration techniques and 2-step ECM	Country specific results; on aggregate it increases inequality

Source: Prepared by the author

Although the literature thus far has provided important explanations and insights into the relationship between FDI and inequality, there are potential drawbacks in the literature. First, most of the cross-country studies do not address the issue of comparability across time and data of inequality data, neither do most studies look if there is the possibility of a non-linear relationship. Even though the cross-national econometric work points towards a positive relationship between FDI and inequality, most studies do not deal with the tripartite division of economic activities, respectively, sectoral-specific effects, capturing different effects of FDI. Furthermore, some cross-sectional studies are based on large samples with high levels of heterogeneity, implying that traditional solutions for dealing with heterogeneity may not be correct (Blonigen and Wang, 2004).

III
Theoretical Framework

In this section, the theoretical foundation of this research will be outlined. The theoretical foundation will be presented by selecting elements of each theory that will be used to create hypotheses on which the data collection will be based. First, the theoretical structure and key elements will be outlined after which the hypothesis will be formulated. In the next section, the research design will be presented.

3.1 The theoretical work by Aghion and Howitt (1998)

The first theoretical model is inspired by the work of Aghion and Howitt (1998), who developed the endogenous growth model. Aghion and Howitt (1998) build their work upon Violante (1996) to develop a simple theoretical framework to explain how technological diffusion can account for the evolution of income inequality. This economic model addresses the link between the presence of multinational firms and inequality in developed host countries. In theory, the model discusses the effects of social learning on economic growth. In practical terms, this means that the model looks at the effects of differences in workers, aggregate output and incomes in the economy. Therefore, the model views MNEs as instruments for introducing new technologies in the host country. According to the authors, the following production structure is assumed:

$$Y = \left\{ \int_0^1 A_i^{\alpha} x_i^{\alpha} \, di \right\}^{1/\alpha}, \quad 0 \leq \alpha \leq 1$$

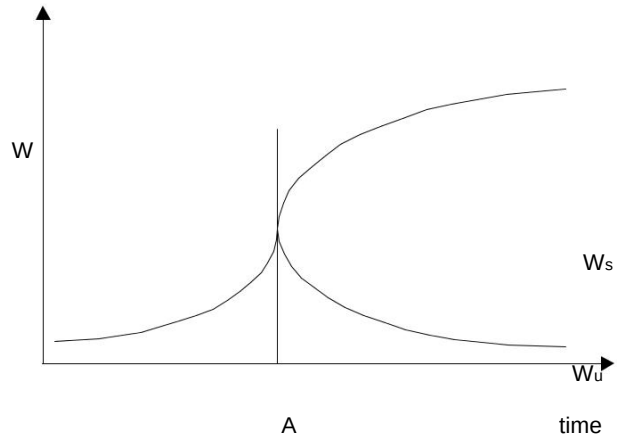
Within this equation, Y refers to the aggregate output that is produced by the use of intermediate inputs x in each sector i. These intermediate inputs depend on labour, which is the only factor of production. The level of output largely depends on the production technology, which is represented by the technology parameter A. This parameter works on the basic principle: the use of an old technology A=1 and the use of a new technology A>1. The technology parameter A is raised by a constant factor y in the case of new technologies. The model assumes that the economy only uses old technologies, implying that new technologies are introduced into the host economy solely through MNEs. This means that MNEs are viewed as role models for domestic firms, who learn by imitating the advanced production technologies that are used by MNEs. This because MNEs which are present in the economy have access to a higher standard of technology than domestic firms. Another assumption that is made by Aghion and Howitt (1998) is that firms that produce using the old technology only require unskilled labour.

Based on the economic model, the authors show that there are two stages of development for introducing a new technology from MNEs. In the first stage, domestic firms need a fraction of skilled labour to execute the necessary research to acquire a format for experimenting with the new technology. In this stage, firms are still producing their output using the old technology, but are highly investing in R&D in the attempt to discover such a format. While doing so, these domestic firms follow a process in which they imitate MNEs that already use the new technology. In this process, the amount of investment in innovation is relatively too small to adopt the supply of skilled labour, which is primarily employed in the old technology-sector. As a result, the demand for skilled labour remains low and the unskilled- and skilled labour have the same income.

In the second stage of development, domestic firms successfully implement the newly acquired format to produce their ultimate output. In the process of implementing, firms make use of the new technology that requires only skilled labour for the production. In the period of transition, the demand for skilled labour steeply increases with the effect of labour-market segmentation. Put it differently, a new technological innovation widens the gap between skilled and unskilled workers because firms use skilled labour to implement the new technology. However, at later stages less skilled labour is used when the new technology has been implemented.

In order to fully understand these two stages of development, Aghion, Howitt and Violante (2002) made a model of the evolution of incomes, which is presented in figure 1.

Figure 1 **Development of incomes skilled- and unskilled labour**



Source: Prepared by the author, based on Aghion and Howitt (1998)

Figure 1 illustrates that at the beginning of stage one there is a low demand for skilled labour, implying that the differences in incomes between the skilled- and unskilled labour are minimal. From this point onwards, the demand for skilled labour steeply increases causing shift in the labour market. As shown in figure 1, there is a point in time (A) in which the labour market becomes segmented. This point indicates that the income for skilled workers increases and the income for unskilled workers falls towards zero.

The model describes the development of income inequality by providing and explaining the adjustment process of firms in the economy. Where in the early stage income inequality increases because firms use skilled labour to innovate, income inequality decreases over time as all firms move into both stages, causing the fall of relative demand for unskilled labour. Eventually, only skilled labour will be employed when all firms are at the latter stage. This model depends upon the number of MNEs since domestic firms learn by imitating MNEs; the higher the number of MNEs present in the economy, the faster the speed of development. In other words, inward FDI can be seen as a vehicle for bringing new technologies into a country with spillover effects when imitation by local firms occurs, foreign investments can lead to intra- and interindustry technology upgrading as stated by Piva (2004) and Kinoshita (2000). This leads to skill-biased technological change as it increases the skill premium because the new technology is a complement to the skilled labour and a substitute for unskilled labour.

3.2 The theoretical work by Feenstra and Hanson (1996)

As mentioned earlier, there are a number of factors that drive the overall distribution of income. In the first theoretical model, technological change biased in favour of skilled labour is the reason for the demand shock. However, there is some disagreement about whether exogenous technological advance is the most important factor in causing increasing demand for skilled workers (Machin and Van Reenen, 1998; Desjonqueres, Machin & Van Reenen, 1998; Haskell, 2000; Slaughter, 1999). Therefore, a substantial part of the theoretical work regarding FDI and inequality depends upon general equilibrium trade models implying that the growing international trade is responsible for the increasing demand for skilled labour (Levy & Murnane, 1992; Gottschalk & Smeeding, 1997).

Feenstra and Hanson (2001) argue that trade in intermediate inputs or global production sharing is an important explanation for the increase in the income gap between skilled and unskilled workers. This work dates to the earlier work of Feenstra and Hanson (1997). In this work, the authors developed a North-South model to examine the potential effect of FDI inflows on incomes in the host countries. In this endowment model, a final good is produced by a continuum of intermediate inputs that varies in the relative amounts of skilled- and unskilled labour. The authors considered a world economy with two countries, North and South. With this as a starting point in their model, each country has given endowments of capital and (unskilled/skilled) labour with the assumption that initially there is no international factor mobility. The assumption is made that there are differences in incomes between these countries since the North specializes in high-skill activities, while the South specializes in low-skill activities. Due to these differences, firms from the North use FDI to move their production to the South, the least skill-intensive activities will be outsourced as the South is specialized in low-skill activities. As a result, the South is the host country of FDI with the effect that the relative demand for high-skilled workers raises. This same process occurs in the North because the

average skill intensity of production rises. In other words, the relative demand for high-skilled workers rises in both countries since both countries produce a more skilled labour-intensive mix of activities. In the context of this paper, the rise of the high-skilled workers in the South must be noted. The reason for this is that the authors assume that inward FDI entails new activities that are more skill-intensive than the host country's existing activities, meaning that capital flows into developing countries increase the demand for skilled labour, which, in turn, causes the relative income of skilled labour to rise.

This model of Feenstra and Hanson (1996) turns the Heckscher Ohlin model (H–O model) on its head, implying that trade should widen income differentials in the North, but should narrow the gap in the South (Heckscher & Ohlin, 1991). This effect arises because the equilibrium trade model assumes that a country will export the good, which is intensive in the factor that the country is relatively well endowed with, and import the good, which is intensive in the factor that the country is relatively scarcely endowed with. The model of Heckscher and Ohlin (1991) implies that trade liberalization will tend to reduce inequality as factors move into labour-intensive industries, causing the relative demand for and income of capital or skilled labour to decline. Feenstra and Hanson (2003) also pointed towards trade liberalization. The authors argue that the differences between high-skilled labour and low-skilled labour is highly dependent on the level of development of the country in which the high-skill and low-skill labour-intensive industries are located. Since this research is dealing with highly developed and developed countries, this implies that some activities might be low-skilled in one country while the same activities are considered as high-skilled labour-intensive in other countries. If this is the case, trade liberalization would increase the demand for high-skilled labour in both less developed and developed countries.

3.3 The theoretical work by Markusen and Venables (1998)

A different stand of the theoretical literature departs from Markusen (1995), where the general equilibrium model starts from the assumption that MNEs have firm-specific assets, such as management skills and technology granting them a productivity advantage over domestic firms in the host country. Based on this work, Markusen and Venables (1998) analysed the influence of FDI on relative incomes in parent- and host countries. Using a two-country model, the authors showed that world endowment growth leads to a great role for multinationals with ambiguous labour demands effects. This can be explained because the assumption is made that initially national firms predominate, but along with growth the number of MNEs increases, meaning that the demand for high-skilled labour increases. On the other hand, if it is assumed that initially there a few national firms then growth can cause a lower demand for skilled labour because of greater scale effects. These effects arise mainly with MNEs that use less skilled labour. When combining the argument of trade liberalization and the skill-biased argument, earlier studies already found evidence that these explanations strengthen each other. Goldberg and Pavcnik (2007) found that increases in international capital flows are significantly associated with an increase in the demand for skilled labour. Feenstra and Hanson (1997) argue that global outsourcing increases the demand for skilled labour. Moreover, Wood (2007) argues that the expansion of international capital flows is partly responsible for the bias of skilled workers.

Several other theoretical explanations of the relationship between FDI and inequality have been proposed in the literature. For example, Aitken and Harrison (1999) and Berg and Taylor (2000) suggest that FDI can cause crowding out of domestic production and therefore affect the income distribution by employment effects. In this paper, FDI affects the income distribution via relative wages. This means on a theoretical level that the direct and indirect effects of FDI could alleviate inequality by paying higher incomes to the less skilled workers. On the other hand, FDI could also worsen inequality when these investments benefit the more skilled workers. In this research there is a third option, as the theoretical considerations lead us to expect a non-linear effect of FDI on inequality, and this will be tested explicitly in the analysis of this paper.

3.4 Sectoral FDI and income inequality

Since this research is interested in the skill-biased argument and the role of trade liberalization in developed economies, FDI must be studied through the perspective of the skill-biased argument. This means that wage premiums arise in a disproportional matter, namely towards the higher skilled workers. In other words, FDI will shift the demand away from low-skilled activities, while raising relative demand and incomes of the higher skilled. If it is assumed that this is true, MNEs pay better wages and target higher skilled workers even if the investment activities are considered as low-skilled in the countries of origin. Following this perspective, it is likely that the effect of FDI in economic sectors differs in the extent to which they transfer skill-bias and affect the income distribution and employment patterns.

In contrast to the long history of research on aggregate FDI and inequality, there has been little research on the sectoral effect of FDI. This is remarkable since there have been important shifts in the sectoral composition of FDI during the period of liberalization (Wacziarg & Welch, 2008). There has been a progressive shift towards services at the expense of manufacturing. In developed economies, the inward FDI in the manufacturing sector decreased from 41% to 25%, whereas it increased from 50% to 69% in the services sector from 1990

till 2010 (OECD,2017; Unctad, 2007). While this shift is, in part, likely to reflect the growing importance of the services sector within countries, it is also likely to capture the growing internationalisation of the services sector because of developments in various subsectors such as ICT, telecommunications and business services. Against this background, it is important to track how sectors are impacted by foreign investment and how these impacts might translate into patterns of income inequality. In other words, the channels through which FDI affects inequality are likely to differ depending on which economic sector receives the foreign investment.

The literature does identify some differential effects of FDI on inequality by sector. In regard to the manufacturing sector, this sector as a whole can be considered as labour-intensive and most theories about distributive effects of FDI deal explicitly with investment in the labour-intensive manufacturing sector as described in section 2. However, the empirical evidence is not conclusive as Alarcon and McKinley (1996) found that wages raise significantly more for skilled workers than for unskilled workers in Mexico. In contrast, Velde and Morrissey (2003) found that FDI increased wages at all skill levels in Asian countries. Since this evidence is inconclusive, this paper views FDI in the manufacturing sector in terms of technology intensity. This because the theoretical considerations of Aghion and Howitt (1998) assume that MNEs which are present in the economy have access to a higher standard of technology than domestic firms do. Since technological change is a common phenomenon in the manufacturing, this sector has different technologies with accompanying levels of technology intensity. Besides this varying level of technology intensity, the manufacturing sector has a less polarized income structure to economic activities with greater differences in skills and therefore differentials in wage (Breemersch, Damijan & Konings, 2017). In order to distinguish the manufacturing sector in terms of high and low technology, this research follows the high-tech classification of manufacturing industries of OECD, which is in line with the Eurostat classification of industries. This industry classification is based on the NACE Rev.2 classification and divides technological intensity into high-technology and low-technology intensive activities. (see Appendix A, Table A.2).

In contrary to the more polarized manufacturing sector, the services sector is highly heterogeneous. This can be explained by varying levels of knowledge intensity scattered across the services sector. Evans and Timberlake (1980) stress this argument by their explanation that the services sector includes everyone from the most highly paid doctors and lawyers to the most poorly paid domestic servants. Since the skill-biased argument is also applied on this sector, the services sector is broken down into two components: knowledge intensive (high wages) and non-knowledge intensive services sectors (low wages). This breakdown of subsectors is made on the bases of the *Science, Technology and Industry Scoreboard* and follows the NACE Rev.2 classification. This breakdown of sectors is in line with the literature as scholars found a strong relationship between inward FDI and income inequality that was driven by the skill-biased argument in high-skilled sectors (Velde & Morrison, 2004). Moreover, capital flows into skill-intensive industries such as finance or business activities, could have a different effect on inequality than lower- skilled subsectors such as hotels and restaurants.

Hypotheses

In this section, the hypotheses will be formulated that are derived from the theories' key elements. These key elements will now be operationalized to create testable hypotheses. Based on these hypotheses, empirical observations will be made to test the theories' relative strength regarding the effect of FDI on inequality. For each theory, one hypothesis is formulated. However, the validity of one hypothesis does not depend on the other hypothesis from the other theories. In the following section, the unified methodological framework will be presented. This framework will be based on the theoretical discussion of this section and will be used to motivate the empirical analysis of this paper.

Hypothesis for the endogenous growth model

In reference to the endogenous growth model, Aghion and Howitt (1998) explicitly refer to Kuznets curve (1955). The Kuznets curve shows that an initial increase in income is associated with increasing inequality, meaning that FDI and inequality have an inverted U-shaped relationship. The idea is quite straightforward; it first assumes that the Kuznets relationship between inequality and development is an empirical regularity; this relationship predicts that any country in its path to development would necessarily pass through a period of high inequality before they decrease when reaching high levels of development. In the light of the theoretical work that is done by Aghion and Howitt (1998), this idea refers to the inverted-U hypothesis of rising and then falling inequality. The skill premium increases as long as learning efforts result in a high demand for skills that are in short supply. Subsequently, income inequality declines to the extent that the supply of the required skills improves and firms have managed the transition to the new technological paradigm. In the scope of this paper, FDI is considered as a vehicle to introduce new technology into a country, such as FDI carried out by multinational firms.

The theoretical considerations lead us to expect a non-linear effect of FDI on inequality. Therefore, if the Kuznets hypothesis is valid, the implications of the model and the predictions of the Kuznets curve would allow proposing the following:

I. The expansion of FDI leads to an increase in income inequality, but at a decreasing rate over time

The main idea in the hypothesis lies in the fact that previously low-skilled workers become skilled by themselves, resulting in middle-income class, and hence, a decrease of the previous inequalities. In other words, inequality is a prerequisite in order to create a better overall income distribution. In relation to the model of Aghion and Howitt (1998), they place technologically superior MNEs into the endogenous growth model, implying that domestic firms learn by imitating MNEs and slowly adopt the advanced technology, which leads to a higher demand for skilled labour. The changes in income are the result of complex interactions between skill development and shifts in the demand for skilled- and unskilled labour. This implies that the effect of FDI on inequality may differ, not only from country to country, but also over time. More specifically, one might expect that the long-run effect differs significantly from the short-run effect. These theoretical considerations are in line with the work of Velde (2003) and Figini and Görg (2011).

This hypothesis is built on the assumption that the effect of FDI on inequality occurs through supply and demand for labour channels. Therefore, the production structure of Aghion and Howitt (1998) follows a framework of two factors: skilled- and unskilled labour in a constant elasticity (one-to-one change) of substitution. In the context of this paper, this elasticity of substitution cannot be tested directly since there is no data available to test explicitly for the channel of skilled-labour demand. Besides that, changes in inequality related to FDI may occur through different channels as these mechanisms differ depending on which economic sector receives the foreign investments. Therefore, technological progress and skill-demand can also be viewed as a potentially additional channel through which globalization operates. This means that the varying channels through which FDI could affect the distribution of incomes within a country are connected to the sectors of the economy in which this investment is made in each country.

Hypothesis for the general equilibrium trade models
Since the latter theories are based on general equilibrium trade models, these theories will be discussed together. In the first general equilibrium trade model, Feenstra and Hanson (1997) provided a model of the globalization of production in which firms in a skilled-abundant North use firms in a non-skilled-abundant South to produce intermediate inputs. Central in this model is the assumption that wages differ between nations since the North specializes in high-skill activities and the South specializes in low-skill activities. As a result, Northern firms use FDI to move their least skill-intensive activities to the South. By moving these activities to the South, the average skill intensity of production rises in the North. The same effect also occurs in the South, since the South initially specializes in the least skilled activities. When the North outsources production to the South, it turns out that the relative demand for high-skilled workers rises in both countries. The reason for this is that the authors assume that inward FDI entails new activities that are more skill-intensive than the host country's existing activities, meaning that capital flows into developing countries increase the demand for skilled labour, which, in turn, causes the relative income of skilled labour to rise. If this theory is valid, one would expect a positive correlation where FDI worsens inequality. The hypothesis is therefore as follows:

II. The expansion of FDI leads to greater income inequality by the increase of the demand for skilled labour in the host country

In other words, this hypothesis suggests that the relationship between FDI and income inequality follows the path that foreign firms pay more than their domestic counterparts due to its wage premium mechanism as a consequence of international trade and global outsourcing. This research follows this mechanism as a possible explanation for changes in inequality with some important sectoral distinctions. In regard to these sectoral distinctions, it is expected that FDI in the services sector is more likely to increase in the income gap between skilled- and unskilled workers than in the manufacturing sector. This not only because of the heterogeneity in the services sector, but also because evidence suggests that wage differentials for foreign firms in the services sector are greater than those in manufacturing sector (Evans & Timberlake, 1980; Velde & Morrissey, 2004; Bogliaccini & Egan, 2017). Furthermore, there are some authors such as Kaiser (2000) who suggests that the skill-biased argument can explain the decline in the demand for low-skilled labour and the increase in the relative demand for high-skilled labour, especially when this is related to high wage industries in the services sector. In line with these findings, Velde and Morrissey (2004) found that skill-biased technological change drives the relationship between FDI and inequality in high-skill sectors. When combining these findings with the polarized income structure of the services sector, one could expect a more unequal income distribution considering the differences between the skilled- and unskilled labour. However, relatively high-skill subsectors also exist in the manufacturing sector and therefore a wage premium could exist in this sector, especially in high-technology subsectors. Besides that, it should be noted that most studies have identified skill-bias in the manufacturing sector. However, since the employment has shrunk in this sector as a consequence of technological incorporation it is expected that FDI in the manufacturing sector has a smaller impact on the overall levels of inequality (Leamer et al., 1999; OECD, 2017; ILO database)

IV
Methodology and data

This section will elaborate on the quantitative design of this research. For this design, the theoretical discussion of section 3 is used as a motivation for the empirical analysis that is focussed on examining the effect of FDI on income inequality and specifically on attempting to identify whether there is indeed a positive, negative, or inverted U-shape relationship. The section presents the basic empirical model, discusses some important econometric issues and describes the data.

4.1 Empirical specification and econometric issues

The links between income inequality and FDI are multifaceted, however, this paper attempts to examine the relationship between FDI and inequality for a sample of 15 European countries. The empirical approach is inspired by the theoretical discussion of section 3. When following the theoretical considerations of Aghion and Howitt (1998), it is expected to find a non-linear effect of FDI on inequality. In order to estimate the impact of FDI on income inequality the following basic model will be used:

$$inequality_{it} = b0 + b1FDI_{it} + b2FDI^2_{it} + b3X_{it} + u_{i+} + e_{it}$$

Where *inequality*it is a measure of within-country income inequality (GINI) over time periods t= 1,2…..,*T* and countries i=,1,2,……,*N.* FDI*it* represents the independent variables on aggregate and (sub)sectoral level FDI measured as inward FDI stocks as a percentage of GDP in country i at time t. Since this research allows for a non-linear relationship between FDI and inequality, the quadratic term for FDI is introduced into model 2 and 4. X*it* is a vector of control variables, discussed below. The term u*i* represents the fixed effect by country, respectively, country-specific effects, capturing any country-specific omitted factors that are assumed to be correlated with inequality and e*it* is the remaining white noise error term. This variable is added to deal with the presence of unobserved heterogeneity across countries. Country and time dummies are part of both equations, but are not reported for ease of visual interpretation. These country and time effects are included to ensure that an exogenous change that comes from outside the model is explained by the model, meaning that other observable or unobservable variables affecting inequality are controlled for in the model.

This equation assumes there is a long-run relationship between persistent movements in equality and persist movements in FDI in host countries using an unbalanced panel of 15 countries with yearly data over a ten-year period (2003-2012). This basic model is endogenous in the sense that, in the long run, changes in FDI cause changes in inequality. For this model, it is decided to measure inequality across sectors (manufacturing and services) and countries. Since the interest of this paper lies in the skill-bias argument, the manufacturing is broken down into low- and high-technology manufacturing subsectors. The services sector is broken into two knowledge intensive- and non-knowledge intensive subsectors. This choice is driven by the heterogeneity along the services sector, as specified in section 3. In this light, there is no explicit breakdown in the data in the context of the gap between skilled- and unskilled workers because of various reasons. First, this choice is driven by the data availability. Second, it can be assumed that inequality also changes within both skilled- and unskilled labour as stressed by Rubinstein and Tsiddon (2004). According to the authors, the effect of technological progress is one-to-one related to the rise in labour productivity, which allows wages to increase or decrease due to the enhancement of individual abilities. As a third reason, it can be assumed that MNEs do not focus their investment equally across the whole manufacturing and services sector, but target their investments to some specific subsectors in which the host country has relative advantages.

The econometric model is estimated using a panel fixed effects model (FEM). As described numerous times in the literature, this model tackles the problem of endogenous explanatory variables from an omitted variables perspective (Deaton,1985; Allison 1994; Teachman et. al., 2001 Beckfield, 2006). In other words, the individual-specific effect (country dummy) is a random variable that is allowed to be correlated with the explanatory variables. The advantage of this model is that it does not estimate the effects of variables whose values do not change across time, but controls for them or partial them out (Bollen & Brand, 2010). Against this background, this model allows to control for the average differences across countries whether these variables are known or unknown to the researcher (Hausman & Taylor, 1981). This model is common for this type of data as a number of articles have made use of the FEM approach in this field of study (see Firebaugh & Beck, 1994; Santarelli & Figini 2002; Gopinath & Chen, 2003; Basu & Guariglia, 2007; Mihaylova, 2015). Also, there is a vast literature in econometrics that suggests that this model overcomes many limitations as it allows to control for time-invariant omitted variables (Baltagi & Raj, 1992; Baltagi,

2008, Wooldridge, 2010). In regard to the limitations of this modelling, some researchers point towards the uncertainty of whether to apply the fixed effects models (FEM) or random effects models (REM). Another potential economic issue of this model is that it might be insufficiently flexible as the effects of variables, including the latent time-invariant variable, might change over time rather than be constant as in the usual FEM. However, there is no easy solution to these issues and therefore the FEM is considered to be a valid estimate for our analysis, especially because the data in this paper does not violate the FEM assumptions (Cameron, & Trivedi, 2005).

4.2 Data and variable description

This research works with an unbalanced panel of 15 developed countries from Europe over the period 2003-2012. The countries included in the sample are Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal and Slovakia. These countries and time samples are chosen because they have the best available (sub)sector data of FDI and inequality. Following figures of OECD and the World Bank Group these countries can be accurately classified as developed countries and high-income economies (Unctad, 2007; UN, 2014; OECD, 2016; IMF, 2017; World Bank Group, 2018).

For these countries, aggregate and (sub)sectoral data in manufacturing and services were relatively common, which allows this research to do a finer-grained secondary analysis. For FDI there are two common measures of inward FDI utilized in the body of literature: stocks and flows. In general, the latter is the better measurement for capturing long-run effects, as it shows the total amount of accumulated FDI within the host country. In contrast, annual FDI inflows fluctuate more easily and tend to be a short-run to medium-run measure. FDI stocks are used because stocks should capture long-run effects more effectively than annual FDI flows together with the assumption that FDI contributes to the stock of general-purpose technology available in the economy (Figini & Görg, 2011; Chintrakarn et al., 2012). Data on FDI are taken from OECD. FDI stock is recorded for each sector in millions of US dollars. These amounts were matched with the Gross Domestic Product (GDP) figures also taken from the OECD database for each year. As mentioned before, the primary-independent variable is aggregate FDI stock as a percentage of GDP. The secondary independent variable is sectoral FDI as a percentage of GDP. The tertiary independent variable is subsectoral FDI as a percentage of GDP. These latter two approaches are warranted, not only because FDI is services is quantitatively important, but it can bring distributional effects that differ from FDI in manufacturing. In addition, it is important to track how subsectors are impacted by FDI and how these impacts might translate into patterns of income inequality.

The dependent variable is within-country income inequality. The measure of income inequality is the Standardized Gini Index from the World Income Inequality Database (SWIID). This is the most widely used measure of income inequality and is abstracted from the SWIID. It can take values from 0 (perfect equality) to 100 (perfect inequality). The SWIID combines information from the World Income Inequality Database (WIID) and Luxembourg Income Study (LIS) offering harmonized micro-data on country level. As stressed by Herzer and Nunnenkamp (2012) and Bergh and Nilsson (2010) the standardized Gini index offers two important advantages. First, it provides data without any gaps, which is necessary for estimating both short-term and long-term effects. As a second advantage, this variable offers comparability among countries, allowing that this data is fully comparable across space and time. Descriptive statistics and the definitions and sources of all variables included in models for the 15 countries under consideration are available in Table B.1 of the Annex.

In accordance with the literature, the model includes a set of controls variables that could affect either income inequality or FDI as omitting them could result in biases and possible misleading effects in the estimation of the impact of FDI on income inequality. According to the political economy literature on FDI and income inequality, six basic control variables are introduced in the equation: openness of trade, the level of economic development, human capital, overall levels of unemployment, measures of employment and public spending. In this paper, only the macroeconomic factors that affect the Gini coefficient with an emphasis on FDI are taken into account.

This first variable is inspired by the work of Francois and Nelson (2003) and Heckscher and Ohlin (1991), who suggest that increased trade in countries with a majority in unskilled labour should decrease inequality. On the other hand, it should increase in countries where the skilled labour is predominant (Feenstra & Hanson, 2003). Based on this model, one could argue that the more open a country is to international trade, the more evident the effect would be on income inequality. However, the earlier empirical work on inward FDI and inequality is not in line with this effect (Soto, 2000; Bergh and Nilsson 2010). In line with this work, Jaumotte et. al. (2013) argue that increasing trade and financial globalization have separately identifiable and opposite effects on the income distribution. Where trade liberalization and export growth are found to be associated with lower income inequality, increases in financial openness are associated with higher inequality for both developing and developed countries. In overall, trade and economic globalization are important aspects of income inequality as stressed by Robbins (1996), Robertson (2000) and Cho and Ramirez (2016). In this research, trade openness is defined as the sum of total imports and exports as a share

of GDP. Data for the construction for this variable comes from the OECD database.

With respect to the level of development, the earlier work of Tsai (1995) and Figini and Görg (2011) suggests integrating GDP per capita taken in current US dollars. This variable is the most popular proxy for the level of economic development and growth. The expected sign of the coefficient GDP per capita is either positive or negative. Economic growth leads to increased income inequality of a country if people cannot enjoy its fruits equally. On the other hand, economic growth may lead to decreased income inequality if there is labour absorbing economic growth and better policies concerning the income distribution. Data for this variable comes from the OECD database (measured in thousands of US dollars).

Coherent with the theoretical work of section 3, human capital is introduced as a third control variable. Human capital can be defined in different ways, the ratio of the number of students enrolled in higher education over population, the ratio of the number of students enrolled in secondary education over population, the ratio of the number of students enrolled in higher education to the number of students enrolled in secondary education, or investments in education. This paper chooses the ratio of the number of students enrolled to secondary education expressed as a percentage of the total population in that age group, as this measure is most adequate and comparable according to Barro and Lee (2001). This variable is included to control for the supply side of the labour market because of the changes in the demand and supply of skilled labour. As discussed earlier, inequality emerges because of labour demand effects. Therefore, one could argue that inequality emerges because there is no equal change in the demand and supply of skilled labour. In other terms, the higher the inequality, the higher the skill premium for labour and the higher the demand for skilled labour. Therefore, one could expect the higher the enrolment ratio, the higher the supply of skilled labour. This is in line with, Castello and Domenech (2002) and Barro (2000) as these authors stated that the higher the level of education in the population, the lower the income inequality. Figini and Görg (2011) stress this argument as the authors argue that an increase in overall education implies an increase in the supply of skilled labour, which should theoretically decrease wage inequality. In other words, education is considered as an investment in human capital that increases the skill of workers. Therefore, a steady growth in the supply side of skilled labour might keep the relative wages of skilled- and unskilled workers constant, even with the argument of skill-biased technological change. So, a higher level of education is likely to reduce income inequality.

In contrary, Lin et al. (2013) suggest that countries with higher levels of human capital could experience positive economic growth and therefore greater income inequality. At last, the theoretical considerations of this research lead us to expect mixed effects on inequality. Data for the construction of this variable comes from the UNESCO database.

As a fourth control variable, overall levels of unemployment are included in the data as these may have a profound impact on inequality due to wage bargaining (Velde, 2003; Bogliaccini & Egan, 2017). Furthermore, patterns of unemployment are inextricably linked with processes of liberalization and economic development and hence the income distribution (Revenga, 1997; Lee, 2005; Dix-Carneiro, 2014). Data from this variable comes from OECD.

In line with this argument, employment by (sub)sector is included in the model. This measure is included since a large number of employment may have a different association with income inequality than one, which is dominated by foreign capital. In other words, inward FDI may not only foster economic growth in a host country through transferring technology and expanding exports, but also contributions to capital formation and employment (Caves, 1996; Borenstein et al., 1998; Aitken & Harrison, 1999; Berg & Taylor, 2000; Ram & Zhang, 2002). Moreover, Lee and Vivarelli (2006) suggest that employment effects of FDI may be country- and sector specific and therefore employment is an important determinant to control for as it can affect the income distribution. Since employment data is not readily available for all subsectors, only employment data on the tripartite division of the services sector is included. Employment data for the manufacturing and services sector as a whole are included as well. Since subsectoral employment is only included for the service activities, this might cause an empirical issue. However, according to Evans and Timberlake (1980), dealing with heterogeneity is more important in the services sector due to the wider income distribution. The construction for this variable comes from the ILO-LABOURSTA database and OECD database.

The level of income inequality can also be affected by other social and political factors. Therefore, as a last control variable, public spending is included in all models on the basis that it is a significant variable in the determination of income inequality. As argued by Afonso, Schuknecht and Tanzi (2010), government spending has a strong negative impact on income inequality. The authors stress that government spending could alleviate inequality both indirectly and directly. Indirectly by improving the human capital, competitiveness of sectors and the labour market. For example, spending on education and health care increases the productivity of low-income people and provides them job opportunities to increase their incomes. This is in line with the work of Atkinson and Brandolini (2006) and Velde (2003), who point towards the positive indirect effects of fiscal policies. Additionally, government spending can also affect inequality directly by transferring income to the less well-off (e.g. active labour market programmes, unemployment, housing and other social policy areas. (Afonso et al. 2010). Data for this variable comes from the OECD database and is measured as a share of GDP.

Table B.2 of the Annex provides an overview of the data sources and the description of all variables. Table B.3 presents a summary of the expected sign of all the coefficients on the variables for the models. The observed signs of all the coefficients that are significant in the different estimations are also presented in the same table.

V
Results

This section presents the empirical results obtained for the panel of data from 15 European countries over the period 2003-2012. Each analysis will be discussed separately before moving on to the conclusion in which the most important results and the limitations of this research will be outlined. This section begins by first examining the basic relationship between aggregate FDI and inequality. Then, the analysis tests if there is an existence of a long run relationship between FDI and inequality on sectoral level. Finally, this research provides the estimates of the relationship between FDI and inequality on subsectoral level.

5.1 FDI and income inequality on the aggregate level

Table 2 presents the main results for the estimation of the relationship between FDI and income inequality at the aggregate level. Column 1 and column 3 show the results for the regressions respectively including the simple FDI term and the quadratic specification. The dependent variable in each model is income inequality. The results indicate that the short-run effects of FDI on income inequality are significant and have a negative effect on income inequality within Europe. In the long-run, the effects of FDI on income inequality are insignificant, implying that there is no evidence to show that this effect is non-linear. These results indicate that when inward FDI on aggregate level increases by 1%, income inequality decreases by 0.019%. Although this result is statistically significant, economically, it is somewhat weak as the value of the coefficient is extremely low. As noted above, similar results are also reported in other studies, for example Figini and Görg (2011) also found that inequality decreases with FDI inward stock. However, the authors found no robust evidence to show that this effect is non-linear. Also, these findings are consistent with the work of Chintrakarn et al. (2012) for the US, whereas these results invite the conclusion that effects of inward FDI are country specific, meaning that the relationship between FDI and inequality tend to differ from developing countries.

In overall, these findings may suggest that European countries already have high standards of technology and further increases of FDI ensures that technologies become more frequently available and easier to use. In terms of the skill-biased argument, this would mean that not only the high-skilled workers are able to capitalize the wage premiums, but that more workers are able to benefit from wage premiums. Specifically, this could mean that the theoretical arguments in section 3 only apply for developing countries as European countries have already reached high levels of technological sophistication.

As regards the control variables, the human capital variable has a negative effect on inequality and this finding is robust under the different specifications. This is in line with the literature on the impact of human capital on inequality, finding that the higher the level of education in the population, the lower the income inequality (Barro, 2000; Castello & Domenech, 2002; Blomstrom & Kokko, 2003; Basu & Guariglia, 2007; Figini & Görg; 2011). This finding is important, as many economists and geographers emphasize that investments in human capital would tend to reduce income inequality and it might be one of the most effective instruments for reducing the gap between the rich and the poor (Tilak, 2002; Psacharopoulos & Patrinos; 2004; Mundy & Verger, 2015). The unemployment coefficient is also found to be statistically significant and have the theoretically expected effects on income inequality, robust throughout the models and estimates with a positive value of between 0.058 – 0.070. The trade coefficient is positive as expected under the theory of Feenstra and Hanson (2003) but is statistically insignificant.

In overall, the results on aggregate level indicate that FDI has, on average, a negative effect on income inequality in Europe. Nonetheless, this finding for this panel does not necessarily imply that FDI affects inequality negatively in each individual country. In regard to these individual effects, it must be mentioned that these estimates could not been calculated given the short time period in our panel. Nevertheless, several authors, such as Irvin and Izurieta (2000), have used short time samples for their analysis in regard to individual country effects, but this goes beyond the scope of this paper. Furthermore, the results of this aggregate analysis suggest that the link between FDI and inequality depends on labour demand effects. In other words, the relationship between FDI and inequality seems to rely on the demand and supply of skilled labour together with the level of unemployment as this could strengthen this relationship by wage bargaining. Arguably, the relationship also depends on the level of technological development in the host country. However, this link is hard to measure and therefore not included in this research. In order to investigate this complex link further and to investigate the role played by labour demand effects, it is important to include employment patterns in the estimation equation on sectoral level.

Table 2 **Foreign direct investments at the aggregate level and inequality**

Dependent variable: income inequality

	Model 3 Coefficient	SE	Model 2 Coefficient	SE
FDI	-0.019**	0.009**	0.013	0.024
FDI squared			0.000	0.000
Trade	0.007	0.004	0.006	0.004
Economic development	0.106	0.324	0.182	0.327
Human capital	-0.043**	0.017**	-0.046**	0.017**
Unemployment	0.058**	0.026**	0.070**	0.027**
Public spending	-0.046	0.031	-0.045	0.030
Constant	38.812***	2.776***	38.334***	2.786***
Observations	149		149	
R square	0.546		0.576	
Adjusted R square	0.494		0.523	
Durbin-Watson	2.25		2.25	
Countries	15		15	

Source: Prepared by the author. Note: All the estimations include country and time fixed effects, not shown in the table ***p ≤.0.01,**p ≤.0.05 *p ≤ 0.1. (two –tailed test)[1].

5.2 FDI and income inequality on the sectoral level

As described in the introduction, the effect of FDI is estimated from a sectoral perspective, identifying two major sectors: the manufacturing and services sector. The results are reported in Table 3 for the two main sectors of FDI, all measured as a percentage of GDP. This sectoral analysis is using a quadratic specification for FDI in order to take account of the possible existence of non-linear relationship between FDI and inequality. The explanatory variables of the model are jointly significant, as high values of F-statistics indicate.

The results reported in Table 3 show that FDI in both sectors have a different impact on inequality. The results for the manufacturing sector are significant in the short run (column 1). The estimate on income inequality is negative with a value of 0.143 at the 5% level, meaning that exposure to FDI leads to decreasing levels of income inequality. However, the squared variable is not significant, indicating that there is no sign of a non-linear relationship between FDI in the manufacturing sector and inequality. This is in line with earlier findings on advanced host countries. Figini and Görg (2011) found that income inequality decreases with inward FDI for developed countries and that there is no robust evidence for a non-linear relationship. In addition, this finding is consistent with the MNE model of Carr, Markusen and Maskus (2001). In their work, the authors argue that foreign affiliates focus on activities that are less skilled labour-intensive than the activities of parents' firms.

Based on these results, one could argue that the non-linear relationship does not hold in advanced host countries. This in contrast with the literature on developing countries as many scholars often support the non-linear hypothesis where FDI and inequality have an inverted U-shaped relationship (Aghion & Howitt, 1998; Figini & Görg, 2011; Kaulihowa & Adjasi, 2018). Moreover, these results suggest that if inward FDI brought new technologies into European countries, the induced technological change was not biased towards skilled labour. Arguably, this may suggest that European countries are at relatively high levels of technological development and already use mature technologies in this sector.

[1] Largely due to incompleteness of FDI statistics, the modelling is confined to the period 2003-212. Greece has been excluded for 2012 due to a lack of complete data.

The estimates of FDI in the services sector reveal that FDI has an insignificant impact on income inequality and therefore does not have the theoretically expected effects on income inequality. This result is unsatisfactory, as it does not confirm one of the hypotheses of this research. A possible explanation could lie in the panel as Blonigen and Wang (2004) and Bomschier (1981) suggest that the failure to find any effect of FDI on income inequality is caused by pooling both developed countries and developing countries in the sample. Therefore, pooling (high)developed and less-developed countries in one sample might generate misleading regression results because these countries have different FDI activities. Despite the fact that all the countries in the panel of this research are considered as developed countries and high-income economies, one could argue that there are critical differences, as high developed countries could react differently to an inflow of new technologies from FDI than developed countries, especially in the services sector as this is the largest sector of FDI (Arnal, & Hijzen, 2008; OECD database). In line with this explanation, Aghion and Howitt (1998) show in their model that wage dispersion first increases with the entry of new technologies and over time this decreases due to learning processes. This argument suggests that effects of FDI may differ, not only through time as long-run effects can differ from short-run effects, but also from country to country due to different learning processes. However, it must be noted that these insignificant results of FDI as reported in Table 3 are in line with earlier findings in the literature that studied developed countries in their cross-country analysis (Blonigen & Slaughter, 2001; Gopinath & Chen, 2003; Milanovic, 2005; Figini & Görg; 2011).

As for the coefficients of the control variables, the regression results, provided in Table 3, show that several coefficients are significant in the expected direction at the 5% level. They are similar in terms of the sign of the coefficients and statistical significance to those of the aggregate analysis, except for government expenditures and unemployment. The results of Table 3 show the human capital variable has a negative impact on income inequality. This finding is robust under the different specifications and has the theoretically expected effects on income inequality (Basu & Guariglia, 2007; Blomstrom & Kokko, 2003; Castelló & Doménech, 2002). This implies that this is a relevant factor for policy makers, especially when policies are targeted towards reducing poverty. In contrast with the first analysis, this sectoral analysis included employment effects to deal more explicitly with labour demand effects. The result on the overall level of unemployment suggest that unemployment patterns contribute towards an increase in income inequality. However, this estimate turns out to be statistically insignificant. As an alternative to the level of unemployment, the level of employment is added in the estimation to deal empirically with sector specific effects as suggested by Lee and Vivarelli (2006). The estimated coefficient of employment in the manufacturing sector is statistically significant under both estimations and shows that a 1% increase in the level of employment implies a decrease in the Gini index between 0.239 and 0.245. This finding is in line with the finding on the overall levels on unemployment in the first analysis of this paper (Table 2). In overall, these findings suggest that employment patterns are associated with levels of inequality as they may offset one another depending on the level of employment, in line with the earlier theoretical work (Aitken & Harrison, 1999; Berg & Taylor, 2000; Ram & Zhang, 2002). In other words, one could argue that employment patterns are exacerbated by FDI activities.

For all models, correlation matrices and Variance Inflation Factors (VIF) were also calculated to check for potential problems of collinearity, see appendix C. Based on Gujarati (2009), correlations of above 0.7 might cause a concern and VIF scores above 10 suggest multicollinearity issues. Based on these rules-of-thumb, employment in the services sector is left out of model 3 and 4 to avoid multicollinearity problems (Belsey, Kuh, & Welsch, 2004; Gujarati, 2009). This variable is high correlated (>0.8) with economic development, employment in the manufacturing sector and human capital. Furthermore, the variance inflation factor (VIF) score for employment in the services sector is the highest among all variables, 10.51, which suggest multicollinearity issues. Based on these statistical overruns, it is not possible to find out if employment effects are sector specific and drive the association between FDI in the services sector and inequality. Especially in this time sample, this could be the case as employment in the services sector as a proportion of total employment has increased because of technological incorporation in the manufacturing sector and because of notable movement from the agriculture sector into the services sector (World Bank Group, 2016). These developments caused the services sector to be the main source of employment in all the EU countries. In 2013, over 70% of the workers in the EU carried out their functions within the services sector (World Bank Group, 2016).

The results reported in Table 3 indicate that public spending has a negative effect on inequality and this is significant under both estimations. This finding is in line with the literature, as scholars found that higher public spending is associated with lower levels of inequality (Velde 2003; Atkinson & Brandolini, 2006; Afonso et al., 2010; Suanes, 2016). In the overall figures, the aggregate analysis showed a negative relationship between inward FDI and inequality, but after correcting for sectoral effects, significant evidence of a negative relationship between FDI and inequality has only been found in the manufacturing sector.

Table 3 **Foreign direct investments at the sectoral level and inequality**
Dependent variable: income inequality

	Model 3		Model 4	
	Coefficient	SE	Coefficient	SE
FDI in manufacturing	-0.143**	0.032**	-0.166**	0.062**
FDI in manufacturing squared			0.014	0.002
Employment in manufacturing	-0.245**	0.100**	-0.239**	0.104
FDI in services	0.031	0.022	-0.018	0.043
FDI in services squared			0.000	0.001
Trade	0.000	0.005	0.001	0.005
Economic development	-0.464	0.400	-0.436	0.409
Human capital	-0.042**	0.018**	- 0.044**	0.019**
Unemployment	0.039	0.029	0.036	0.030
Public spending	-0.093**	0.036**	-0.087**	0.037**
Constant	41.009***	4.721***	40.874**	4.804**
Observations	139		139	
R square	0.733		0.822	
Adjusted R square	0.696		0.794	
Durbin-Watson	1.896		1.896	
Countries	14		14	

Source: Prepared by the author. Note: All the estimations include country and time fixed effects, not shown in the table
***p ≤.0.01,**p ≤.0.05 *p ≤ 0.1. (two –tailed test)[2].

5.3 FDI and income inequality on the subsectoral level
As discussed in section 3, the theoretical arguments do not apply to the earlier estimates that are reported in Table 2 and 3. As explained, this could be caused by the panel of countries in this paper. However, these earlier results do not consider differences between low- and high-skilled workers or differences in technology intensity, which are both critical in regard to skill-bias. Specifically, the theoretical considerations of this research suggest that the relationship between FDI and inequality is linked to economies activities, respectively, sectoral-specific effects. This because many scholars found that skill-bias drives the relationship between FDI and inequality in high-skill sectors and therefore, effects could be stronger in knowledge intensive and technologically advanced sectors (Chennells and Van Reenen, 1999; Krugman, 2000; Feenstra & Hanson, 2001; Markusen & Venables, 1997; Velde & Morrissey, 2004; Cipollina et al., 2013; Bogliaccini & Egan, 2017). In line with this explanation, it must be noted that foreign investments tend to go to different industries within the economy depending upon their characteristics in relation to profit maximalization (e.g. cheap labour or level of technology) (Todaro & Smith, 2004). Therefore, this research splits the sample into two groups for each sector. For the manufacturing sector, this means that there is a breakup in low- and high-technology manufacturing activities. For the services sector, there is a breakup in non- knowledge intensive activities and knowledge intensive activities, in line with the literature and OECD classification schemes of economic activities.

While subsector data for the manufacturing sector was not common along countries in the analysis, it was possible to divide the manufacturing sector in terms of technology intensity. The reason for this is that the manufacturing is more polarized than the services sector. This combined with the theoretical considerations of this research lead us to expect a lower propensity for inegalitarian outcomes. Also, due to data limitations, it was not possible to test whether strictly low-skilled or high-skilled labour in the manufacturing sector might

[2] Similar to the first model there is incompleteness of FDI statistics, the modelling is confined to the period 2003-2012. Greece has been excluded for 2012, Portugal has been excluded for all years due to lack of data.

be linked with inequality. However, since the skill-biased argument is associated with technologically advanced sectors, the data could be divided on the bases of technology intensity. In order to do so, the subsectors are divided into low- and high-technology manufacturing sectors, which are consistent with the OECD Science, Technology and Industry Scoreboard that is similar to the Eurostat classification scheme (Eurostat, 2017b). The low-tech manufacturing industry corresponds to Food, beverage and tobacco; Textiles, clothing and leather; Wood and wood products; Publishing, printing and reproduction of recorded media. The second group of high-technology manufacturing corresponds to Chemicals and chemical products; Electrical and electronic equipment; Precision instruments; and Motor vehicles and other transport equipment. For this high-tech manufacturing sector, the group of Chemicals and chemical products is excluded in the sub-sectoral analysis because FDI data was not readily available. As mentioned earlier, data on employment at the subsectoral level of the manufacturing sector was not readily available and therefore not included in the model.

For the services sector it is expected that some service subsectors would perhaps be more strongly associated with inequality than others since the skill-biased argument is in favour of skilled workers. Based on this argument, the services sector is indicated by two categories: non- knowledge intensive and knowledge intensive services industries, which are consistent with the OECD classification schemes, in order to test whether low- or high-skilled labour within the services sector might be linked to inequality (OECD, 2017). The non-knowledge intensive service activities correspond to Transport, storage and communications; Finance; Business activities. The group of non-knowledge intensive services corresponds to; Trade; Hotels and restaurants. For these two groups, not all subsectors are included in the estimation due to data limitations and the size of subsectors. The full classification can be found in Table A.2 of Appendix A. In line with the classification schemes for the non-knowledge and knowledge intensive service sectors, employment data is constructed for each subsector calculated as a percentage of the overall employment as the indicator.

The results of the FEM analysis are reported in Table 4 and Table 5. Table 4 shows the estimates on subsectoral level which means that economic activities are merged into the categories, in line with the OECD classification schemes. Table 5 shows the analysis at the tripartite divisional of economic activities. Both regressions are estimated with the same variables, only this time without using the quadratic term as the literature does not indicate that there is a non-linear relationship between specific economic activities and FDI.

As shown in Table 4, evidence suggests that FDI into low-technology intensive manufacturing sector are associated with increases in inequality. This finding is significant and indicates that when FDI in low-technology manufacturing sector increases by 1%, income inequality increases by 0.193%. However, this evidence is not robust as only significant evidence for FDI in the Food, beverage and tobacco sector is found. As reported in Table 5, statistically significant evidence is found of a positive relationship which responds to an increase in inequality of 0.170 points per each unit increase of FDI in the Food, beverage and tobacco sector. This evidence suggests that not all types of workers necessarily benefit from FDI to the same extent. A possible justification for this is that FDI induces skill-specific technological change and provides more training to skilled than unskilled workers in this sector. This justification is in line with Alarcon and McKinley (1996), as the authors argue that wages raise significantly more for skilled workers than for unskilled in specific manufacturing sectors. However, since this research has no data on the educational level and real wages of workers, this clarification cannot be validated.

For Table 5, all other FDI activities are insignificant at the 5% level, therefore this relationship must be interpreted with caution as no hard conclusion can be drawn in relation to the skill-biased argument. For the high-technology manufacturing subsector, Table 4 suggests that FDI is negatively associated with inequality. However, this estimate turns out to be statistically insignificant. Therefore, there is no robust evidence of the skill-biased argument and its association with technologically advanced subsectors. In contrary to the findings of Velde and Morrison (2004), this paper argues that the countries in the sample of this research already have high levels of technological sophistication, implying that the high-skilled workers are not able to capitalize the wage premiums in the high-technology manufacturing sector (Feenstra & Hanson, 2001; Markusen & Venables, 1997). In fact, it is arguable that skill-bias technological change and associated wage premiums are only observable in developing countries due to processes of liberalization and differences in technological sophistication (Gottschalk & Smeeding, 1997; Harrison & Hanson, 1999; Agenor, 2003). More specifically, one could argue that structural changes brought in by MNEs with technological advantages have a different impact in developed countries as MNEs do not have driven out domestic firms, not to mention the privatizing and the restructuring public utilities in many developing countries. In other words, it seems that the skill-bias argument is not evident for countries within Europe as it has a relatively low polarized income structure in both manufacturing and services industries compared to developing countries.

As for FDI in the services subsectors, the estimates reported in Table 4 and 5 turn out to be statistically insignificant at the 5% level. This suggest that the theory of Kaiser (2000) where the skill-bias argument is related to high wage services sectors is not proved in this research.

In regard to the control variables, the findings are more or less similar to the earlier estimations. A similar positive significant relationship is found between the level of unemployment and inequality. The coefficient of unemployment seems rather robust throughout the models and estimates with a value of between 0.070 – 0.095. In relation to labour demand effects, the results reported in Table 4 show that employment patterns for both knowledge intensive services and non-knowledge intensive sectors are associated with decreases in inequality. However, only significant evidence is found for employment in the non-knowledge intensive services sector. More specifically, Table 5 shows that this effect on inequality is only significant for employment in the trade service sector, which is part of the non-knowledge intensive services subsector. This finding is significant and indicates that when employment in the trade services increases by 1%, income inequality decreases by 0.54%. It is noteworthy that statistical significant evidence has only been found for this sector, which is in line with Lee and Vivarelli (2006), as they argue that employments effects are sector specific. A possible explanation for this is given by Moore and Ranjan (2005), who argue that an increase in the employment rate of skilled workers increases their threat point in the bargaining process, which ensures a wage premium. The opposite happens for unskilled labour. However, this conclusion cannot be drawn based on the results presented in Table 5. A further interesting result lies in the human capital, as the impact of education is significant in both models with a coefficient that is negative between 0.064 and 0.066.

Overall, the data fits very well in all models as the adjusted R^2 fluctuates between 49% and 84%. The Durbin-Watson statistic for all models indicates no serial correlations in the error terms. As mentioned in the main sector analysis, a VIF analysis is carried out to deal with possible multicollinearity. Using the diagnostic procedure proposed by Neter et al. (1996), the diagnostic test (cook 's distance) identified possible influential outliers. Heteroscedasticity, multicollinearity (correlations), normal distribution and outliers' tests are all available in Appendix C.

Table 4 **Foreign direct investments at the subsectoral level and inequality**

	Model 5 Coefficient	SE
FDI in non-knowledge intensive services	-0.094*	0.053*
Employment in non-knowledge intensive services	-0.362**	0.137**
FDI in knowledge intensive services	-0.010	0.013
Employment in knowledge intensive services	-0.123	0.158**
FDI in low-technology manufacturing	0.193**	0.081**
FDI in high-technology manufacturing	-0.070	0.075
Trade	0.006	0.004
Economic development	-0,212	0.365
Human capital	-0.066***	0.019***
Unemployment	0.070**	0.028**
Public spending	-0.023	0.033
Constant	44.398***	4.422***
Observations	134	
R square	0.767	
Adjusted R square	0.720	
Durbin-Watson	2.329	
Countries	14	

Source: Prepared by the author. Note: All the estimations include country and time fixed effects, not shown in the table
***p ≤.0.01,**p ≤.0.05 *p ≤ 0.1. (two –tailed test)[3].

Table 5 **Foreign direct investments at the tripartite division of economic activities and inequality**

	Model 6 Coefficient	SE
FDI in trade	-0.260	0.057
Employment in trade	-0.540**	0.205**
FDI in hotels and restaurants	-0.277	0.283
Employment in hotels and restaurants	0.0186	0.427
FDI in Finance	0.005	0.023
Employment in Finance	-0.271	0.489
FDI in Business activities	-0.028	0.017
Employment in Business activities	0.131	0.176
FDI in Food, beverage and tobacco (manufacturing)	0.170**	0.079**
FDI in Textiles, clothing and leather (manufacturing	0.405	0.247
FDI in Electrical and electronic equipment and precision instruments (manufacturing)	-0.355*	0.178*
FDI in motor vehicles and other transport equipment (manufacturing)	-0.034	0.096
Trade	0.003	0.004
Economic development	-0.535	0.401
Human capital	-0.064***	0.018***
Unemployment	0.095**	0.029**
Public spending	-0.051	0.037
Constant	39.820***	4.103***
Observations	134	
R square	0.880	
Adjusted R square	0.847	
Durbin-Watson	2.195	
Countries	14	

Source: Prepared by the author. Note: All the estimations include country and time fixed effects, not shown in the table ***p ≤.0.01,**p ≤.0.05 *p ≤ 0.1. (two –tailed test)[3].

[3] The following data observations have been excluded from the sample: those with missing values and those which are outliers in the key variables.

VI
Conclusion

Income inequality has widened in both new and old EU member states over the past two decades. With increasing concerns over what happens when the gap between the rich and the poor further increases, this issue of global economic inequality has led researchers to explore the potential link between income inequality and FDI as it is one of the driving forces of globalization. While there is a large theoretical literature connecting these variables, the empirical literature on the relationship between FDI and inequality is not conclusive because most scholars treat FDI as uniform and therefore reliable empirical evidence on the distributional effects of FDI is largely lacking, especially for developed countries. This present study contributes to closing this gap. This research examined whether inward FDI has an effect on domestic income inequality by using a panel of 15 European countries over the period 2003-2012. Compared with previous studies, this paper makes a new contribution to the understanding of the impact of FDI on inequality in advanced host countries. By using a fixed effects regression, it examines inequality from three different perspectives: aggregate, sectoral and the subsectoral perspective. In line with the theoretical work of Aghion and Howitt (1998) and Feenstra and Hanson (1996), this study highlights one of the more important causal pathways between FDI and inequality, directly brought about by skill-bias. Using OECD stock data for FDI and ILO data for employment, this research found evidence that FDI is associated with a decrease in inequality in line with a number of studies in the literature (Gopinath & Chen, 2003; Figini & Görg, 2011; Chintrakarn et al., 2012; Im & McLaren, 2015).

The results suggest that certain inflows of FDI into European countries are associated with shifts in the income distribution, even after controlling for the two most common explanations of wage inequality: economic development and trade (Feenstra & Hanson, 1997; Harrison & Hanson, 1999). The results indicate that the short-run effects of FDI on inequality are significant and negative on aggregate level. However, this paper could not confirm an (inverted)- U relationship between FDI and income inequality. As noted earlier, this is the opposite of findings in several previous studies (Reuveny & Li, 2003; Choi, 2006; Lee, 2006; Herzer & Nunnenkamp, 2013). Nevertheless, the findings in this paper have reasonable grounds as most studies found evidence of a positive correlation between FDI and inequality on developing countries arguing that skill-biased technological changes together with trade liberalization drives the association between FDI and higher inequality. In contrast with this explanation, this research only deals with (highly) developed countries, which are considered as high-income economies. This difference in the country panel is a good justification against the argument of technological change in the shape of non-linear relationship. Against this background, this paper argues that European countries are already at relatively high levels of technological development and use mature technologies (IMF, 2017; World Bank Group, 2018). Therefore, the demand towards higher skilled labour diminishes with further increases in FDI, implying that foreign investments may ensure that technologies become easier to use and more frequently available. In other words, the skill-bias argument would not only apply to the high-skilled workers as more workers become able to benefit from wage premiums. However, since it was not possible to test directly for the channel of skilled-labour demand, this explanation must be interpreted with caution as no hard conclusion can be drawn in relation to the skill-bias argument.

Since this research is interested in sectoral differences and the role played by labour demand effects, the sectoral analysis showed that the relationship between FDI and inequality is only significant in the manufacturing sector. As shown in model 3, statistically significant evidence is found of a negative relationship which responds to a decrease in inequality of 0.143 points per each unit increase of FDI in the manufacturing sector. This finding is in line with the work of Breemersch et al. (2017). Simultaneously, statistical significant evidence is found of a negative relationship between employment patterns in the manufacturing sector and inequality. This analysis also showed that the government seems to play an important role in reducing income inequalities as the estimated coefficients on government spending in these estimations are significant.

In order to investigate this complex link further and to look for the skill-bias argument, this research explicitly studied knowledge intensive and technologically advanced sectors as these sectors are directly linked to the skill-bias argument according to different scholars (Chennells and Van Reenen, 1999; Krugman, 2000; Feenstra & Hanson, 2001; Markusen & Venables, 1997; Bogliaccini & Egan, 2017). Again, when the effect of FDI by subsector is analysed, the quantitative effects of FDI turn out to be relatively small and only significant for FDI in the low- technology manufacturing subsector. On a smaller scale, the analysis at tripartite division of economic activities

showed that all FDI activities are insignificant at the 5% level except for FDI in Food, beverage and tobacco sector (low-technology manufacturing sector), implying that FDI into this specific sector causes an increase in inequality (0.170). The largest effects on income inequality come from employment patterns. While certain subsectoral effects of FDI are associated with more equitable income distribution within countries, the relationship between FDI and inequality seems to depend most directly on labour demand effects. In fact, all models found robust evidence of a negative relationship between human capital and income inequality. This is in line with the literature, as labour or human capital, i.e. the distribution of education and the returns to skill, is an important factor of production that drives the level of income inequality (Blomstrom & Kokko, 2003; Basu & Guariglia, 2007; Figini & Görg; 2011). At the same time, it is one of the most effective instruments for reducing income inequality (Tilak, 2002; Psacharopoulos & Patrinos; 2004; Mundy & Verger, 2015). This finding is similar to employment, as there is a remarkable consistency in the finding that employment patterns plays an important role in the levels of income inequality, controlling for size and sector. This paper argues that employment patterns which are exacerbated by FDI have strong distributional effects that vary by sector and country. In other words, this study shows that a sectoral approach for FDI matters because FDI and employment patterns in different sectors have different impacts depending on whether FDI is carried out in the services- and manufacturing sector. Although only significant statistical evidence is found of a positive relationship between inequality and FDI in the low-technology manufacturing sector, and more specifically in the Food, beverage and tobacco sector, the skill-biased argument is still a good explanation for inegalitarian outcomes. This because wage premiums for skilled workers which are related to technological advantages of MNEs coupled with the sectoral distribution of employment that are associated with foreign investments make the relationship between FDI and inequality more understandable.

The results of this research invite the conclusion that policymakers do not have to fear that access to foreign knowledge and technology is found at the cost of deepening the economic and social inequality where multinational firms locate. Notwithstanding, trade-offs associated with FDI cannot be ignored under any condition as the question remains unanswered what exactly explains the varying levels of inequality across European countries. In this light, this paper opens the door for further research as there are a number of ways to further develop these conclusions.

First at the empirical level, this study is limited by the availability of FDI and employment data on the tripartite division of economic activities. Although, this research was able to collect sub- sectoral data for 14 European countries, the sample is still quite small compared to all countries of Europe, apart from the concern that is tied to the heterogeneity of the sample. Secondly, and not surprisingly, the literature would be improved with firm level data; for example, wage and employment data for MNEs would show how sectors and different workers are impacted by FDI and in turn, how these impacts explain patterns of income inequality. Furthermore, firm level data would have been better for examinations of the issue of technological spillovers and the skill-bias argument in relation to skilled- and unskilled labour. Unfortunately, firm-specific wage and employment data was not readily available.

At theoretical level, a first issue relates to the lack of literature concerning the FDI as a channel for transferring technology, especially in advanced host countries, since it is not clear how this globalisation factor affects inequality. Second, a possibility to be pursued in future research relates to the Kuznets hypothesis as future research could put more effort in the aspect of technological adaption or learning efforts at domestic firms. Regarding these two issues, it must be clear that there is evidence that MNEs can raise human capital of host countries this due to sponsoring of universities and other educational institutions, by sponsoring education of employees or by training and qualifications (Fosfuri, Motta, & Rønde, 2001; Alfaro, & Rodríguez-Clare, 2004). In other words, FDI promotes skill development and most likely this process occurs more often in countries where appropriate skills are relatively well available. For future research, this means that the relationship between FDI and inequality must be studied by integrating more geographical considerations. This because FDI tend to go to destinations where the costs of training workers to use new technologies are minimized. Therefore, regional factors instead of country factors might be important for the understanding of the effect of FDI on income inequality, as this might help to understand the mechanisms and channels related to skilled-labour demand (Dutta & Osei-Yeboah, 2013).

Findings in this paper leave several issues for future research and should thus be treated as a relevant factor by public policymakers, especially when the policies concerned are redistributive in character. While FDI may have been good for development, more can be done to improve its impact on the income distribution in Europe, either through appropriate government policies in the area of education, training and infrastructure. Strictly, policymakers need to keep in mind that a country structure of income depends on several factors such as institutions, public policies, education, domestic and foreign preferences and, perhaps most important, the nature of its technology. Countries should still consider investing in more education, but on the other hand, governments should not expect to solve problems in the income distribution by attracting high quality FDI (high-technology or high-end sectors). This may not be beneficial if the high quality FDI does not match with the skill profiles of their working populations.

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Appendix A

Table A.1 List of countries in main models

Austria	France	the Netherlands
Czech Republic	Germany	Norway
Denmark	Greece	Poland
Estonia	Hungary	Portugal
Finland	Italy	Slovakia

Table A.2 Subsectors classification based on the OECD Science, Technology and Industry Scoreboard

Subsectors services sector
Knowledge intensive services corresponds to Transport, storage and communications; Finance; Business activities; Education; and Health and social services.
Non-knowledge intensive services corresponds to Electricity, gas and water supply; Construction; Trade; Hotels and restaurants; Public administration and defence; and Community, social and personal service activities

Subsectors manufacturing industry
Low-tech manufactures corresponds to Food, beverage and tobacco; Textiles, clothing and leather; Wood and wood products; Publishing, printing and reproduction of recorded media; and other manufacturing.
High-tech manufactures corresponds to Chemicals and chemical products; Electrical and electronic equipment; Precision instruments; and Motor vehicles and other transport equipment

Appendix B

Table B.1 **Descriptive statistics**

	N	Minimum	Maximum	Mean	Std. Dev.
Standard Gini SWIDD	150	23.0	35.5	28.76	3.39
FDI aggregate[4]	149	5.73	107.65	39.00	18.68
FDI in manufacturing	139	.93	39.69	9.72	7.33
FDI in services	140	4.42	66.29	25.47	13.80
Employment manufacturing	140	9.18	28.56	18.12	5.11
Employment services	139	53.08	82.20	67.15	7.55
Openness of trade	150	9.75	159.92	88.77	33.25
Human Capital	149	90.47	131.74	104.79	9.32
Unemployment	150	2.50	19.62	8.11	3.58
Public Spending	150	33.57	57.95	46.89	5.29
GDP per capita	150	1.23	6.54	3.13	1.08
FDI in low-technology manufacturing	137	0.33	12.42	2,46	2.49
FDI in high-technology manufacturing	134	0.01	8.50	1.48	1.64
FDI in non-knowledge intensive services	134	0.42	13.76	4.62	2.47
FDI in knowledge intensive services	137	1.85	53.26	16.89	11.15
Employment in non-knowledge intensive services	139	14.78	26.56	17.59	2.54
Employment in knowledge intensive services	139	7.17	20.18	12.00	3.09
FDI in trade	138	0.42	13.56	4.23	2.43
FDI in hotels and restaurants	134	0.00	3.28	0.34	0.65
FDI in Finance	138	0.92	32.44	7.43	5.77
FDI in Business activities	137	0.00	34.07	9.45	8.60
FDI in Food, beverage and tobacco	137	0.12	12.04	1.67	2.28
FDI in Textiles, clothing and leather	138	0.06	3.36	0.79	0.67
FDI in Electrical and electronic equipment and precision instruments	134	-0.02	3.59	0.55	0.69
FDI in motor vehicles and other transport equipment	136	-1.30	4.98	0.93	1.14
Employment in trade	139	11.51	19.88	13.93	1.69
Employment in hotels and restaurants	139	1.65	6.68	3.66	1.15
Employment in Finance	139	0.97	3.24	2.22	0.52
Employment in Business activities	139	5.29	17.53	9.79	2.79

Note: Values represent data prior to interpolation.

[4] All variables of FDI are measured as stock as a percentage of GDP

Table B.2 **Data sources and description**

Variables	Description	Data sources
Standardized Gini	Gini net represents estimates on income Gini index of inequality in equalised household disposable income	SWIDD database
Foreign direct investment	Inward FDI stock ratio to GDP	OECD database
Openness of trade	The sum of total imports and exports as a share of GDP	OECD database
Economic development	Annual real GDP per capita (in thousands)	OECD database
Human capital	Gross number secondary education rate	UNESCO database
Unemployment	Overall level of unemployment	OECD database
Employment	Level of employment as a percentage of total employment	ILO and OECD database
Public spending	Central government expenditure as a share of GDP	OECD database

Table B.3 **Expected sign of the coefficients of the variables in the models**

Variable	Expected sign	Observed sign
FDI	+-	-**
FDI in manufacturing	+-	-**
FDI in services sector	+-	+
FDI in subsectors	Sector specific	Sector specific
Trade	+-	+
Economic development	+-	-
Human capital	-+	-**
Unemployment	+	+**
Employment	Sector specific	Sector specific*
Public spending	-	-**

Note if significant * ***p ≤.0.01,**p ≤.0.05 *p ≤ 0.1

Appendix C

Influence statistics for models 1 through 6

Figure C.1 **Influence statistics for model 1 and 2**

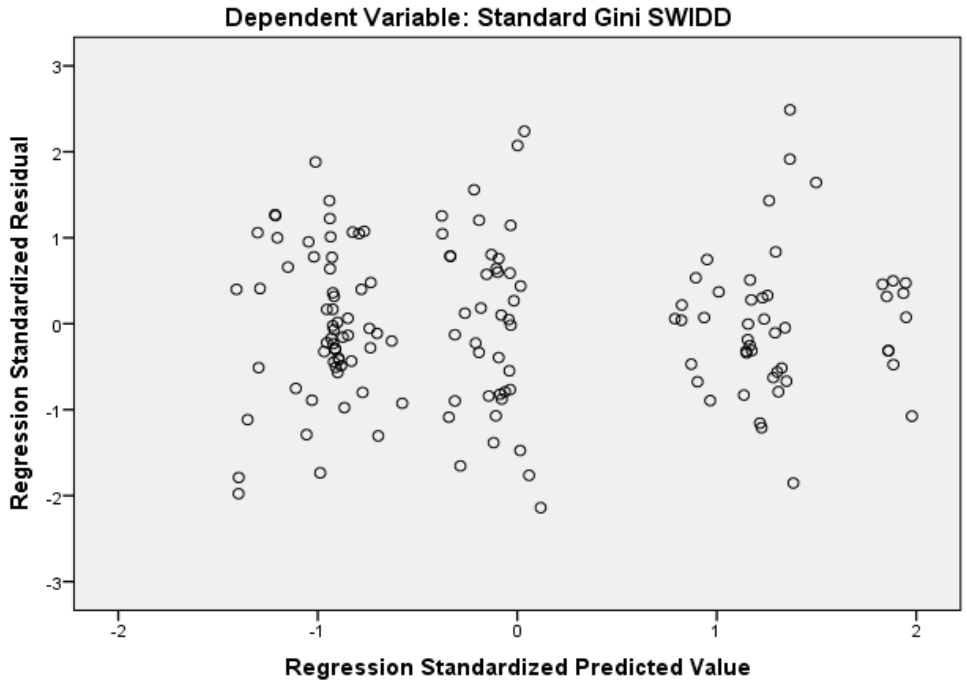

Figure C.2 Influence statistics for model 3 and 4

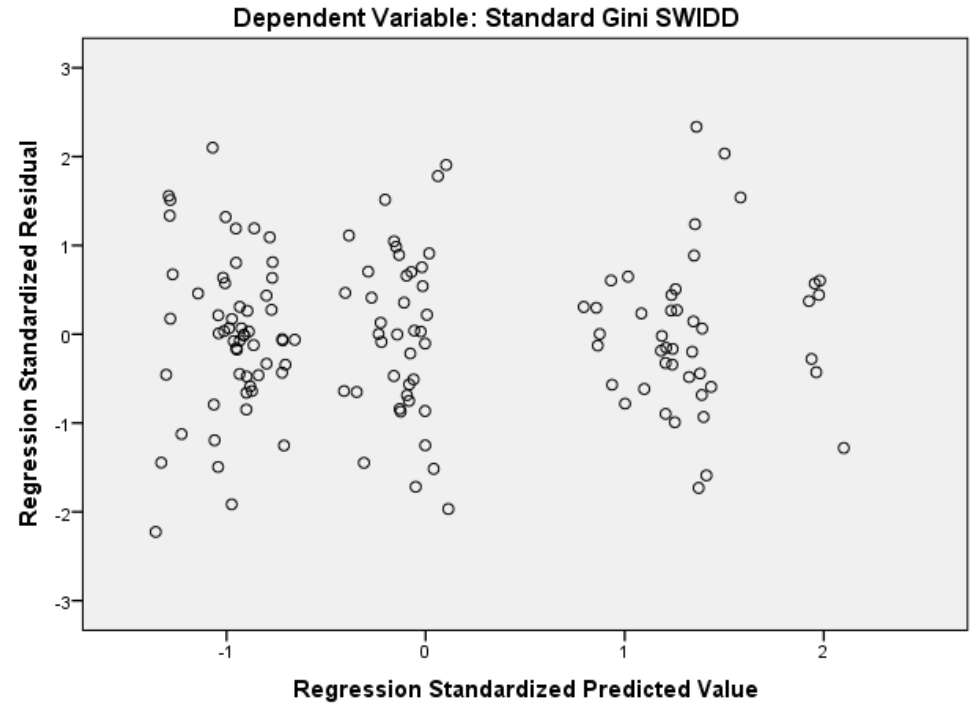

Figure C.3 **Influence statistics for model 5**

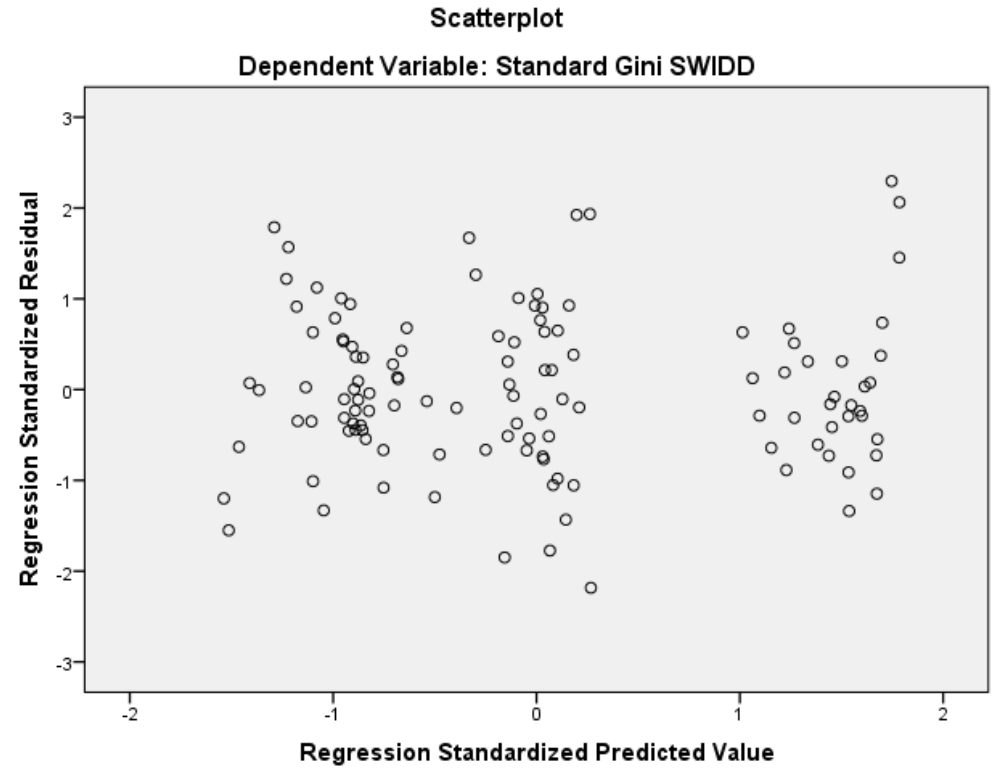

Figure C.4 **Influence statistics for model 6**

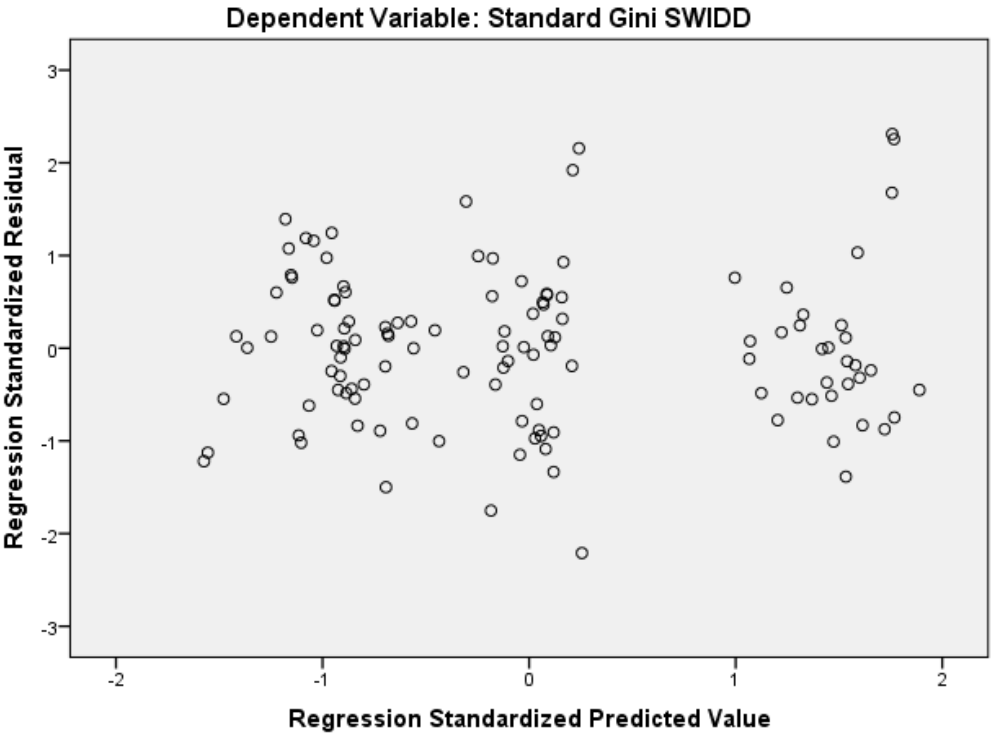

Table C.1 Multicollinearity test and cooks distance (influential outliers)

VIF test and Cooks distance

Model	VIF mean	Cook's distance minimum	Cook's distance maximum	Cook's distance mean
Model 1	2.517	0	1.223	0.18
Model 2	2.368	0	1.223	0.18
Model 3	3.284	0	0.1299	0.20
Model 4	2.692	0	0.1299	0.20
Model 5	2.980	0	0.212	0.17
Model 6	4.432	0	0.615	0.21

Table C.2 **Correlation matrix aggregate analysis**

		Standard Gini	FDI	Trade	Human capital	Unemployment	Public spending	Economic development
Standard Gini	Pearson Correlation	1	-,491**	-,668**	-,371**	,370**	-,119	-,454**
	Sig. (2-tailed)		,000	,000	,000	,000	,148	,000
	N	149	149	149	146	149	149	149
FDI	Pearson Correlation	-,491**	1	,685**	,648**	-,499**	,002	,421**
	Sig. (2-tailed)	,000		,000	,000	,000	,981	,000
	N	149	149	149	146	149	149	149
Trade	Pearson Correlation	-,668**	,685**	1	,394**	-,447**	-,170*	,355**
	Sig. (2-tailed)	,000	,000		,000	,000	,038	,000
	N	149	149	149	146	149	149	149
Human capital.	Pearson Correlation	-,371**	,648**	,394**	1	-,427**	,342**	,591**
	Sig. (2-tailed)	,000	,000	,000		,000	,000	,000
	N	146	146	146	146	146	146	146
Unemployment	Pearson Correlation	,370**	-,499**	-,447**	-,427**	1	-,124	-,645**

	Sig. (2-tailed)	,000	,000	,000	,000		,133	,000
	N	149	149	149	146	149	149	149
Public spending	Pearson Correlation	-,119	,002	-,170*	,342**	-,124	1	,288**
	Sig. (2-tailed)	,148	,981	,038	,000	,133		,000
	N	149	149	149	146	149	149	149
Economic development	Pearson Correlation	-,454**	,421**	,355**	,591**	-,645**	,288**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	
	N	149	149	149	146	149	149	149

*No problematic collinearity/correlations were found for the aggregate analysis

Table C.3 **Correlation matrix sectoral analysis**

Correlations											
		Standard Gini	FDI manufacturing	FDI in services	Trade	Human capital	Unemployment	Public spending	Economic development	Employment manufacturing	Employment services
Standard Gini SWIDD	Pearson Correlation	1	-,415**	-,421**	-,668**	-,371**	,370**	-,119	-,454**	,049	-,356**
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,148	,000	,570	,000
	N	149	138	136	149	146	149	149	149	139	139
FDI in manufacturing	Pearson Correlation	-,415**	1	,385**	,536**	,400**	-,290**	-,188*	,167	-,189*	,304**
	Sig. (2-tailed)	,000		,000	,000	,000	,001	,027	,050	,026	,000
	N	138	138	136	138	135	138	138	138	138	138
FDI in services	Pearson Correlation	-,421**	,385**	1	,635**	,616**	-,464**	,206*	,368**	-,328**	,554**
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,016	,000	,000	,000
	N	136	136	136	136	133	136	136	136	136	136
Trade	Pearson Correlation	-,668**	,536**	,635**	1	,394**	-,447**	-,170*	,355**	-,123	,368**
	Sig. (2-tailed)	,000	,000	,000		,000	,000	,038	,000	,148	,000
	N	149	138	136	149	146	149	149	149	139	139
Human capital	Pearson Correlation	-,371**	,400**	,616**	,394**	1	-,427**	,342**	,591**	-,714**	,843**
	Sig. (2-tailed)	,000	,000	,000	,000		,000	,000	,000	,000	,000
	N	146	135	133	146	146	146	146	146	136	136
Unemployment	Pearson Correlation	,370**	-,290**	-,464**	-,447**	-,427**	1	-,124	-,645**	,384**	-,574**
	Sig. (2-tailed)	,000	,001	,000	,000	,000		,133	,000	,000	,000
	N	149	138	136	149	146	149	149	149	139	139

Public spending	Pearson Correlation	-,119	-,188*	,206*	-,170*	,342**	-,124	1	,288**	-,432**	,458**
	Sig. (2-tailed)	,148	,027	,016	,038	,000	,133		,000	,000	,000
	N	149	138	136	149	146	149	149	149	139	139
Economic development	Pearson Correlation	-,454**	,167	,368**	,355**	,591**	-,645**	,288**	1	-,685**	,826**
	Sig. (2-tailed)	,000	,050	,000	,000	,000	,000	,000		,000	,000
	N	149	138	136	149	146	149	149	149	139	139
Employment manufacturing	Pearson Correlation	,049	-,189*	-,328**	-,123	-,714**	,384**	-,432**	-,685**	1	-,825**
	Sig. (2-tailed)	,570	,026	,000	,148	,000	,000	,000	,000		,000
	N	139	138	136	139	136	139	139	139	139	139
Employment services	Pearson Correlation	-,356**	,304**	,554**	,368**	,843**	-,574**	,458**	,826**	-,825**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	,000	,000	
	N	139	138	136	139	136	139	139	139	139	139

*No problematic collinearity/correlations were found except for employment in the services sector as reported in section 5.2. Correlation matrices for the subsectoral and individual sectoral analyses are not reported for ease of visual interpretation. For these analyses no problematic collinearity/correlations were found.