Nijmegen School of Management

Master's Thesis:

The Impact of FDI and Innovation Activities on Income Inequality in Emerging Countries.

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Abstract

Motivated by ongoing debate among economists and policymakers about potential benefits and drawbacks of FDI, this paper is set out to explore the relationship between FDI, innovations and income inequality in the specific sample of emerging countries. In particular, for estimating the income inequality, this research focuses on wage inequality between high-skilled and low-skilled workers. Based on theoretical foundation of previous academic studies, several hypotheses are developed. Thus, there is expectation that FDI increases wage inequality between high-skilled and low skilled workers in the sample of host emerging countries. In addition, there is a hypothesis that through innovations FDI has indirect effect on wage inequality. Empirically, these two hypotheses are tested using a panel data analysis for a 10-year dateset consisting of 21 emerging countries for the 2006-2016 period. The findings present mixed results. Thus, employing static fixed effect model, findings verify that FDI increases significantly wage inequality. However, using dynamic panel model, there is no evidence that FDI has any effect on wage inequality. Furthermore, there is no evidence found that innovations have mediating impact on the relationship between two main variables, hence the second hypothesis is rejected.

Contents

List of abbreviations

ECB	European Central Bank
EPO	European Patent Office
EMBI Global	Emerging Market Bond Index Global
EU	European Union
FDI	Foreign Direct Investments
FEM	Fixed Effects Model
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GIMI	Global Investable Market Indexes
GINI	GINI is measure of statistical dispersion designed to represent income or wealth distribution of a nation's residents
GMM	Generalized Methods of Moments
GNI	Gross National Income
ILOSTAT	International Labour Organization Statistics database
IMF	International Monetary Fund
MNEs	Multinational Entreprises
MSCI	Morgan Stanley Capital International
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
RAM	Random Effects Model
R&D	Research and development
SDG	Sustainable Development Goals
UIS	UNESCO Institute for Statistics
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
VIF	Variance Inflation Factors

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Introduction

The global economy has undergone crucial changes in the last couple of decades. In the international market arena, the importance of multinational enterprises (MNEs) associated with Foreign Direct Investments (FDI) has significantly risen (OECD, 2008). Developing and emerging economies began benefiting from international experience, openness of trade, international network of production and foreign investments. Over nearly twenty years, FDI is considered as a key element of a country's economic integration, as a significant source of income growth, modernization and as a part of entire globalization process (OECD, 2002; OECD, 2008; World Bank, 2018).

Most empirical studies present the evidence that FDI has potential to bring various benefits to the recipient countries. In particular, FDI contributes to economic growth and productivity in developing and emerging economies (De Mello, 1999; Borensztein et al., 1998; Li & Liu, 2005; Herzer et al. 2008; De Vita & Kyaw, 2009). However, many economists and policymakers address concerns about potential drawbacks of FDI, particular its effects on poverty, income inequality, unemployment and, in general, achievement of Sustainable Development Goals (SDGs)[1]. For instance, the director of Global Justice Now, Nick Dearden, has stated that "the vast wealth and power of corporations is at the heart of global problems including inequality and climate change"[2]. Obviously, FDI, which is provided by corporations, may be seen as both "boon" and "bane" for the economies.

Furthermore, Figini & Görg (2006) point out that many researchers have focused on positive efficiency outcomes of FDI and "what is generally neglected is the issue of equality". In existing literature, there are scholars who suggest that growth of FDI leads to increase the income inequality in developing and emerging countries due to paying a premium for skilled labour (Feenstra & Hanson,1997; Chen et al., 2011; Lee & Wie, 2015). While others argue that there is no significant association between FDI and changes in income inequality (Blonigen & Slaughter, 2001; Sylwester, 2005; Milanovic, 2003; Chintrakarn et al., 2010).

[1] The 17 SDGs were adopted by world leaders at a United Nations summit in September 2015 and are listed in https://www.un.org/sustainabledevelopment/development-agenda/.

[2] The weekly International Health Policies (IHP) newsletter provides the highlights of the week: World Health Summit, "Corporate power needs to be reined in" (October, 2018) page 18 http://www.internationalhealthpolicies.org/wp-content/uploads/2018/10/IHPn493.pdf

In addition, a majority of researches consider FDI as a key driver for productivity and technological growth (Kokko & Blomstrom, 1996; Wu, 2000; Kinoshita, 2000; Wang & Xie, 2016) in emerging countries. Hence, innovation activities, such as technology transfer, are considered to be crucial with respect to the gains in infrastructure and industrial growth. Nevertheless, present literature pays little attention to the effect of innovations on income inequality.

This research is motivated by ongoing debate among economists and policymakers about the effects of FDI on income inequality. In addition, this paper attempts to provide an extensive analysis of the relation between FDI and income inequality taking into account a growing number of innovation activities and their impact on income inequality. The goal is to explore controversial findings of the previous empirical studies and to try to contribute to the existing literature by evaluating the effect of FDI on income inequality in the context of emerging economies. The choice of the economies is explained below.

Compared to existing studies, less attention was given to examine empirically the role of FDI and income inequality in emerging host countries. In recent academic studies the evidence is found for a number of developed countries (Mihaylova, 2015; Lee 2006; Herzer & Nunnenkamp, 2013), developing countries (Tsai, 1995; Dollar & Kraay, 2001; Velde & Morrissey, 2004; Basu & Guariglia, 2007) and for sample of OECD countries (Figini & Gorg, 2006; Atkinson, 2009; Tridico, 2017). Note, that many countries can not be seen as developed because of lower level of productivity of their economy (Global Competitiveness Report, 2015). Overall, the destination of MNEs investments includes many foreign countries with various economies (advanced economies, emerging market and developing economies[3]). However, over past few decades there is steadily decline of foreign direct investments to advanced economies. The decline has started after major financial crisis in 2008 (ECB Economic Bulletin, 2018). Recently, the statistics showed that FDI flows to advanced economies fell by one fourth compared to 2016 (UNCTAD, 2018b). However, the different situation is illustrated with FDI flows to emerging economies. According to ECB Economic Bulletin (2018), "after the financial crisis, the importance of EMEs as a destination for FDI has gradually increased. In 2013, for the first time, EMEs attracted more than 50% of inward FDI". Hence, the choice of the emerging economies stems from the fact that currently these economies are the major host countries of FDI flows. As a result, the relationship between FDI and income inequality is

[3] Statistical Appendix of IMF World Economic Outlook (2016) presents the classification of countries and economies.

investigated based on the sample of 24 emerging economies (More extensive elaboration of emerging economies is provided in the Appendix A).

Therefore, for current study following research questions have been developed: how does FDI affect income inequality in emerging economies? What do innovations supported by MNEs mean for the relationship between FDI and income inequality emerging economies?

To answer the above research questions, this paper starts by examining previous literature on the topic of FDI and income inequality, going into a more detailed explanation of the role innovation activities generated by FDI. This research follows theoretical frameworks by the trade perspective by Feenstra & Hanson (1996) model and innovative perspective by Aghion & Howitt (1998) and Aghion & Commander (1999) model. In addition, the spillovers effects of FDI are considered. These models are used as theoretical support for deriving two hypotheses and conducting empirical analysis.

In detail, the trade theory states that foreign-owned firms have impact on wage inequality and distribution of income as they demand different types of labour and pay higher wages than local firms. The North South endowment model (Feenstra & Hanson, 1996) shows that in host countries foreign firms employ labour that is relatively skilled by local standards. Hence, with the first hypothesis it is expected that FDI increases wage inequality in the sample of host emerging countries.

Considering the spillover effects of FDI, it can be stated that advanced technology are transferred to domestic firms in form of spillovers (Haddad & Harrison, 1993; Blomström & Kokko; 1998; Taylor & Driffield, 2005).This implied mechanism may be seen as indirect effect which influences wage inequality within the domestic economy. Hence, by the second hypothesis it is expected that through innovation activities FDI has indirect effect on wage inequality in the sample of host emerging countries.

Empirically, these two hypotheses are tested using a panel data analysis for a 10-year dateset consisting of 21 emerging countries for the 2006-2016 period. However, the techniques of hypotheses estimation are significantly different. Thus, for the first hypothesis static fixed effect and dynamic models are employed. For testing the second hypothesis, the mediation analysis is used. In order to present more accurate model of the relationship between main variables, several controls are added to the analysis. In line with the previous studies, chosen control variables are human capital, trade openness, unemployment rate and population growth. Finally, robustness checks are performed in order to verify the results.

Estimation results from the panel estimation specification present the evidence for the conducted hypothesis on the relationship between FDI and income inequality. The results from fixed effect model support first hypothesis. However, the dynamic panel data specification model has not found any effect of FDI, but it verifies that the income inequality has a significant component that influences the current level of inequality. In addition, the results from the mediation analysis presents that innovations have no indirect effect on the relationship between FDI and income inequality. Finally, the robustness checks are implemented for ensuring the relevant results and for controlling eventual pitfalls.

The remainder of this research is as follows. The next section, Chapter 1, presents a review of prior studies and simultaneously introduces the concept of FDI and income inequality. Afterwards, in Chapter 2, the key theoretical frameworks are evaluated with further developing a number of research questions. Then, in Chapter 3, testable hypothesis, methodology approach and empirical research method are discussed which will be applied further in the paper. Chapter 4 presents the empirical results of the estimations and robustness checks are performed. Finally, conclusion identifies some limitations and discusses possibility of further implications.

Chapter 1. Literature Review

The first chapter introduces a concept of FDI with its current world trend and an overview of the previous academic literature on the effects of FDI on income inequality. Furthermore, the main contributions from recent empirical studies will be highlighted. A number of academic studies have investigated the relationship between FDI and income inequality, however, there is no consensus between authors.

1.1. Nature and extent of FDI

In the contemporary economic world, foreign direct investment (FDI) is a key element in the globalization and international economic integration. To begin with, it is crucial to introduce the concept of FDI provided by Benchmark Definition presented by OECD (2008):

"FDI promotes stable and long-lasting economic links between countries through direct access for direct investors in home economies to production units (businesses/enterprises) of the host economies (i.e. the countries in which they are resident). The lasting interest is evidenced when the direct investor owns at least 10% of the voting power of the direct investment enterprise. Direct investment may also allow the direct investor to gain access to the host economy which it might otherwise be unable to do."[4]

Furthermore, FDI is driven by multinational enterprises (MNEs) and there are considerable factors, which allow enterprises to diversify their participation in the competitive markets abroad: liberalization of trade and market deregulation, technological innovations and less communication costs (OECD, 2008). In addition, various motives lead to promotion of FDI overseas. One of the famous economists, John Dunning, (Dunning, 1993; Dunning and Lundan, 2008) categorizes FDI motives by four main groups: market seeking, resource seeking, strategic asset or knowledge seeking and efficiency seeking[5]. Market seeking MNEs invest abroad to supply goods or services to new foreign markets. Resource seeking MNEs wish to gain access to particular resources, natural or unskilled/semiskilled labor, that do not exist, or exist but at higher costs, in their home country. Strategic asset market seeking MNEs consider to augment existing or to obtain new firm's advantages for long-term competitiveness. Efficiency market

[4] This general definition of FDI is based on OECD, Detailed Benchmark Definition of Foreign Direct Investment, 4th edition (OECD, 2008), in line with the International Monetary Fund (IMF and Balance of Payments and International Investment Position Manual, 6th edition (BPM6).

[5] The "classic" taxonomy of FDI motives is the four-way classification advanced by John Dunning (Dunning, 1993 and Dunning and Lundan, 2008).

seeking MNEs design FDI for promoting a more efficient organization of the firms' value added activated including access to resources and its serving of foreign markets.

Turning to some data, the development of FDI across recent years can be presented. The global trend (Figure 1) shows the decline of FDI flows in the world from 2005 to 2017, measured in billions of US dollars. In 2017, world foreign direct investment (FDI) flows decreased by 23 per cent to US$1.43 trillion from $1.87 trillion in 2016 (UNCTAD, 2018b).

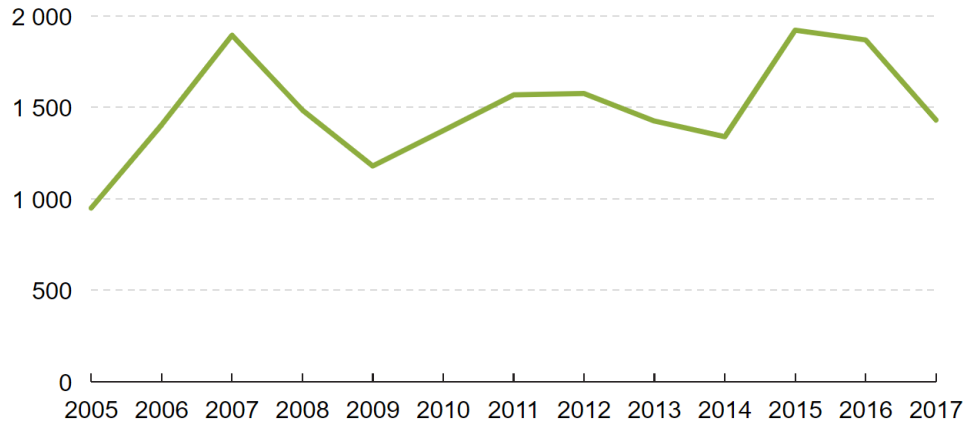


Figure 1. Global trend. World FDI flows (Source: UNCTAD, 2018b)

However, studying the distribution of FDI among various economies[6], the main declining trend is not obvious. For making a better overview, it is necessary to identify various trends for each group of economies. Thus, Figure 2 (below) presents the distribution of inward FDI flows by different economies from 1970 till 2016. According to the report (ECB Economic Bulletin, 2018), the left hand scale is share of advanced and emerging markets in world inward FDI, in percentages. The right hand scale is the total inward FDI, in billions of US dollars. The solid line shows how inward FDI flows are changing over time.

[6] The classification of economies is presented in the appendix (Appendix A).

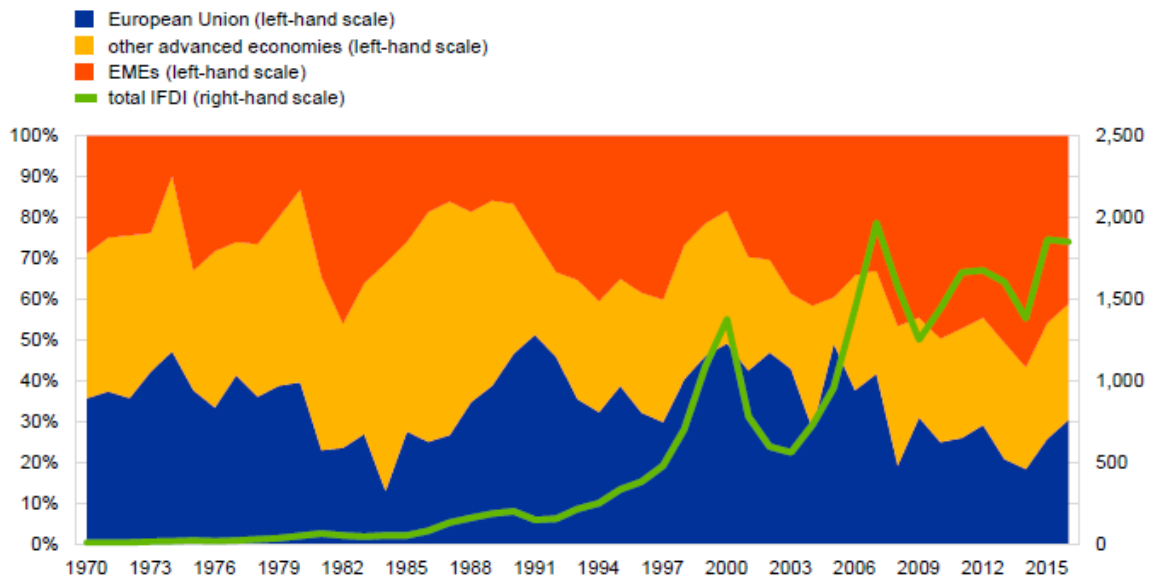


Figure 2. Inward FDI flows by destination (Source: ECB Economic Bulletin, 2018)

From the graph above (Figure 2), it can be seen that, originally, advanced economies and EU have played a major role for FDI flows and attracted between 60% and 70% of total inward FDI flows. However, after 2008 the FDI landscape has undergone significant changes. Emerging economies entered the global competition on the economic market arena. Inward FDI flow to EU and advanced economies has declined while FDI flows to emerging economies has grown. According to ECB Economic Bulletin (2018), in 2013 emerging economies attracted more than 50% of FDI inward flows. Hence, the trends of inward FDI flows vary by the type of economies.

Additional evidence for the described trend of FDI could be found in the book "Multinational corporations and local firms in emerging economies" published by Rugraff & Hansen in 2011. The authors highlighted one of the most remarkable aspects of FDI: FDI is robustly growing in emerging economies. According to Rugraff and Hansen (2011), the trend started in early 1990s and reached 30-40% of all FDI flows in the mid-2000s. The authors point out that, despite the reduction of absolute amount of FDI during the financial crisis, FDI has continued to increase relative to total FDI in emerging economies driven by various motives by MNEs.

Furthermore, the feature of FDI steadily growth is supported by the World Investment Report 2018: despite the overall decline of FDI presented in figure 1, emerging economies have upswing of FDI inflows. The World Investment Report (UNCTAD, 2018b) states: "FDI recovery remains bumpy, with diverging trends among regions". Thus, emerging and

developing economies are forecasted to recovery significantly in 2017, supported by growth in China and by a sharp economic expansion in natural-resources.

According to the WIR report 2018, developing and emerging economies accounted for 6 of the top 10 host economies. The most attractive emerging host economies for MNEs are China, India, Indonesia, Thailand, Brazil, Mexico, Philippines, Vietnam, Singapore (UNCTAD, 2018b). In addition, FDI inflow to emerging economies presents a growth of 81 per cent to $68 billion, changing the trend of last two years. This increase is related to foreign investments associated with the privatization of state-owned assets in the Russian Federation and mining exploration activities in Kazakhstan (UNCTAD, 2018b).

1.2. FDI and income inequality

Being introduced to the foreign economy by MNEs, FDI has enough force to influence economic growth of the host countries (De Mello, 1999; Borensztein et al., 1998; Li & Liu, 2005). Consequently, in the recent literature, FDI has been seen as a central element in the global economy (Herzer et al. 2008; De Vita & Kyaw, 2009). However, effects of FDI are not always positive (Figini & Görg, 2006). Therefore, the estimation of the relationship between FDI and income inequality should receive more attention as findings are not obvious.

Thus, in a cross-country framework Choi (2006) finds evidence, using a panel of 119 countries in the 1993-2003 period that an increase in FDI leads to a rise in income inequality. Similar findings are presented by the work of Basu & Guariglia (2007). The authors use a panel of 119 developing economies for the 1970-1999 period and report that FDI steadily increase income inequality. In addition, Feenstra & Hanson (1997) argue that global outsourcing considerably rise the demand for skilled workers both in developed and developing economies. Authors imply the investigation of this hypothesis on Mexico and find out that inward FDI leads to widening the wage gap between skilled and unskilled employees.

Several empirical studies present the evidence that FDI capital flow is associated with raised inequality due to paying skill premium in developing countries. Thus, Gopinath & Chen (2003) have made a cross-country research for 15 advanced economies and 11 developing countries and present the evidence that inward FDI flow rises the wage gap between skilled and unskilled workers in developing countries.

Despite a number of researches which highlight that FDI lead to increase income inequality, there are scholars who present different empirical results. Thus, Sylwester (2005) provides investigation on relationship between FDI and income inequality in less developed countries

between 1970 and 1989. The author has not found any significant association between FDI and changes in income inequality (Sylwester, 2005). Similar outcome is provided by Blonigen & Slaughter (2001). Authors were not able to identify any significant effects of FDI on income inequality within US manufacturing industries in 1977-1994. In addition, the research by Jensen & Rosas (2007) illustrates that rise of inward FDI leads to a decrease in income inequality in Mexico from 1990 till 2000.

Furthermore, a considerable research is made by Chintrakarn et al. (2010), in which the authors explore the relation between inward FDI stocks and income inequality by panel cointegration techniques in the United States for the period 1977-2001. As a result, Chintrakarn et al. (2010) conclude that in the short run the impact of FDI on income inequality is insignificant. While in the long run FDI reduces income inequality in the US. However, the authors point out significant heterogeneity across US states that can influence the results in several states. In addition, there is another research that presents the results using panel cointegration techniques. Thus, Herzer & Nunnenkamp (2013) study the sample of European countries and present that in the long term the relationship between FDI and income inequality is negative, i.e. the income distribution becomes less unequal, while in the short term the relation is positive. Furthermore, the authors identified the long run causality and suggest that a rise in FDI reduces inequality in the long run and that a reduction in inequality refers to increase of FDI (Herzer & Nunnenkamp, 2013).

From the academic studies, it can be summarized that the impact of FDI on income inequality exists in all types of economies. However, inward FDI has remarkable role to developing and emerging economies: significant issues such as poverty, unsustainable consumption, unemployment and economic inequality prevail in mentioned economies (United Nations SDG Report, 2018). The key objectives for economists worldwide is to generate tools for meeting SDGs and to integrate them into national development plans. One of the universally-agreed tools is sufficient foreign investment which will help to increase the overall living condition and to lead to economic growth in developing and emerging countries. However, from the literature overview, it could be seen that there has not been yet a consensus regarding the impact of FDI on income inequality. Furthermore, number of studies investigate the impact of FDI on wage inequality focusing on individual emerging countries without sample of several countries, for example, Latin America (Velde, 2003; Herzer et al. 2008; Macarena & Oriol, 2015), China (Chen et al., 2011), Indonesia (Lee & Sjöholm, 2004), Mexico (Feenstra & Hanson, 1997).

1.3. FDI and innovations

Many authors consider FDI as not only a channel of capital flow which influences national income but also as a channel of innovative activities transfer to the host economies. Once, American economist, Joseph Stiglitz, states: ”The argument for foreign direct investment is compelling. Such investment brings with it not only resources, but technology, access to markets and (hopefully) valuable training, an improvement in human capital” (Stiglitz 2000, p. 1076).

Overall, the literature presents several major channels of innovation diffusion: via FDI, international trade and international patents rights (Keller, 2001). FDI seems to be one of the most crucial modalities due to the capabilities of FDI to transfer technology incorporated with intangible assets such as human capital, which could not be transferred through other avenues (Kinoshita, 2000). Hence, innovations are generated by the R&D activities and technology spillovers from foreign direct investments (FDI). Innovation activities are highly significant for developing countries that cannot finance technological development. Thus, FDI are highly effective channel for innovation activities diffusion, which in its turn has an impact on productivity growth, rise of income and entire economic growth (Keller, 2010).

Furthermore, the majority of economists identify North-South product cycle through foreign direct investments with innovation transfer across international borders (Helpman, 1993; Gass & Saggi, 1995; Feenstra & Hanson, 1997). Multinational enterprises (MNEs) have increasingly been outsourcing the basic stages of production to low wage countries due to cost differential and efficiency gains in the production chain (Roording & de Vaal, 2010). Rodrigues-Clare (1996) suggests that MNEs with their investments bring the benefits not only to the subsidiaries but also for the host country’s economy. In particular, the author argues that FDI transferring innovations might engage more activities that generate impact for local economy. In addition, in their research, Roording & de Vaal (2010) mention that apart from direct impact on employment and income, FDI may generate crucial spillover effects such as technological or knowledge effects.

1.4. Innovation activities and income inequality

In the modern world innovations play a significant role in economic growth, particularly for developing countries. A number of research papers (Sachs & McArthur, 2002; Solow, 1957; Aghion & Jaravel, 2015) identify technological change (innovations) as a key driver of long term economic growth. There is less amount of studies which examine the impact of innovations on income inequality. Majority of economists suggest that innovations lead to the

productivity effect which boost workers' wages. Moreover, advanced technologies require high skilled employees and thus increased wages (Breau et al., 2014). Thus, Benos & Tsiachtsiras (2018) demonstrate that innovations boost income inequality. However, the effect is less significant when there are defensive patents from European Patent Office (EPO) matching with their investors.

However, there are scholars who argue that innovations refer to income inequality reduction. Aghion et al (2018) argue that knowledge spillovers from innovations might have positive impact for individuals with less high skills. These workers are able to learn from their high skilled colleagues, increase their productivity and, as a result, have raised wages (Lee, 2011). In addition, Antonelli & Gehringer (2017) argue that technological change can decrease income inequality. According to authors, technological change helps increase total factor productivity and labor productivity. As a result, the income of all individuals in the economy will increase. Furthermore, Risso & Carrera (2018) use the Gini index for measuring income inequality, R&D as a percentage of GDP as a measure of innovation. Their findings tell that the level of R&D should be high enough to reduce income inequality. In any other case R&D will increase income inequality.

From the overview of previous literature by three parts, namely *FDI and income inequality, FDI and innovations, innovation activities and income inequality,* the conclusion can be made that innovation activities generated by FDI not only have significant role in overall economic development but also have certain influence on income inequality. For further examination of relationship between FDI, innovations activities and income inequality, the next chapter will present theoretical foundation for developing hypotheses.

Chapter 2. Theoretical Background

The second chapter presents a theoretical foundation and testable hypotheses for the current research. It is crucial to outline theoretical models since they are a grounding base for hypotheses, data selection and entire empirical approach for the next section.

A considerable impact was made by Slaughter (1999), who provided an overview of recent methodologies regarding the causes of rising wage inequality. Thus, the author points out two theoretical approaches as the most significant ones in analyzing income inequality: "trade" and "labour" perspectives. Moreover, Slaughter (1999) emphasizes that shift in labor can be driven by skill upgrading and technological change. Furthermore, Taylor and Driffield (2005) consider both trade and technological advance as the main causes for increase in relative demand for higher skilled labour. In addition, Driffield (2010) noted that existing empirical literature explains the impact of FDI by undergoing "trade versus technology" debate.

Thus, in line with the Slaughter (1999), Taylor & Driffield (2005) and Driffield (2010)'s conclusions, this research will introduce two different accesses. The first perspective is the trade approach, which focuses on the direct effects of FDI and trade on income inequality. The second perspective is innovation avenue, which focuses on the impact that skill upgrating and technological change have on income inequality. This is Slaughter's "labour" perspective, which is named, however, differently since this research is interested in the impact of innovation activities on income inequality.

2.1. The trade perspective by Feenstra & Hanson (1996) model

Several existing studies (Gottschalk & Smeeding, 1997; Slaugher, 1999) argue that such factors as international competition, opening of trade, foreign capital flows play a crucial role in the economic system and drive labour demand and thus, have certain impact on FDI and income inequality.

Considering trade and investments in the world economy, Feenstra & Hanson (1996) developed a North – South flow capital model correspond to outsourcing activities by Northern firms. The main underlying assumption is that there is no international factor mobility. The authors argue that Northern countries have primarily high skilled activities while the Southern specializes in inputs that are relatively intensive in low skilled labour. Due to this assumption, Northern enterprises outsource relatively low skilled intensive activities to the South. However, while from North's perspective, the inputs for the production require unskilled labour, from South's perspective, the activities, outsourced from the North, require skilled labour. As a result, the

demand for high skilled employees in Southern countries raises. Feenstra & Hanson (1996) pointed out that the demand for skilled workers also rises in North countries since, after outsourcing to the South, the activities are left in North which require high skilled workers. However, in the context of this research, the demand of relatively high skilled employees in the South should be noted as this demand may cause the income inequality in host countries.
Furthermore, Feenstra & Hanson made significant contribution by another research published in 2001. In their new work, the authors consider the liberalization of trade as important factor which influence the wage gap. In particular, "production sharing" or "outsourcing" play crucial role on labor demand. The authors argue that trade in intermediate inputs has more significant impact on wages that the trade in final consumers goods. In addition, Feenstra & Hanson (2001) emphasizes that skilled –biased technological changes due to innovations should be considered as important issue for increasing the wage gap.

2. 2. The innovation perspective by Aghion & Howitt (1998) and Aghion & Commander (1999) model

The theoretical framework by Feenstra & Hanson (1996), which was presented above, introduces how FDI flows may increase inequality in income distribution. However, Figini & Görg (1999) looked at the impact of FDI from another angle. The authors argue that MNEs not only outsource their production due to relatively unskilled and cheap labour abroad, but also foreign enterprises introduce advanced technologies and innovations in the host countries. The role of these innovation activities is significant and should be carefully considered in the relationship between FDI and income inequality. The authors, Figini & Görg (1999), support their arguments based on the model provided by Aghion & Howitt in 1998.

By publishing their book "Endogenous Growth Theory", Aghion and Howitt (1998) made significant contribution to the economic world. The authors developed endogenous growth theory, which challenges the neoclassical approach by suggesting new channels through which technological progress, namely General Purpose Technology (GPT), can influence income inequality (Aghion & Howitt, 1998). One year later, in 1999, Aghion & Commander introduced a framework by which they investigate the impact of social learning on economic growth, in particular the effects of social learning among employees, aggregate output and wages in the economy.

The model provided by Aghion & Commander (1999) is based on the production function and can be represented by mathematical expression as following:

$$Y = \left\{\int_0^1 A_i^a * x_i^a * di\right\}^{1/a}, 0 \leq a \leq 1;$$

where Y illustrates aggregate output that is produced by intermediate inputs $x(i)$ and technology parameter $A(i)$. In detail, $x(i)$ is manufacturing labour used to produce intermediate goods in sector i. The integral represents many different varieties of intermediates inputs i.e. infinite amount (between 0 and 1). In addition, the level of the output depends on the production technology, represented by parameter A(i). If $A(i) = 1$, the old technology is still used in the production, while new technology is adopted, if $A(i) > 1$. Hence, depending on the technology, the combination of intermediate inputs leads to more or less aggregate output i.e. there is a technology parameter to each of the intermediate inputs. Generally, all intermediates inputs with technology form constant elasticity of substitution production. This implies, that any change in the inputs results in the constant change in the aggregate output.

Furthermore, Aghion & Commander (1999) describe two different stages of technological development and inequality. With the first stage authors consider the slow process of switching from old to new technology in the company: firms are still producing their output using the old technology but at the same time firms are investing in the development. The authors assume that the new technology requires skilled workers, however, local firms need some time for updating the skills of employees as they are unfamiliar with it. The amount of investments in innovations is too small, the demand for high skilled labor is low, skilled and unskilled workers are paid the same amount of wage. Hence, the wage inequality is low. In second stage, firms are considered which are successfully able to implement new technologies and produce output. This requires high skilled labor and thus a rise in wages. As a result, the inequality is increasing. However, when technology is implemented by all the domestic firms, the demand for unskilled labour has not anymore existed thus, inequality decreases. Thus, inequality follows a specific trend, namely U-shape pattern, with upward trend in the short run which turns downward in the long run (wage inequality first increases but at a decreasing rate after the introduction of new technologies due to a learning process).

In their research, Figini & Görg (1999) employed described model and stated “that through FDI, MNEs introduce a higher level of technology in the host country which leads to an increase in the demand for skilled labor and thus, a change in the wage inequality between skilled and

unskilled labor". In addition, the evidence for inverted U-shape relationship between wage inequality and FDI was presented by conducted econometric study for Ireland (Figini & Görg, 1999).

Several further studies (Figini & Görg, 2006; Franco & Gerussi, 2013) follow the Aghion & Howitt (1998) theory and take up Aghion & Commander (1999) model examining the effect of FDI on income inequality in their empirical researches. Thus, Franco & Gerussi (2013) consider FDI and trade as crucial determinants for income inequality in transition countries (TCs). However, FDI do not seem to have significant impact on income inequality in TCs when considered as single variable. Moreover, Figini & Görg (2006) argue that with FDI flow into economy local firms follow up by imitating the more advanced technology and innovations used by MNEs. Thus, the inequality gap can be reduced.

The innovative perspective model may be relevant for the current research if we, following Figini & Görg (2006) assumption, consider that new technology is introduced to the host economy by outsourcing. In particular, if by two-stages process we view FDI as a vehicle for new innovative technologies supplied by MNEs, then, next to the positive impact on total firms' productivity, the gap between skilled and unskilled employees may increase due to the fact that specific skilled required to absorb imported technologies (Franco & Gerussi, 2013).

2. 3. Effects of FDI

For further evaluation of FDI impact, it is crucial to present theory regarding FDI effects which was elaborated in the previous academic literature. A number of studies state that presence of FDI in host economy has several impacts and can be characterized as direct and indirect (spillover) effects of FDI (Colen, Maertens, & Swinnen, 2008; Hanousek et al., 2011). According to previous research, the direct effect refers to economic performance of firm entered by the foreign investors, usually measured by "Total Factor Productivity" (Hanousek et al., 2011). Thus, several studies (Aitken & Harrison, 1999; Borensztein; De Gregorio & Lee 1998; Blomström & Sjöholm 1999) present the evidence that indeed, through the direct effect, FDI increases enterprise productivity in developing countries. In addition, (Damijan et al,2003) offer evidence that FDI, as a source of productivity growth, is important for firms in transition economies.

The indirect effects are externalities (i.e. spillovers) to companies and industries in the host country. In accordance with conducted empirical findings, spillover effects are interpreted as a transfer of knowledge and technology from a foreign subsidiary to domestic firms (Hanousek

et al., 2011). In addition, technology spillovers can occur between firms that are integrated with the MNE on the inter-industry level (vertical spillovers) or in direct competition with MNE on the intra-industry level (horizontal spillovers) (Damijan et al, 2003; Hanousek et al., 2011). In their research, Blomström & Kokko (1998) as well as Haddad & Harrison (1993) put special attention to the technology transfer, as spillover effect of FDI. The authors provided at least four channels for technology transfer through FDI to local firms, through which spillovers may boost productivity in the host country: imitation, skills acquisition, competition, foreign linkage (Blomström & Kokko cited by Hanousek et al., 2011; Colen, Maertens, & Swinnen, 2008). The overview of intra-industry spillovers is made by Görg & Greenaway (2004) and presented in the table below (table1).

Table 1. Potential Channels for Spillover from Foreign Direct Investment

Driver	*Sources of productivity gain*
Imitation	Adoption of new production methods. Adoption of new management practices.
Skills acquisition	Increased productivity of complementary labor. Tacit knowledge.
Competition	Reduction in X-inefficiency. Faster adoption of new technology.
Exports	Scale economies. Exposure to technology frontier.

Table 1. Potential channels for spillover from FDI (Source: Gorg & Greenaway, 2004, p.173)

Categorizing the first channel, it should be mentioned that imitation is a classic transmission mechanism for new products and processes. Local firms usually adopt new manufacturing methods and management experience from foreign subsidiaries of MNE (Görg & Greenaway, 2004). According to authors, incoming firm will produce in competition with local companies. As a result, may increase the speed of adoption of innovation and lead to a reduction in inefficiency in analogous (Görg & Greenaway, 2004).

Particular in this paper, the skill acquisition is the most interesting channel as it refers to labor turnover and as might have impact on income inequality. Categorizing skills acquisition, the technological transfer can take place through employees of MNEs subsidiary who are trained by affiliates of MNEs. These workers contribute to higher productivity when they move to the domestic firms with their knowledge and new technical skills. For preventing the knowledge outflow, foreign subsidiaries attempt to pay more to retain workers, namely skill premium, and also to attract skilled workers from domestic firms (te Velde 2003). Görg & Greenaway (2004) names such impact as a spillover effect on wages from MNEs and thus, from FDI. The authors

argue that the presence of MNEs refers to higher levels of technology than domestic firms and, hence, pay higher wages in the same sector.

In their research, Taylor & Driffield (2005) assume two effects from FDI. The direct effect is related to Feenstra & Hanson (1996) and that foreign firms entering the industry will pay above the average for skilled workers. Furthermore, the authors assume an indirect effect, caused by the increase in technological capabilities associated with foreign inward investments. Taylor & Driffield (2005) state that advanced technology are transferred to domestic firms in form of spillovers. The authors consider this linkage as indirect effect which has certain impact on wage inequality in the host country.

In addition, Tomohara & Yokota (2011) suggest that FDI may cause direct and indirect effects of wage inequality by two distinct channels. When foreign owned companies use advanced technologies and innovations, the demand for skilled labor increases. Thus, FDI causes wage inequality through skill-biased technological. Through this channel, the authors assume that FDI has direct effect. Furthermore, FDI may have such externalities as technology spillover effects on local companies. Thus, FDI could change the structure of the local labor market. This impact is seen by authors as indirect effect.

Furthermore, several studies name other channels through which the income inequality may be changed. Thus, Jensen & Rosas (2007) consider two channels through which FDI might affect income inequality. Firstly, by bringing new capital to the foreign country, MNEs reduce the total return on capital and raise the returns to labour. Thus, foreign capital competes with domestic capital for local employees, driving up wages and decreasing the productivity of local firms. This effect would speed up convergence of the incomes of labor relative to capital, decreasing income inequality. Secondly, MNEs pay higher wages in order to keep trained workers and avoid spillovers. Higher wages by foreign subsidiaries may lead to rise the income gap between skilled and unskilled employees.

2.4. Hypotheses

From the literature review, it can be summarized that FDI have significant effects on income inequality. However, there are mixed results regarding the link between FDI and income inequality. As a result, this research attempts to investigate further the relationship between FDI and income inequality and find the evidence if FDI either increase or decrease income

inequality. Hence, this paper aims to answer the question: how does FDI effect income inequality in emerging economies.

However, assessing the extent of income inequality and its large structural changes is made particularly complex due to the lack of precise definitions and concepts used in different studies. Thus, many authors employ different statistical measures for estimation of income inequality. For example, previous studies have primarily evaluated inequality by income distribution, i.e. dispersion. The distribution was measured by the Gini coefficient (Figini & Gorg, 2006), the Coefficient of Variation (Lessman, 2013), the Theil index (Dreher & Gaston, 2008; Yay et al., 2016), the share of labour compensation in GNP (Gopinath & Chen, 2003).

Before deriving the hypotheses and implicating the terminology this study attempts to make the distinction between two terms: income inequality and wage inequality To begin with, it is crucial to introduce the broad term of inequality provided in Appendix B by OECD (2011). Furthermore, authors (Sbardella et al., 2017) conclude that wages constitute a major component of total income. In addition, wages reflect the skill levels of workers, which in their turn are directly related to industrial development such as innovations and technological change.

As a result, with regards to inequality, this research will focus on wages for estimation of income inequality. In detail, the wage inequality contains difference of wages between high-skilled and low-skilled workers (Lipsey & Sjoholm, 2004; te Velde & Morrissey, 2010; Chen et al, 2011). After the elaboration of specific terminology, several hypotheses can derived in line with the theoretical framework.

Trade perspective

In their research, Te Velde & Morrissey (2010) consider the demand for skills as major factor for wage inequality between skilled and low skilled employees. In addition, trade theory states that foreign-owned firms have impact on wage inequality and distribution of income as they demand different types of labour and pay higher wages than local firms. The North South endowment model, established by Feenstra & Hanson (1996) shows that in host countries foreign firms employ labour that is relatively skilled by local standards. Hence,

Hypothesis 1: FDI is expected to increase wage inequality between skilled and unskilled workers in the sample of host emerging countries.

Indirect effect of FDI

Furthermore, previous academic studies show the linkage between FDI and innovation activities in the host countries. Majority of researches indicate that FDI generates innovation diffusion.

The second theoretical model developed by Aghion and Howitt (1999), namely innovation perspective, illustrates the impact that skill upgrating and technological change have on income inequality. The theoretical framework shows that introduction of new technologies leads to growing demand for skilled labour. Hence, there is a certain effect on wage inequality.

Therefore, the next research question related to FDI, income inequality and innovation activities: What do innovations mean for the relationship between FDI and income inequality in emerging economies?

While receiving FDI, the host country will not automatically obtain the tools and strategies from the foreign subsidiaries (Aghion & Howitt, 1998; Figini & Görg, 2006). From previous theory sections, where effects of FDI are presented, it can be concluded that FDI in the host economy has a direct effect on firms' efficiency and has potential to create spillover effects to the local firms and entire host economy (Damijan et al,2003).

Following the theoretical assumptions provided by Taylor & Driffield (2005), this paper assumes two effects of FDI on inequality. The direct effect is related to Feestra & Hanson (1996) model, which refers to a rise in skilled labour demand and, thus, wage inequality (hypothesis 1&2). Furthermore, this studies anticipate the indirect effect, caused by an increase in innovation activities and technological capabilities associated with FDI. From the theory of previous studies, it can be stated that the only way local firms to gain from presence of FDI, is by spillovers effects of FDI, namely technology transfers (Haddad & Harrison, 1993; Blomström & Kokko; 1998). The benefits for the domestic firms can be generated through FDI spillover effects in the form of imitation, skills acquisition, competition, foreign linkage (Blomström & Kokko; 1998). Through these channels the productivity of local firms increases (Barrios & Strobl, 2002). At the same time, the boost of productivity may also lead to rise of wages in the local firms. As foreign companies usually pay higher wages and skill premium (te Velde 2003), and as there is a competition for the same labour force, domestic firms may offer higher wages in order to attract employees and to have skilled labour along with foreign enterprises. As a result, the wages for skilled labour may be increased by foreign enterprises as well as local firms.

Previous studies have identified the spillover effects of FDI (Damijan et al, 2003; Hanousek et al., 2011). In addition, previous studies (Haddad & Harrison, 1993; Blomström & Kokko; 1998; Taylor & Driffield, 2005) state that advanced technology are transferred to domestic firms in form of spillovers. This implied mechanism may be seen as indirect effect which influences wage inequality within the domestic economy and leads to following hypothesis:

Hypothesis 2: Through innovation activities FDI has indirect effect on wage inequality among skilled and unskilled workers in the sample of host emerging countries.

For simplified representation of theoretical relationship, figure 3 shows the hypotheses in schematic terms. Current research attempts to explain the change of income inequality by indirect impact of FDI. Hence, the model of the research consider not only direct causal effect of FDI on income inequality but also the indirect (non-observable) effect on income inequality through mediator variable, named innovation activities.

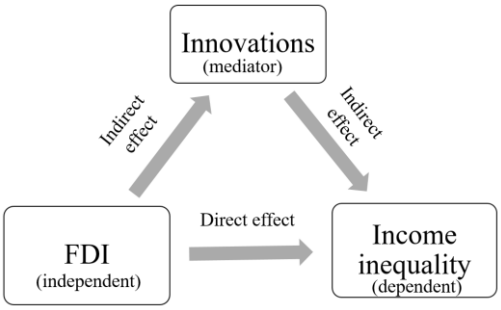


Figure 3. Mediation model (Author's compilation)

The novelty in the investigation of the relationship between FDI and income inequality is an introduction of third hypothetical variable, innovation activities, which have a certain effect on the dependent variable. The mediation model above suggests that the independent variable, FDI, influences innovation activities, which in turn has certain impact on the dependent variable, income inequality. Thus, innovation activities can be named mediator variable (MacKinnon, 2008), which is able to clarify the nature of relationship between FDI and income inequality.

Chapter 3. Data and Econometric Methods

This chapter will provide an operationalization part of the research, specifically, data collection and empirical strategy based on the key elements from the theoretical frameworks discussed in previous chapter. The aim is to present empirical model and discuss significant econometric issues before empirically estimating the potential relationship between FDI and income inequality.

3.1. Data and variable description

Previous studies have not investigated the relationship between FDI and income inequality in emerging countries. "Emerging economies" occupy the middle position between developed and developing countries with respect to technological capabilities and possibility of rapid growth. Since there is no general agreement concerning term "emerging economies" (Appendix A), this paper will follow the MSCI's list of emerging markets. According to MSCI's "Annual Market Classification Review 2018", there are 24 emerging markets (Appendix A).

In addition, the academic researches of the relationship between FDI and wage inequality fall into two broad types: macro i.e. national level and micro i.e. firm level (te Velde & Morrissey, 2002). In line with the availability of data, this research will explore the relationship between indicators at the national level.

Therefore, this research works with an balanced panel of 21 emerging countries over the period 2006-2016. The countries included in the sample are Brazil, Chile, China (Hong Kong), Colombia, Czech Republic, Egypt, Greece, Hungary, Indonesia, Korea, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, South Africa, Thailand, Turkey, and United Arab Emirates.

Since this study investigates the macro level relationship between FDI and wage inequality at using the econometric estimation, the major variables are described below.

Wage inequality

As it was mentioned (2.4), that there are various ways to assess income inequality. Thus, several studies (Choi, 2006; Figini & Görg, 2006; Franco & Gerussi, 2013) have measured wage inequality as Gini coefficient which presents the information on the entire income distribution of households in economies. However, the primary intention of this study is to model the effects of FDI on inequality applying more direct and precise approach than commonly used correlation between Gini coefficient and determinants of FDI.

Therefore, this paper seeks to measure income inequality as wage inequality, taking into account the difference of wages between high-skilled and low-skilled workers (Lipsey & Sjoholm, 2004; te Velde & Morrissey, 2010; Chen et al, 2011). Many economists (Girma &Gorg, 2007; Lipsey & Sjoholmm, 2004; te Velde & Morrissey, 2010) have tried to match the occupation with skills, in accordance with the World Trade Report (2008): "the measurement of skills is sometimes based on occupational classification data". Unfortunately, the available data distinguishing employees based on their occupation is limited (WTO, 2008). Despite the difficulties in obtaining good quality time series data on wages by skill level (Freeman & H. Oostendorp, 2000; te Velde & Morrissey, 2010), this paper is trying to overcome this issue by gathering information on employment by occupation and wages by occupation in line with te Velde & Morrissey (2010) approach.

For collecting available data on employment and wages by occupation, this paper uses International Labour Organization Statistics database (ILOSTAT)[7] as a main source. Firstly, it is crucial to derive the information from employment by occupation, namely "employment by sex and occupation" and to divide occupations into high skilled and low-skilled workers. According to the database, employment by occupation consists of following major groups:

1. Managers (ISCO-08)
2. Professionals (ISCO-08)
3. Technicians and associate professionals (ISCO-08)
4. Clerical support workers (ISCO-08)
5. Skilled agricultural, forestry and fishery workers (ISCO-08)
6. Service and sales workers (ISCO-08)
7. Craft and related trades workers (ISCO-08)
8. Plant and machine operators, and assemblers (ISCO-08)
9. Elementary occupations (ISCO-08)

In addition, the employment by occupation is presented in thousands of people (ILOSTAT, 2018). This study uses the available information for the sample of emerging countries.

[7] The world's leading source of labour statistics https://www.ilo.org/global/statistics-and-databases/lang--en/index.htm

For the purpose of current investigation, we divided occupations into skilled (major groups: 1, 2, 3, 4, 5) and low-skilled workers (other major groups: 6, 7, 8, 9) following te Velde & Morrissey (2010)'s approach. Then the annual sum of skilled workers and the annual sum of unskilled workers are calculated for each country.

Secondly, information on wages by occupation, namely "mean nominal monthly earnings of employees by sex and occupation—harmonized series" is derived. The mean monthly wage of employees is provided in US dollars. In line with te Velde & Morrissey (2010) approach, this research divides occupation into skilled and unskilled workers in a way that matches the split skilled and unskilled for employment data. Then, the mean wages of skilled employees is calculated on the basis of total skilled employment. In details, the amount of people employed in certain skilled occupation category (thousands) is multiplied by the mean wages for skilled employees for the same occupation category. Then, the sum of skilled wages by occupation categories is divided by total skilled employment. For illustration, the formula is provided:

$$Wage\ skilled = \frac{\sum_{n=5}(Empl_n * Wage_n)}{Total\ Unskilled\ Empl}$$

Respectively, the mean wages of unskilled employees is calculated on the basis of total unskilled employment.

As a result, the proxy of inequality through measuring a wage gap can be created. In particular, following Figini & Gorg (1998) by formula:

$Wage\ Inq_{it} = \left[\frac{w_b}{w_w}\right]_{it}$, where w_b measures the wage of blue-collar (unskilled) and w_w measures the wage of white-collar (skilled) workers.

Foreign direct investment (FDI)

In the econometric estimation this paper is mainly concerned to explore the impact of inward FDI on wage inequality. Usually FDI is measured in two ways: as a (net) flow or as a stock. Both are widely used in the previous academic studies. However, in current research the assumption is taken into account which was presented by Figini & Görg (2006) "FDI contributes to the stock of general-purpose technology available in the economy". In addition, FDI stocks are able to capture long term effects more effectively than annual FDI flow. Hence, as a proxy, FDI inward stocks as a percentage of GDP will be used in this study (in line with Te Velde & Morrissey, 2002).

FDI variable is taken from a comprehensive database for international investment data, the United Nations Conference on Trade and Development (UNCTAD, 2018)[8].

Innovation activities

Following the UIS Education Data Release (2018), the most updated database for innovation activities is the UNESCO Institute for Statistics (UIS)[9]. The measurement of innovation activities is derived from UIS dataset as gross domestic expenditure on R&D (GERD) as a percentage of GDP.

Other variables

In accordance to previous academic studies, there are other factors that can influence the relationship between FDI and wage inequality. Thus, the model of this paper includes a set of control variables, which might have additional effect on either FDI or income inequality and, thus, make the estimation biased.

Based on the previous academic studies there is a suggestion to include following variables in the equation as control ones: openness to trade, human capital, size of economies and unemployment rate.

Considering openness to trade, Suanes (2016) emphasizes the importance of control for the trade indicator (the sum of total import and export as share of GDP) as there is controversial findings of impact of FDI and trade on income inequality. With respect to the theoretical link by Feenstra & Hanson (1996), international outsourcing shift a portion of production and intermediate goods, hence, the trade between countries grows and certain labour demand effect wage inequality. As a result, it is crucial to control the effects of increased trade volumes on wage inequality. The trade openness was frequently used as control variable in following previous studies: Te Velde & Morrissey, 2004; Taylor & Driffield, 2005; Figini & Görg, 2011; Tomohara & Yokota, 2011. Data for this variable is derived from the World Development Indicators database.

A number of studies (Mincer, 1996; Barro, 200; Castello & Domenech, 2002; De Gregorio & Lee, 2003) argue that the higher level of education lead to reduction of income gap. Hence, the

[8] All data and metadata provided on UNCTADstat through website https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx?sCS_ChosenLang=en

[9] The UIS is the official source of data used to monitor progress towards Sustainable Development Goal on education (SDG 4) and the Education 2030 Agenda. http://data.uis.unesco.org/

next control variable is human capital, which can be determined using the information on school enrollment ratios and population structure over time (Barro & Lee, 2010). Human capital measure is obtained from Penn World Table[10] and defined as index of human capital per employee. The index is based on the average years of schooling (Barro & Lee, 1996 citied by Feenstra et al., 2015) and assumed rate of returned for education attainment (Caselli, 2005 citied by Feenstra et al., 2015).

The third variable is size of economies that can be defined as population growth. The level of unemployment is included as the fourth control variable in the estimation as it may affect inequality through the wage bargaining (te Velde, 2003). Data for these variables is taken from World Development Indicators.

Descriptive statistics representing the basic features of the dataset is provided in the beginning of the estimation (Chapter 4).

3. 2. Methodology

Empirical model of FDI direct effects

The first interest of this research refers to exploration of direct relationship between FDI and inequality. In line with first hypotheses, the following empirical model (1) of this study will investigate if FDI has any impact on (wage/income) inequality:

Equation 1. $WageINQ_{it} = \alpha + \beta_1 * FDI_{it} + \beta_2 * X_{it} + \varepsilon_{it},$

where, dependent variable $WageINQ_{it}$ is represented by the relative wage inequality between skilled and unskilled workers, namely $Wage\ Inq_{it}$. The independent variable FDI_{it} is inward FDI stock as a percentage of GDP country i in period t, X_{it} is a vector of main control variables. The last variable ε_{it} is the standard error term. As it was discussed in data description, the set of control variables represents trade openness, human capital, size of economies and unemployment rate.

In accordance with our hypothesis, if β_1 is positive, inward FDI will increase wage inequality.

Due to unobserved heterogeneity between countries, several authors (Figini & Corg, 2011; Yay, Tastan & Oktayer, 2016) preferred a fixed – effect panel approach as an estimation method.

[10] Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" American Economic Review, 105(10), 3150-3182, available for download at www.ggdc.net/pwt The Database avaliable https://www.rug.nl/ggdc/productivity/pwt/

However, Dreher & Gaston (2008) mentioned that "inequality tends to change slowly over time". As a result, the authors consider the dynamic model which contains one or more lagged dependent variables. In addition, analyzing the methodological approaches used in previous literature, there can be a conclusion that a number of studies (Gopinath & Chen, 2003; Dreher & Gaston, 2008; Yay, Tastan & Oktayer 2016) prefer the Dynamic Panel estimation over the Ordinary Least Square (OLS) techniques.

In accordance with the previous approaches (Gopinath & Chen, 2003; Dreher & Gaston, 2008) the model of the current research should be expanded by introducing a dynamic component due to the fact that inequality of today depends on the past inequality:

Equation 1a. Specified dynamic model

$$WageINQ_{it} = \alpha + \beta_1 * FDI_{it} + \beta_2 * WageINQ_{i(t-1)} + \beta_3 * X_{it} + u_{it},$$

$$u_{it} = \eta_i + \varepsilon_{it},$$

where the structure of errors (u_{it}) is such that it contains a component $\eta_i$that differs from case to case but does not vary over time i.e. unobserved time-invariant heterogeneity and ε_{it} as error component. The element η_i is also known as unobservable individual effects, unobservable heterogeneity or unit heterogeneity. All other variables remain constant and they are explained above, in the *Equation 1*.

According to the definition (Pickup et al., 2017), dynamic process is one that includes one or more lags of the dependent variable on the right hand side of the equation. In the case of current model, a dynamic component is $\beta_2 * WageINQ_{i(t-1)}$. This reflects that dependent variable, $WageINQ_{it}$, becomes to be autoregressive i.e. lagged value of dependent variable is used as predictor variable for current variables. However, adding the lagged value of dependent variable, the correlation appears between the dynamic component and unobserved individual effects (Pickup et al., 2017),.

Note that, according to Nickell (Econometrica, 1981; cited by Pickup et al., 2017), a serious difficulty arises with static fixed effects model known as "Nickell bias". This term, "Nickell bias", refers to the lagged dependent variable which can not be seen an independent variable due to its correlation with individual specific effect, i.e. $E(\eta_i | WageINQ_{i(t-1)}) \neq 0$. This correlation appears: the random intercept η_i represents the combined effect on dependent variable.

In addition, the explanatory variable may also correlate with the error term, i.e. $E(FDI_{it}|\varepsilon_{it}) \neq 0$. Hence, the presence of endogeneity issues entails that least squares estimators may be biased and inconsistent. Commonly used solution is to employ General Methods of Moments (GMM) estimators, proposed by Arellano and Bond (1991). Further elaboration of the technique is represented in *3.3. Estimation techniques.*

Empirical models of FDI indirect effect

In order to investigate the mediator effect hierarchical regression method could be employed. This estimation method was suggested by Baron and Kenny in 1986. Overall, there are three following steps (MacKinnon, 2008):

1) $INQ_{it} = \alpha_1 + \beta_1 * FDI_{it} + \varepsilon_{it}$

First step is to regress the independent variable, FDI_{it} on dependent variable,INQ_{it}, in order to confirm that FDI_{it} is a significant predictor of the dependent variable, INQ_{it} i.e. β_1 should be significant.

2) $Innovations_{it} = \alpha_2 + \beta_2 * FDI_{it} + \varepsilon_{it}$

The second step refer to a confirmation that there is strong relationship between the mediator, $Innovations_{it}$, and independent variable, FDI_{it}, i.e. β_2 should be significant enough to support that the independent variable is a crucial predictor of the mediator. Otherwise, there is no longer possible to mediate anything.

3) $INQ_{it} = \alpha + \beta_3 * FDI_{it} + \beta_4 * Innovations_{it} + \varepsilon_{it}$

The final step involves the regression of dependent variable, INQ_{it},on both mediator, $Innovations_{it}$, and independent variable, FDI_{it}, in order to confirm that the mediator is a significant predictor of the dependent variable,. If a mediator, $Innovations_{it}$, is indeed a significant predictor of then previously significant independent variable, FDI_{it}, in first equation could be greatly reduced.

The measurements of the variables in the estimation above are following: dependent variable INQ_{it} is measured as the wage gap between skilled and unskilled workers, the independent variable FDI_{it} is inward FDI stock as a percentage of GDP, the mediator, $Innovations_{it}$, GERD as a percentage of GDP, ε_{it} is the error term.

3.3. Estimation techniques

Our data encompasses 143 observations (21 countries and 10 years). For further investigation of the relationship between FDI and income inequality, the panel data framework is going to be implemented as, in accordance with previous studies (Gopinath & Chen, 2004; Mihaylova, 2015), panel data estimation technique is common for the research in the this field.

In addition, panel data estimation technique has many advantages over pure time series and cross-sectional data analysis (Hsiao, 2007). Firstly, panel data decreases the problem of collinearity between independent variables due to large number of entire variables. Secondly, analysis with panel data helps to overcome issues with omitted variable that might be correlated with explanatory variables. Thirdly, the panel data allows to estimate the relationship over time i.e. dynamic relationship (Hsiao, 2007), which is a primary aim of this research.

Using the panel analysis, it is necessary to make the choice among several estimation techniques. Overall, panel data provides three estimation techniques: pooled OLS, fixed effect and random effect model (Mátyás & Sevestre, 2008). Examining various patterns of emerging economies, the report by OECD (2011) identifies following: "the emerging economies represent a highly heterogeneous group, in terms of economic size, population, levels of per capita income and growth performance over the past decade." In addition, inward levels of FDI stocks are also heterogeneous. As a result, taking into account heterogeneity, the fixed effect panel techniques are more likely to be employed. To choose between the two specifications and to verify the choice, Hausman test could be run. This test allows to check whether there is a correlation between entity errors and regressors. The null hypothesis is that the preferred model is random effects and the alternative fixed effects (Greene, 2008, ch. 9).

However, proceeding the estimation using panel methods, there should be a check for a number of estimation issues (Gopinath & Chen, 2004). This step contains the application of diagnosis tests in order to identify such potential problems as heteroscedasticity, autocorrelation, multicollinearity.

First one is heteroscedasticity test because the standard error is key to conducting significant tests. Biased standard errors lead to irrelevant determinations. To control for the presence of heteroscedasticity a modified Wald test for groupwise heteroscedasticity could be employed. In the case that heteroscedasticity is identified, the robust standard errors could be implemented to overcome the problem (Green, 2008, ch. 13).

Since the autocorrelation represents an issue in macro panels (Mihaylova, 2015), to verify this there is a Wooldridge test. The null hypothesis presents no serial correlation (first order auto correlation). In the case the autocorrelation is detected, the stata program allows to implement "cluster" for clustering the standard errors by country in order to avoid the autocorrelation issue.

The next issue is the presence of multicollinearity which can be detected by high correlation between independent variables. For testing the presence of multicollinearity, the Variance Inflation Factors (VIF) is implemented. The level of the VIFs is below 5, indicating that the issue of multicollinearity is not in the sample.

In addition, it is crucial to test for time-fixed effects. Time-invariant variables, namely "year effects" or "year dummies'', capture the influence of aggregate (time series) trends. Stata allows to make a joint test to see if the dummies for all years are equal to zero, if they are then no time fixed effects are needed.

However, as it was mentioned in the methodology section, due to fact that inequality of today depends on the past inequality, the dynamic model has been employed. As a result, empirical problems imply with consistency of OLS as there is a positive correlation between lagged dependent variable and fixed effects in the error term (Roodman, 2009), which give the rise to "dynamic panel bias" (Nickel, (1981) cities by Roodman, 2009). According to Roodman (2009), "there are two ways to work around the endogeneity: difference GMM and system GMM". For making the choice between the these two approaches, the rule-of-thumb (Bond, 2001) will be employed. According to Bond (2001), it is crucial to compare first-differenced GMM results to those obtained by pooled OLS and fixed effects OLS. If the difference GMM estimate obtained is close to or below the fixed effects estimates, this suggests that the former estimate is downward biased due to the weak instruments. In such case, it is appropriate to explore the quality of the instruments and thus to apply a system GMM.

Regarding potential indirect effect, the mediation approach with regression analysis is applied. As it was mentioned in the section 3.2, the estimation follows several step approach provided by Baron & Kenny (1986). The purpose of first two steps is to conduct that zero-order relationship among variables exists. According to MacKinnon (2008), if zero-order relationships are not significant, then it is likely that mediating effect is absent. After detecting the significant relationship between independent variable & dependent variable, as well as between mediator & independent variable, the multiple regression analysis can be conducted. This step is crucial for identifying full or partial mediation. If the independent variable is no

longer significant when mediator is controlled, then there is full mediation. However, when independent variable is still significant then there is a partial mediation.

Chapter 4. Empirical results

The aim of this section is to present empirical verification of hypotheses set out in chapter 2.4. By modelling the relationship between FDI and income inequality, empirical results are obtained for panel data from 21 countries over 10 years period (2006-2016). The information was derived from five different datasets in order to find required variables. The datasets were merged in one dataset in order to imply the estimation techniques using STATA.

4.1. Estimation results

Before making the estimation, there could be a quick look at the listed countries and the summary statistics presented below (Table 2 & 3). Overall, there are 21 emerging countries in the sample according to the availability of data. The summary statistics allows to identify a considerable heterogeneity across emerging countries. For example, inward FDI presents a minimum value of 9,09 and a maximum value of 542,48, illustrating large variation across countries. The same diverse range of values is assessed by trade openness and unemployment rate. The negative mean value of population growth means that some countries have to deal with loss of population or insignificant growth. In addition, human capital (hc) seems to be evenly distributed.

#	Country	ID
1	Brazil	BRA
2	Chile	CHL
3	Colombia	COL
4	Czech Republic	CZE
5	Egypt	EGY
6	Greece	GRC
7	Hong Kong, China	HKG
8	Hungary	HUN
9	Indonesia	IDN
10	Korea	KOR
11	Mexico	MEX
12	Parkistan	PAK
13	Peru	PER
14	Phillipines	PHL
15	Poland	POL
16	Qatar	QAT
17	Russian Federation	RUS
18	South Africa	ZAF
19	Tailand	THA
20	Turkey	TUR
21	United Arab Emirates	ARE

Table 2. List of emerging countries

Variable	Obs	Mean	Std. Dev.	Min	Max
WageINQ	161	.6704973	.6104993	.183537	5.128996
fdi	231	51.04789	94.45921	9.091813	542.4886
hc	231	2.780613	.4551451	1.77684	3.661578
trade	231	90.90077	78.84577	22.10598	442.62
unempl	231	7.100307	6.024557	.14	28.489
PopGrowth	231	1.585034	2.765609	-.7251208	16.33164
Innovations	193	.8637901	.8067404	.046362	4.28874

Table 3. Descriptive statistics

It is crucial to mention that some missing values were filled in using averages of values on both sides (Little & Rubin, 2019). As a result, the merged dataset provides strongly balanced panel, indicating that all countries have data for all years (2006-2016, delta is 1 year).

Regarding possible relationship between the variables, the correlation matrix was derived (Appendix C). The dependent variable of interest, wage inequality, is correlated with the previous values of wage inequality and with human capital. However, there are not any problematic cases of correlation. The highest values for correlation (around 0.05) are between trade and unemployment, between trade and population growth.

In addition, by plotting histograms it can be seen that not all the variables have been normally distributed. Some have a skewed distribution and outliers on the right hand side. Hence, to have a more suited distribution, a natural logarithm is generated for some variables for transforming the data.

4.1.1. Evaluating the impact of FDI on wage inequality, OLS, Fixed Effect Model

This study is interested to investigate the effects of FDI over time, hence the use of fixed effects model is more suitable taking into account heterogeneity of sample (described in chapter 3.3.). For investigating this issue, the Hausman test is applied (Appendix D.0). Essentially, the test detects whether there is a correlation between individual random effects and regressors in the model. In our analysis the null hypothesis (of homoscedasticity) is rejected, thus there is a correlation. In details, the Prob > chi2=0.004, which is < 0.05 (i.e. significant). Hence, fixed effects model is preferable. This choice is in line with previous academic studies (Figini & Gorg, 2011).

The test for time-fixed effects shows the necessity to add the time-fixed effect in the model. According to the estimation, the Prob > F is 0.0493, which is < 0.05, thus the null hypothesis

that the coefficients for all the years are jointly equal to zero is rejected. Thus, in our estimation time fixed effects is needed. The run test can be found in Appendix D.1.

Furthermore, Baltagi states that the cross sectional dependence is a problem in macro panels with long time series (over 20-30 years). However, in our estimation, the problem of cross sectional dependence is not considered as there are too few common observations across panel. In addition, the presence of multicollinearity was tested by the Variance Inflation Factors (VIF). The level of VIF is below 5 for all the estimators, thus there is no issue of multicollinearity (Appendix D.2.).

Following Greene (2000, p. 598), with the help of modified Wald test for groupwise heteroscedasticity in the residuals of a fixed effect regression model the presence of heteroscedasticity is identified (Appendix D.3.). As Prob > chi2=0.00, which is < 0.05, thus the null hypothesis (homoscedasticity) is rejected. The presence of heteroscedasticity is detected. In addition, it is crucial to evaluate the correlation in the dataset. Serial correlation causes the standard errors of the coefficients to be smaller than they actually are and high R-squared. The null hypothesis presents no serial correlation. In the current analysis, the null hypothesis is rejected as Prob > F= 0.0197, which is < 0,05 (Appendix D.4.). Hence, a significant test statistic indicates the presence of serial correlation (Drukker, 2003; Wooldridge, 2002). For correction of heteroscedasticity and autocorrelation the robust fixed effect model with clustered standard errors will be obtained.

Table 4 presents the results of the estimations of the robust fixed effect panel analysis and consists of five models. The model (1) is the simplest and contains the key independent variable, FDI. Other four models (2-5) have gradually added control variables, so the influence of each variable can be obtained.

	(1) lWageINQ	(2) lWageINQ	(3) lWageINQ	(4) lWageINQ	(5) lWageINQ
FDI (lfdi)	0.268	0.245	**0.306***	**0.251***	0.268
	(1.38)	(1.40)	(2.32)	(2.10)	(2.08)
Human Capital (hc)		-0.398	-0.569	-0.669	-0.672
		(-1.05)	(-1.82)	(-1.99)	(-1.92)
Openness to Trade (ltrade)			0.878	0.843	0.899
			(1.78)	(1.75)	(1.59)
Unemployment (lunempl)				-0.0936	-0.0943
				(-2.00)	(-1.72)
Population Growth (lPopGrowth)					0.0250
					(0.45)
_cons	-1.627*	-0.475	-4.021	-3.284	-3.592
	(-2.61)	(-0.65)	(-2.07)	(-1.76)	(-1.59)
N	161	161	161	161	143

Table 4. FDI and Wage Inequality (2006-2016), OSL, Fixed Effects

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the model 1, it is observed that the key independent variable does not have any significant effect on wage inequality. However, FDI gets significance in the 3rd and 4th model when there are additional control variables, such as human capital, unemployment and openness for trade. In model 5, FDI loses its significance, however, the loss is actually not huge, as the t-value decreases only by 0.02 (from 2.10 till 2.08). Generally, all control variables have no significant effect on the relationship between the two key variables.

Overall, the relationship between FDI and wage inequality is strongly positive. Nevertheless, the relationship between key independent variables and wage inequality becomes significant in when adding additional controls to the model. In detail, FDI is significant enough and have positive impact on wage inequality i.e. in this period FDI increases wage inequality: the gap between wage of skilled workers and the wage of unskilled workers broadens. This result

supports first hypothesis and goes in line with general studies of FDI and wage inequality (Feenstra & Hanson, 1997; Gopinath & Chen, 2003).

However, several authors (Dreher & Gaston, 2008) consider OLS Fixed effects inconsistent with estimation of wage inequality, as the current wage inequality depends on past its values. Therefore, the elaboration of the other technique is presented below.

4.1.2. Evaluating the impact of FDI on wage inequality, GMM estimator

Firstly, it is essential to introduce a dynamic component, namely lagged wage inequality. Running the regression, the lagged dependent variable is significant and has strong positive coefficient (Appendix E.0). Generalized Method of Moments (GMM) may be suitable for current analysis due to unobserved panel heterogeneity and measurements errors.

In accordance with the rule-of-thumb approach (Bond, 2001), it is crucial to choose appropriate method for analysis: difference GMM or system GMM. This estimation consists of several steps. The first step is related to the dynamic model which should be initially estimated by pooled OLS and LSDV approach. In this model, the coefficient of lag of dependent variable is highly significant and equal: L1=0.08959, (Appendix E.1). The second step in to generate the fixed effect estimation technique with the same model. The coefficient of first lag of dependent variable is highly significant and equal 0.2739 (Appendix E.2). The final step is to generate difference GMM. The coefficient of interest in one step model is 0.5037 (Appendix E.3). and in the two step difference the coefficient is 0.7261 (Appendix E.4). In current analysis, the coefficients of difference GMM estimator are considerably larger than the coefficients of fixed effects OLS (Table 5). Hence, the difference GMM technique is appropriate for the dynamic panel estimation. In addition, according to Roodman (2009), two step difference GMM is efficient and robust to heteroscedasticity and autocorrelation.

Estimators	**Coefficients**
Pooled OLS	0.8959
Fixed Effects OLS	0.2739
One-Step Difference GMM	0.5037
Two-step difference GMM	0.7261

Table 5. Rule-of-Thumb. Comparison of coefficients

Table 6 provides the results of dynamic panel estimation employing the two step difference GMM approach. The lagged dependent variable is significant at 1% level. It is crucial that AR

(2) statistics is not significant in this analysis (Appendix E.4) as if a significance AR (2) is detected, the lags of endogenous variables are not appropriate instruments for current values. However, non of the regressors are significant. This lead to the conclusion, that there is no effect of FDI on wage inequality. This is in line with previous academic studies (Aitken et al. 1996; Blonigen & Slaughter, 2001).

	(1) lWageINQ
L.lWageINQ	0.726**
	(3.56)
lfdi	0.147
	(0.97)
ltrade	-0.0767
	(-0.13)
lunempl	-0.0121
	(-0.25)
N	120

Table 6. FDI and Wage Inequality (2006-2016), Dynamic Panel estimation, two steps difference GMM

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.1.3. Evaluating the role of Innovations as potential mediator

In accordance with the methodology, the multiple steps regression analysis is conducted in order to identify the mediation effect. Referring to the estimated results (Table 2), the relationship between FDI and wage inequality is significant in specification model 3 and 4. Conducting the panel regression with mediator, namely innovations, as dependent variable and FDI as independent variable, the results assume positive and significant relationship between the variables (Appendix F.0).

The last step of mediation analysis involves the relationship between dependent variable, wage inequality, and two variable FDI and innovations. The results, presented in appendix F.1, show no significant relationship between variables. As the result, there is no mediation effect and the second hypothesis is rejected.

4.2. Robustness check

In this section, the robustness checks are implemented for ensuring the relevant results and for controlling eventual pitfalls.

Regarding the main independent variable, in the current study FDI is presented as inward stocks as a percentage of GDP. However, the results are mixed and not clear. Hence, it could be relevant to employ the other proxy of FDI, namely inward FDI flows as a percentage of GDP.

Table 7 presents the estimated results when inward FDI stocks are replaced by inward FDI flows. In the model 1, it is observed that the key independent variable, inward FDI flows, does not have any significant effect on wage inequality. In addition, FDI flows are also insignificant in models (2-5) when there are additional control variables, such as human capital, unemployment and openness for trade.

	(1) lWageINQ	(2) lWageINQ	(3) lWageINQ	(4) lWageINQ	(5) lWageINQ
FDI inward flows (lFDIfl)	0.0310	0.0270	0.0148	0.00536	0.00757
	(0.95)	(0.91)	(0.78)	(0.28)	(0.32)
Human Capital (hc)		-0.346	-0.274	-0.329	-0.391
		(-0.83)	(-0.95)	(-1.11)	(-1.33)
Openness to Trade (ltrade)			0.479	0.452	0.400
			(1.15)	(1.13)	(0.95)
Unemployment (lunempl)				-0.1000	-0.119
				(-1.46)	(-1.38)
Population Growth (lPopGrowth)					-0.0536
					(-1.23)
_cons	-0.610***	0.364	-1.864	-1.436	-1.043
	(-25.30)	(0.32)	(-1.46)	(-1.22)	(-0.76)
N	157	157	157	157	141

Table 7. Estimation results using FEM Panel Analysis, replacing FDI stocks by FDI inflows

t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Regarding the control variables, several studies (Gopinath & Chen, 2003; Dreher & Gaston, 2008) find that level of economic development is significant for relationship between FDI and income inequality. Thus, it is considered to employ level of economic development represented by annual GDP growth, as another control in the robustness mode. In addition, the inflation rate can be relevant for emerging economies as it refers to macroeconomic stability and overall country competiveness. Hence, inflation rate may be significant for the relationship between FDI and income inequality. The estimation results with additional control variables can be found in below. In sum, the presence of level of economic development and inflation rate does not changing the impact of FDI on income inequality.

	(1) lWageINQ	(2) lWageINQ	(3) lWageINQ	(4) lWageINQ	(5) lWageINQ	(6) lWageINQ	(7) lWageINQ
lfdi	0.268	0.245	**0.306***	**0.251***	0.268	0.257	0.318
	(1.38)	(1.40)	(2.32)	(2.10)	(2.08)	(1.37)	(1.56)
hc		-0.398	-0.569	-0.669	-0.672	-0.364	-0.359
		(-1.05)	(-1.82)	(-1.99)	(-1.92)	(-1.02)	(-0.93)
ltrade			0.878	0.843	0.899	0.902	0.899
			(1.78)	(1.75)	(1.59)	(1.56)	(1.66)
lunempl				-0.0936	-0.0943	-0.0980	-0.121
				(-2.00)	(-1.72)	(-1.88)	(-1.89)
lPopGrowth					0.0250	0.0198	0.0530
					(0.45)	(0.19)	(0.49)
lGDP						0.105	0.125
						(1.88)	(2.07)
linflation							-0.0194
							(-0.96)
_cons	-1.627*	-0.475	-4.021	-3.284	-3.592	-4.540	-4.643
	(-2.61)	(-0.65)	(-2.07)	(-1.76)	(-1.59)	(-1.48)	(-1.52)
N	161	161	161	161	143	128	121

Table 8. Estimation results using FEM Panel Analysis with additional control variables

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusion

Motivated by ongoing debate among economists and policymakers about potential benefits and drawbacks of FDI, this paper is set out to explore the relationship between FDI, innovations and income inequality in the specific sample of emerging countries.

In a global overview, the current research is novel for several reasons. Firstly, the relationship between variables is examined in the sample of emerging countries. Since last decade emerging economies play crucial role in the entire economy, due to the fact that they are seen as major host countries for FDI flows. Hence, this research investigates the relationship in new significant set of countries. Secondly, the intention of this study is to model the effects of FDI on inequality applying more direct and precise approach than commonly used correlation between Gini coefficient and determinants of FDI. Therefore, the income inequality is presented in terms of relative wages i.e. the ratio between unskilled and skilled workers. Finally, taking into account spillovers of FDI i.e. generated innovations, the study attempts to discover the meaning of innovation activities for the relationship between FDI and income inequality.

However, looking closely to the interpretation of estimations, the results are mixed. Employing the static panel fixed effect approach, the results lead to the conclusion that FDI is significant and have positive impact on wage inequality i.e. FDI increases wage inequality: the gap between wage of skilled workers and the wage of unskilled workers broadens. Hence, the first hypothesis is supported. This result goes in line with general studies of FDI and wage inequality (Feenstra & Hanson, 1997; Gopinath & Chen, 2003). Taking into account that "inequality tends to change slowly over time" (Dreher & Gaston, 2008), another estimation technique with dynamic component is considered to be used, namely two steps difference GMM estimator. From this perspective, the significance of the FDI has not been detected and, a result, the first hypothesis is rejected: there is no effect of FDI on wage inequality.

Furthermore, there is an expectation for mediating effect of innovation activities. However, the indirect effect has been found. Hence, the second hypothesis is rejected. There are several possible explanations of this result. These findings may suggest that the model is very simplistic and hence, inaccurate. In addition, there may be used other estimation techniques as current test for mediation have potential issue (MacKinnon, 2008)

In addition, this paper has few limitations. Firstly, it is relative small panel sample, as in the reviewed literature more observations are commonly used with longer time period. Moreover, the data on the relative wages would have been more accurate. However, this limitation is

related to the availability of data and to restricted set of emerging countries. Another issue is the biased estimation of mediating effect. An alternative perspective is to calculate the indirect coefficient by Judd & Kenny (1981) approach or by Sobel (1982) estimation technique.

Consequently, findings of this paper leave several aspects for future research. It could be useful to consider other proxies for control variables and, thus, to try to make the model more accurate. Furthermore, according to theoretical framework, the indirect effect of the innovation may exist. Hence, it could be relevant to continue the investigation on mediating effect applying different methods. Finally, there is a room for empirical investigation considering how FDI in different sectors might affect inequality in various ways.

Appendix

Appendix A. Classification of economies

There are several classification of economies in the global economic system.

A. The World Bank classifies economies based on their GNI per capita (computed using the "Atlas" method). Use of this classification system does not imply a judgment concerning the development status of any country or territory.

In 1978, the first World Development Report introduced groupings of "low income" and "middle income" countries using a threshold of $250 per capita income as threshold between the groups. Since 2019, the World Bank has introduced and update and assigned the world's economies into four income groups — high, upper-middle, lower-middle, and low.

https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2018-2019

B. The United Nations Conference on Trade and Development (UNCTAD) considers three classification of countries and economies according to their level of development: "developing", "developed" and "transition". However, there is no established convention for the distinction of "developing", "transition" and "developed" countries or areas in the United Nations system.

Transition economies (UNCTAD, 2018): Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Montenegro, North Macedonia, Republic of Moldova, Russian Federation, Serbia, Serbia and Montenegro, Socialist Federal Republic of Yugoslavia, Tajikistan, Turkmenistan, Ukraine, Union of Soviet Socialist Republics, Uzbekistan.

https://stats.unctad.org/handbook/Annexes/Classifications.html

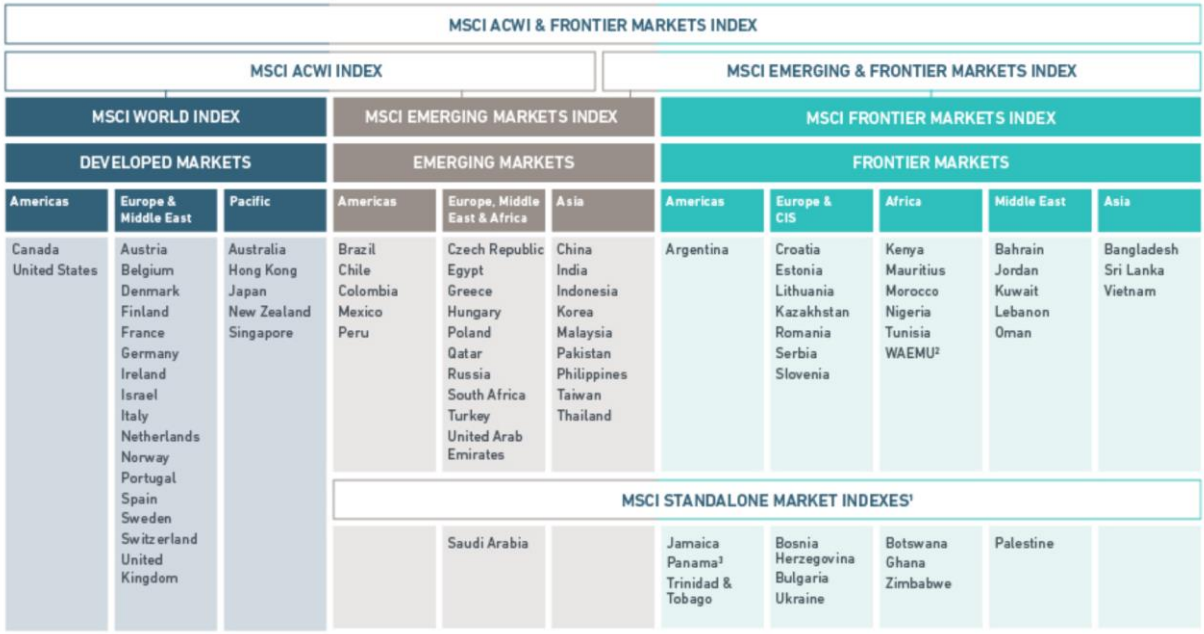
C. In 1981, Antoine W. Van Agtmael introduced a term "emerging market economy" in the International Finance Corporation of the World Bank. Emerging countries are considered to be in a transitional phase between developing and developed status.

In the global economy, there is no consensus, which countries should be classified as emerging markets. However, nowadays, there are several groups of analysts who present the list of emerging markets.

For example, the Emerging Market Bond Index Global (EMBI Global) by J.P. Morgan was the first comprehensive EM sovereign index in the market. It provides full coverage of the

EM asset class with representative countries, investable instruments, and transparent rules. The Morgan Stanley Capital International (MSCI) Emerging Market Index follows the market caps of the companies on the countries' stock markets.

The MSCI Global Investable Market Indexes (GIMI) Methodology Country Classification (https://www.msci.com/market-cap-weighted-indexes):



According to MSCI‘s “Annual Market Classification Review 2018”, there are 24 emerging markets, including Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russia, South Africa, Taiwan, Thailand, Turkey, and United Arab Emirates.

International Monetary Fund (IMF) has a similar list of 23 countries (World Economic Outlook, 2018).

Since there is no general agreement concerning term “emerging economies”, this paper will follow the MSCI‘s list of emerging markets.

Appendix B. Concept of inequality

This study attempts to make the distinction between two terms: income inequality and wage inequality. To begin with, it is crucial to introduce the broad term of inequality provided by OECD (2011). According to the report (OECD, 2011), "use of term "inequality" should clearly state inequality of what and among whom. Different income aggregates and population subgroups will be affected differently by different driving forces". Hence, following concepts are included in definition " inequality" by OECD (2011):

- Dispersion of hourly wages among full-time (or full-time equivalent) workers.
- Wage dispersion among workers (e.g. annual wages, including wages from part-time work or work during only part of the year).
- Individual earnings inequality among all workers (including the self-employed).
- Individual earnings inequality among the entire working-age population (including those who are inactive, i.e. not working).
- Household earnings inequality (including the earnings of all household members).
- Household market income inequality (including incomes from capital, savings and private transfers).
- Household disposable income inequality (taking into account public cash transfers received and direct taxes paid).
- Household adjusted disposable income inequality (taking into account the values of publicly provided services such as health or education).

Appendix C. Correlation Matrix

	Wage INQ	LagWage INQ	Lag2Wage INQ	fdi	hc	trade	unempl	PopGrowth	Innovations
Wage INQ	1								
LagWage INQ	**0.875*****	1							
Lag2Wage INQ	**0.844*****	**0.924*****	1						
fdi	-0.161	-0.161	-0.162	1					
hc	**0.388*****	**0.300****	**0.286****	0.192	1				
trade	-0.0467	-0.0994	-0.114	**0.888*****	**0.402*****	1			
unempl	-0.150	-0.0875	-0.0448	-0.169	**-0.0376**	**-0.231***	1		
PopGrowth	-0.147	-0.205	-0.180	-0.0644	**-0.506*****	**-0.212***	-0.190	1	
Innovations	**0.833*****	**0.636*****	**0.625*****	-0.0966	**0.624*****	0.0923	-0.0583	**-0.293****	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix D. Evaluating the impact of FDI on wage inequality, OLS, Fixed Effect

Appendix D.0 Hausman Test

```
. hausman fe re, sigmamore
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lfdi	.389719	.1085991	.2811199	.0763595
hc	-.4965355	-.3027692	-.1937663	.1192212
ltrade	.6380732	.2629443	.3751288	.1283701
lunempl	-.0872233	-.0707312	-.0164921	.0277777
lPopGrowth	-.0015589	-.0789948	.0774358	.0221877

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       22.78
                Prob>chi2 =      0.0004
```

Appendix D.1 Time fixed effect

```
. xtreg lWageINQ lfdi hc ltrade lunempl lPopGrowth i.year, fe

Fixed-effects (within) regression               Number of obs      =       143
Group variable: countrynum                      Number of groups   =        18

R-sq:                                           Obs per group:
     within  = 0.3358                                         min =         1
     between = 0.1678                                         avg =       7.9
     overall = 0.0705                                         max =        11

                                                F(15,110)          =      3.71
corr(u_i, Xb)  = -0.8450                        Prob > F           =    0.0000
```

lWageINQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lfdi	.2682191	.124395	2.16	0.033	.0216974	.5147408
hc	-.6716113	.2689905	-2.50	0.014	-1.204687	-.1385352
ltrade	.8985685	.1888585	4.76	0.000	.5242953	1.272842
lunempl	-.0942937	.0547183	-1.72	0.088	-.2027325	.014145
lPopGrowth	.0249662	.0494125	0.51	0.614	-.0729577	.1228902
year						
2007	.1797636	.0943021	1.91	0.059	-.007121	.3666483
2008	.1756097	.0893398	1.97	0.052	-.0014408	.3526602
2009	.3886887	.0923096	4.21	0.000	.2057528	.5716246
2010	.2766326	.0916983	3.02	0.003	.0949081	.4583571
2011	.2861818	.0902283	3.17	0.002	.1073704	.4649932
2012	.2554889	.0948425	2.69	0.008	.0675333	.4434446
2013	.2803064	.0998219	2.81	0.006	.0824827	.4781301
2014	.2829951	.1020182	2.77	0.007	.0808189	.4851712
2015	.3251016	.1116534	2.91	0.004	.1038308	.5463724
2016	.3140544	.1251653	2.51	0.014	.0660062	.5621027
_cons	-3.591639	1.212515	-2.96	0.004	-5.99456	-1.188719
sigma_u	1.0793133					
sigma_e	.18162699					
rho	.97246163	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(17, 110) = 48.17                     Prob > F = 0.0000

. testparm i.year

 ( 1)  2007.year = 0
 ( 2)  2008.year = 0
 ( 3)  2009.year = 0
 ( 4)  2010.year = 0
 ( 5)  2011.year = 0
 ( 6)  2012.year = 0
 ( 7)  2013.year = 0
 ( 8)  2014.year = 0
 ( 9)  2015.year = 0
 (10)  2016.year = 0

       F( 10,   110) =    1.92
            Prob > F =    0.0493
```

Appendix D.2 VIF test

```
. vif
```

Variable	VIF	1/VIF
ltrade	3.15	0.317184
hc	2.25	0.443597
lfdi	2.20	0.455552
lPopGrowth	1.62	0.618272
lunempl	1.54	0.647570
Mean VIF	2.15	

Appendix D.3 Heteroskedasticity test

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (18)  =    4303.11
Prob>chi2 =      0.0000
```

Appendix D.4 Serial correlation test

```
. xtserial lWageINQ lfdi hc ltrade lunempl lPopGrowth

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      13) =      7.067
           Prob > F =      0.0197
```

Appendix E. Evaluating the impact of FDI on wage inequality, GMM estimator

Appendix E.0 Lagged dependent variable

```
. reg lWageINQ l.lWageINQ lfdi l.lfdi hc ltrade lunempl
```

Source	SS	df	MS	Number of obs	=	137
				F(6, 130)	=	156.54
Model	34.7401626	6	5.79002709	Prob > F	=	0.0000
Residual	4.80851834	130	.036988603	R-squared	=	0.8784
				Adj R-squared	=	0.8728
Total	39.5486809	136	.290799124	Root MSE	=	.19232

lWageINQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lWageINQ						
L1.	.8913659	.0350129	25.46	0.000	.822097	.9606347
lfdi						
--.	.0489581	.115293	0.42	0.672	-.1791353	.2770516
L1.	-.1118845	.117405	-0.95	0.342	-.3441563	.1203873
hc	-.0099427	.0494358	-0.20	0.841	-.1077455	.08786
ltrade	.0813554	.0426174	1.91	0.058	-.002958	.1656689
lunempl	.018264	.0172462	1.06	0.292	-.0158555	.0523835
_cons	-.1909039	.1239863	-1.54	0.126	-.4361961	.0543882

Appendix E.1

```
. reg lWageINQ l.lWageINQ lfdi hc ltrade lunempl yr*, robust
note: yr1 omitted because of collinearity
note: yr3 omitted because of collinearity

Linear regression                               Number of obs     =        137
                                                F(14, 122)        =     168.53
                                                Prob > F          =     0.0000
                                                R-squared         =     0.8915
                                                Root MSE          =     .18756
```

lWageINQ	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lWageINQ						
L1.	.895894	.1171849	7.65	0.000	.6639148	1.127873
lfdi	-.0521541	.0378601	-1.38	0.171	-.127102	.0227937
hc	.017812	.0887044	0.20	0.841	-.1577873	.1934113
ltrade	.0699456	.0331312	2.11	0.037	.0043592	.1355321
lunempl	.0132869	.0112345	1.18	0.239	-.0089529	.0355268
yr1	0	(omitted)				
yr2	.1433168	.0794035	1.80	0.074	-.0138704	.3005039
yr3	0	(omitted)				
yr4	.1264247	.1128675	1.12	0.265	-.0970078	.3498572
yr5	-.093722	.0781522	-1.20	0.233	-.248432	.0609881
yr6	-.0285855	.0297407	-0.96	0.338	-.0874601	.0302891
yr7	-.0635868	.0316609	-2.01	0.047	-.1262627	-.0009109
yr8	-.0365268	.0329503	-1.11	0.270	-.1017552	.0287016
yr9	-.0493042	.0313728	-1.57	0.119	-.1114098	.0128014
yr10	-.0309064	.0293961	-1.05	0.295	-.089099	.0272861
yr11	-.0689621	.045384	-1.52	0.131	-.1588043	.0208801
_cons	-.2173325	.1937122	-1.12	0.264	-.6008052	.1661402

Appendix E.2

```
. xtreg lWageINQ l.lWageINQ lfdi hc ltrade lunempl yr*, fe
note: yr1 omitted because of collinearity
note: yr11 omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       137
Group variable: countrynum                      Number of groups   =        17

R-sq:                                           Obs per group:
     within  = 0.4193                                         min =         2
     between = 0.0152                                         avg =       8.1
     overall = 0.0032                                         max =        10

                                                F(14,106)          =      5.47
corr(u_i, Xb)  = -0.7731                        Prob > F           =    0.0000
```

lWageINQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lWageINQ						
L1.	.2739891	.0839943	3.26	0.001	.1074622	.4405159
lfdi	.343132	.1281985	2.68	0.009	.088966	.5972979
hc	-.6694183	.2703449	-2.48	0.015	-1.205403	-.1334333
ltrade	.786916	.1853848	4.24	0.000	.4193725	1.154459
lunempl	-.0361677	.048132	-0.75	0.454	-.1315941	.0592587
yr1	0	(omitted)				
yr2	-.0467967	.1064325	-0.44	0.661	-.2578094	.164216
yr3	-.0038243	.1094941	-0.03	0.972	-.220907	.2132585
yr4	.1539929	.0834377	1.85	0.068	-.0114304	.3194161
yr5	-.0474225	.0711017	-0.67	0.506	-.1883886	.0935437
yr6	.0036593	.0743948	0.05	0.961	-.1438357	.1511543
yr7	-.0265728	.0690372	-0.38	0.701	-.1634457	.1103002
yr8	-.0109143	.0647828	-0.17	0.867	-.1393525	.117524
yr9	.0015063	.0632426	0.02	0.981	-.1238784	.126891
yr10	.027567	.0565903	0.49	0.627	-.0846288	.1397628
yr11	0	(omitted)				
_cons	-2.994366	1.186013	-2.52	0.013	-5.345752	-.6429809
sigma_u	.87617425					
sigma_e	.15596479					
rho	.96928684	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(16, 106) = 4.40                     Prob > F = 0.0000
```

Appendix E.3

Dynamic panel-data estimation, one-step difference GMM

Group variable: countrynum		Number of obs	= 120
Time variable : year		Number of groups	= 17
Number of instruments = 21		Obs per group: min	= 1
F(15, 17)	= 38.51	avg	= 7.06
Prob > F	= 0.000	max	= 9

lWageINQ	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lWageINQ						
L1.	.5037041	.1727976	2.91	0.010	.139133	.8682753
lfdi	-.380056	.3970849	-0.96	0.352	-1.217832	.4577199
ltrade	.4388758	.3636839	1.21	0.244	-.3284301	1.206182
lunempl	-.0373562	.0570127	-0.66	0.521	-.1576426	.0829301
yr1	0	(omitted)				
yr2	.1588293	.0960732	1.65	0.117	-.0438674	.3615261
yr3	0	(omitted)				
yr4	.2746179	.264533	1.04	0.314	-.2834979	.8327338
yr5	.1300951	.152638	0.85	0.406	-.1919429	.4521331
yr6	.113517	.1236415	0.92	0.371	-.1473438	.3743778
yr7	.1025832	.142736	0.72	0.482	-.1985635	.4037299
yr8	.1354107	.1674742	0.81	0.430	-.217929	.4887504
yr9	.1170934	.1675513	0.70	0.494	-.2364089	.4705957
yr10	.1757058	.2022473	0.87	0.397	-.2509987	.6024103
yr11	.1852564	.2548985	0.73	0.477	-.3525325	.7230452

Instruments for orthogonal deviations equation
  Standard
    FOD.(ltrade hc lunempl yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/10).L.lWageINQ collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.22 Pr > z = 0.221
Arellano-Bond test for AR(2) in first differences: z = 0.01 Pr > z = 0.991

Sargan test of overid. restrictions: chi2(6) = 9.50 Prob > chi2 = 0.147
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6) = 2.68 Prob > chi2 = 0.848
  (Robust, but weakened by many instruments.)

Appendix E.4

Dynamic panel-data estimation, two-step difference GMM

Group variable: countrynum		Number of obs	= 120
Time variable : year		Number of groups	= 17
Number of instruments = 22		Obs per group: min	= 1
F(15, 17)	= 6.88	avg	= 7.06
Prob > F	= 0.000	max	= 9

lWageINQ	Coef.	Corrected Std. Err.	t	P>|t|	[95% Conf.	Interval]
lWageINQ						
L1.	.7260623	.2041347	3.56	0.002	.2953758	1.156749
lfdi	.1468745	.1508011	0.97	0.344	-.1712881	.4650371
ltrade	-.0767214	.570158	-0.13	0.895	-1.27965	1.126207
lunempl	-.0121155	.0489048	-0.25	0.807	-.1152957	.0910647
yr1	0	(omitted)				
yr2	.1901136	.1309725	1.45	0.165	-.0862143	.4664414
yr3	.0946407	.127249	0.74	0.467	-.1738313	.3631126
yr4	.096751	.1397213	0.69	0.498	-.1980351	.3915371
yr5	-.0296321	.0627831	-0.47	0.643	-.1620928	.1028287
yr6	.0843009	.0942967	0.89	0.384	-.1146478	.2832495
yr7	-.0245067	.0818836	-0.30	0.768	-.1972659	.1482526
yr8	0	(omitted)				
yr9	-.103089	.1658536	-0.62	0.542	-.4530095	.2468314
yr10	-.0366182	.0720491	-0.51	0.618	-.1886286	.1153921
yr11	-.0484309	.0825631	-0.59	0.565	-.2226237	.125762

Instruments for orthogonal deviations equation
  Standard
    FOD.(ltrade lfdi hc lunempl yr1 yr2 yr3 yr4 yr5 yr6 yr7 yr8 yr9 yr10 yr11)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/10).L.lWageINQ collapsed

Arellano-Bond test for AR(1) in first differences: z = -1.31 Pr > z = 0.189
Arellano-Bond test for AR(2) in first differences: z = -0.34 Pr > z = 0.731

Sargan test of overid. restrictions: chi2(7) = 13.99 Prob > chi2 = 0.051
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(7) = 3.37 Prob > chi2 = 0.849
  (Robust, but weakened by many instruments.)

Appendix F. Evaluating the role of innovations as potential mediator

Appendix F.0

```
. eststo:xtreg lInnovation lfdi, re cluster () robust

Random-effects GLS regression                   Number of obs     =        193
Group variable: countrynum                      Number of groups  =         21

R-sq:                                           Obs per group:
     within  = 0.1003                                         min =          2
     between = 0.0017                                         avg =        9.2
     overall = 0.0019                                         max =         11

                                                Wald chi2(1)      =       5.94
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0148

                              (Std. Err. adjusted for 21 clusters in countrynum)
------------------------------------------------------------------------------
             |               Robust
lInnovations |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        lfdi |   .3503871    .143814     2.44   0.015     .0685168    .6322574
       _cons |  -1.846835   .6058337    -3.05   0.002    -3.034247   -.6594225
-------------+----------------------------------------------------------------
     sigma_u |  .96229585
     sigma_e |  .21221385
         rho |  .95362256   (fraction of variance due to u_i)
------------------------------------------------------------------------------
(est3 stored)
```

Appendix F.1.

	(1) lWageINQ	(2) lWageINQ	(3) lWageINQ	(4) lWageINQ	(5) lWageINQ
lfdi	0.239	0.343	0.436	0.412	0.473
	(0.97)	(1.17)	(1.95)	(1.94)	(2.05)
lInnovations	-0.0816	0.0293	0.0538	0.0397	0.0447
	(-0.28)	(0.13)	(0.34)	(0.26)	(0.26)
hc		-0.699	-0.572*	-0.556*	-0.589*
		(-1.62)	(-2.69)	(-2.61)	(-2.65)
ltrade			0.857*	0.834*	0.846*
			(2.27)	(2.30)	(2.29)
lunempl				-0.0629	-0.0691
				(-1.13)	(-0.95)
lPopGrowth					0.0283
					(0.56)
_cons	-1.404	0.302	-4.079*	-3.838*	-4.010*
	(-1.44)	(0.46)	(-2.26)	(-2.25)	(-2.29)
N	131	131	131	131	113

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

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