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MARMARA ÜNİVERSİTESİ

SOSYAL BİLİMLER ENSTİTÜSÜ

İKTİSAT (İNG) ANA BİLİM DALI

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EXAMINING THE RELATIONSHIP BETWEEN INCOME AND FOREIGN DIRECT INVESTMENT FOR THE GAMBIA, GHANA AND SENEGAL USING UNCONVENTIONAL METHODOLOGIES

MA Thesis

Alfusainey Touray

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TEZ ONAY BELGESİ

İKTİSAT (İNGİLİZCE) Anabilim Dalı İKTİSAT (İNGİLİZCE) Bilim Dalı TEZLİ YÜKSEK LİSANS öğrencisi ALFUSAINEY TOURAY'nın EXAMINING THE RELATIONSHIP BETWEEN INCOME AND FOREIGN DIRECT INVESTMENT FOR THE GAMBIA, GHANA AND SENEGAL USING UNCONVENTIONAL METHODOLOGIES adlı tez çalışması, Enstitümüz Yönetim Kurulunun 01.06.2017 tarih ve 2017-12/44 sayılı kararıyla oluşturulan jüri tarafından oy birliği / oy çokluğu ile Yüksek Lisans Tezi olarak kabul edilmiştir.

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ÖZET

GELENEKSEL OLMAYAN YÖNTEMLER KULLANARAK GAMBIYA, GANA VE SENEGAL İÇİN GELİR VE DOĞRUDAN YABANCI SERMAYE YATIRIMLARI ARASINDAKİ İLİŞKİNİN İNCELENMESİ

Doğrudan yabancı yardım akışlarının, yatırımı alan ülkenin ekonomisinin üzerindeki etkisi özellikle ampirik literature henüz açıkça açıklanmamıştır. Geçmişte yapılan bir çok çalışma, modelin yanlış belirlenmesi ve içsellik problemleri yüzünden karmaşık bir haldedir. Bu eksikliklere çare bulabilmek için ,bu çalışma 3 Afrika ülkesindeki (Gambiya, Gana, Senegal) doğrudan yabancı yardım akışı ve gelir arasındaki ilişkiyi incelemek için klasik olmayan bir yöntem olan dalgacık yöntemini kullanmaktadır. Ramsey (2002), dalgacık analizi ile klasik yöntemlerle yapıldığında saklı Kalan ilişkilerin ortaya çıktığını göstermiştir ki geçmişte klasik yöntemlerle yapılan ampirik çalışmaların çoğunun sonucu bundan etkilenmiştir. Dahası, geçmişte yapılan çalışmalar sadece zaman alanlı ilişkiyi incelemiştir. Ayrıca, bu çalışma hem zaman hem de sıklık alanı ile ilişki üzerinde çalışmaktadir ki bu sayede temelde yatan güçlü faktörler tespit edilebilsin. Bu çalışmanının ampirik sonuçları göstermektedir ki doğrudan yabancı yardım akışının etkisinin; yatırım yapılan ülkenin, yabancı yardımlarla getirilen yabancı teknolojiyi özümsemesi ile doğrudan yabancı yardımıcın iç pazar yatırımı için tamamlayıcı ya da yedek olması seviyesine bağlıdır.

Nispeten özümseme kapasitesi yüksek olan (gelişmiş finansal iç pazar) ve doğrudan yabancı yardımların iç yatırımı tamamladığı ve geliri arttırdığı ülkelerde (Senegal ve Gana), Gambiya gibi düşük özümseme kapasitesine sahip ve doğrudan

yabancı yatırımların iç yatırımın ikamesi olduğu bir ülkeden daha çok fayda sağlandı. Nedensellik zaman ve ölçeğe bağlı olarak çif yönlüdür.

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ABSTRACT

EXAMINING THE RELATIONSHIP BETWEEN INCOME AND FOREIGN DIRECT INVESTMENT FOR THE GAMBIA, GHANA AND SENEGAL USING UNCONVENTIONAL METHODOLOGIES

The impact of FDI inflow on the economy of the host country has not been clearly defined, especially in the empirical literature. Most of the empirical results from past studies are distorted by model misspecification and endogeneity problems. In order to find a cure for these deficiencies, this study uses unconventional methodologies called wavelet analysis to examine the nexus between FDI inflows and income in three African countries (The Gambia, Ghana, and Senegal). Ramsey (2002) shows that wavelet analysis reveals relationships that are veiled under conventional methodologies which probably affected the outcome of most of the past empirical studies. Moreover, the former empirical studies examined the nexus only in the time domain. However, this study uses both time and frequency domain to study the nexus, so that the underlying factors that are powerful could be determined.

The empirical results of the current study show that the impact of FDI inflows depend on the host country's ability to absorb foreign technology brought by the FDI and the degree to which the FDI is a complement or a substitute for domestic investment. Countries (Senegal and Ghana) that have a relatively high absorptive capacity (i.e a developed domestic financial market) and where FDI complements domestic investment in enhancing income derived more benefit from FDI than a

country (The Gambia) with a low absorptive capacity and where FDI substitutes domestic investment. Causality is bidirectional depending on time and scale.

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İstanbul, 2017

Alfusainey Touray

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LIST OF ABBREVIATIONS

BOP	**:**Balance of Payment
COI	**:**Cone of Influence
CWT	**:**Continous Wavelet Transform
DI	**:**Domestic Investment
DOS	**:**Department of States
FEZs	**:**Free Economic Zones
EPZ	**:**Export Processing Zones
FDI	**:**Foreign Direct Investment
FT	**:**Fourier Transform
GDP	**:**Gross Domestic Product
GEG	**:**Global Electrical Group
GIEPA	**:**Gambia Investment and Export Promotion Agency
GIPC	**:**Ghana Investment Promotion Centre
GIPFZA	**:**The Gambia Investment Promotion and Free Zones Agency
GOG	**:**Government of Ghana
MCC	**:**Millennium Challenge Corporation
MTN	**:**Multinational
MTNs	**:**Multinationals
NAWEC	**:**The National Water and Electricity Company
NPV	**:**Net Present Value
OECD	**:**Organization for Economic Cooperation and Development
R&D	**:**Research and Development
STFT	**:**Short-Time Fourier Transform
TFP	**:**Total Factor Productivity
UNCTAD	**:**United Nation Conference on Trade and Development
VAT	**:**Value Added Tax
WPS	**:**Wavelet Power Spectrum
WTC	**:**Wavelet Coherence
XWT	**:**Cross Wavelet Transform

Chapter 1: Introduction

1.1. Background

If you look at the standard of living around the world, there is a huge difference among countries. There are some countries that have a high standard of living such as United States, United Kingdom, Germany, and Japan while others have a low standard of living such as The Gambia, Chad, Zimbabwe, Indonesia, and Brazil. The natural question that emerges when one compares the standard of living or welfare across the globe is why some countries are poor while some countries are so rich? To find answers to this question one has to look at the economic growth (income growth) of countries and what determines the economic growth of countries. Economic growth is a sustained increased in the income of a country over time. It is believed to be the main determinant of good standard of living or welfare of a country. Thus, most policy questions are centered on what determines the economic growth of a country as in the quote below;

> *"Of all the policy questions concerning growth, the most fundamental is whether there are any policies that an omniscient, omnipotent, benevolent social planner could implement to raise the welfare of all individuals in an economy"* (Romer, 1988, p.3).

What determines the income of a country is normally found in economic growth models or theories. The first well-known model to study the dynamic relationship between income and the role of investment could be traced back to the papers of Harrod (1939) and Domar (1946). The two papers explicitly state that the main determinant of the income of a country is saving which is channeled to investment in capital. However, the shortcomings of the Harrod-Domar model was the assumption of fixed capital-labour ratio, the assumption that labor is exogenously determined and no mentioning of the role of technology in the determination of income of a country.

Fortunately, these weaknesses of the Harrod-Domar model were corrected by two influential economists; Solow (1956) and Swan (1956). In their papers, they emphasized the importance of investment as a source of income growth. The model went further by stating that though capital accumulation is important in the determination of income of a country, but when an economy reaches its steady state, in the long-run, the growth rate of income of a country will depend on technology rather than saving. This is because in the long-run, there will be diminishing returns to factors and whether people will be willing to save. Solow-Swan model concluded that for a nation to sustain income growth, it must also sustain technological progress.

As in the Harrod-Domar model, Solow-Swan model also has a shortcoming of assuming technology is an exogenous variable. This shortcoming was corrected by two economists; Lucas (1988) and Romer (1986), they are the leading proponents in the coining of endogenous growth models. In the endogenous model, technology is endogenous variables and is responsible for sustaining the growth rate of income in the long-run. Moreover, Romer (1989) believes that technological change is not exogenous, but rather an intentional activity of people, for instance, research and development (R&D). This forms the basis of what is now known as endogenous growth theory.

It is due to these economic growth models putting emphasize on the importance of investment and technology in determining the income growth of a country that most governments and its policymakers find ways to stimulate domestic technology and domestic investment (DI). Unfortunately, sometimes DI and domestic technology are not sufficient to start income growth or sustain it. Thus, the government and its policy makers make policies to attract foreign direct investment (FDI). These changes in national policies to attract FDI are carried out due to the notion held by most academics and policymakers that FDI promotes income growth and development in the host country by bringing technologies and increasing the stock of capital in the host country. Within the past two decades, the borders of emerging economies and all countries at any level of development have reduced barriers to the inflows of foreign capitals, and ensure that domestic internal conditions are favorable to FDI (UNCTAD, 1999C). Some of the

national policies that attract FDI are; tax holidays, exemptions from import duties, and provision of subsidies. Avi-Yonah (2000) stated that since the year 1998, one hundred and three countries have given special tax treatments to foreign establishments that have established production or administrative facilities in their countries. These special tax treatments are given to foreign enterprises, but not to domestic companies that are in the same business ventures. The impact of FDI on income, growth and the channels through which FDI affects economic growth of the host country is not clear cut in the literature. Some empirical studies have shown that there is a positive relationship between FDI and income, but there are some researchers who believe the impact of FDI on income is ambiguous (Bloomström & Kokko, 1998; Pessoa, 2007; Wang, 2009). It is due to this ambiguity that motivates this study.

1.2. The Objective and Novelty of the Study

The main objective of this thesis is to examine the nexus between FDI inflows (per stock of FDI inflows) and income (per capita income and per capita income growth) for three countries (The Gambia, Ghana, and Senegal) using a methodology called wavelet analysis. I have not come across any empirical work on the relationship between income and FDI inflows for The Gambia, Ghana, and Senegal using wavelet analysis. The previous studies on other countries that investigate the relationship between income and FDI inflows used conventional econometrics analysis that captured the relationship between the variables in time domain only. This thesis goes beyond conventional econometric time domain analysis by using wavelet analysis that uses both time and frequency domain analysis. The advantage of using time-frequency domain to understand the relationship between variables is that it reveals many hidden information and relationships that conventional econometric analysis that uses only time domain cannot.

By using wavelet analysis to investigate the nexus between FDI and income, one can conclude that the main contribution of this study is the application of wavelet analysis. Moreover, another contribution is that the study examined how the interaction

of FDI and domestic investment (DI) affects income in each country. The impact of the interaction of FDI and DI on income is examined because according to De Mello (1999), the growth-enhancing effect of FDI depends on the degree of complementarity and substitution between FDI and DI.

1.3. Research Questions

This thesis seeks to answer the following questions;

- Is there a nexus between per capita income and per stock of FDI inflows (the level effect of FDI inflows)? If there is a nexus, how does this nexus change over different frequencies and over time?
- Is there a nexus between per capita income growth and per stock of FDI inflows (the growth effect of FDI inflows)? If there is a nexus, how does this nexus change over different frequencies and over time?
- What is the nexus between per capita income and per stock of FDI inflows in terms of leading and lagging over different frequencies and overtime time? That is, what is the direction of causality?
- What is the nexus between per capita income growth and per stock of FDI inflows in terms of leading and lagging over different frequencies and overtime time? That is, what is the direction of causality?

The remainder of this thesis is organized as follows: chapter two reviews the literature on income growth and FDI inflows. Chapter three discusses the theoretical modeling of the nexus between FDI-Income and also reviews FDI in each country used in this study. Chapter four explains the data and the methodology used to capture the relationship between FDI inflows and income. Chapter five gives the empirical results for The Gambia, Senegal, and Ghana. Chapter six summarizes and analyses the empirical results. Finally, chapter seven concludes the study and also gives recommendations.

Chapter 2: Literature Review

2.1. Introduction

In order to find answers to what determines the income or income growth of a country and to determine the link between income and FDI inflows, this chapter reviews some economic growth models. The chapter also reviews the literature on FDI by examining the channels through which FDI affects the income of the host country, the internal domestic conditions that must be in place for the host country to realize a positive benefit from FDI inflows, and the results of the previous empirical studies on The Gambia, Ghana, and Senegal.

2.2. Income and Economic Growth Models

Income growth is defined as a sustained increase in the output or income of a country over time. The role of income growth of a country cannot be overemphasized. Economic or income growth is responsible for more than tenfold expansion in income in the United States during the past century. The incomes in the United States and Western Europe are at least thirty times greater than incomes in most of the Sub-Saharan Africa. Hence, one can conclude that it is due to differences in economic growth between the United States and Sub-Saharan Africa that is responsible for such a huge difference in per capita income or standard of living (Jones, 1998). The obvious question is what is the United States doing that leads to tenfold increase in its income that the Sub-Saharan Africa or countries like Mexico or India are not doing? The importance of economic growth is not only known to economists but also to policymakers. Thus, economists started to embark on research to find out what determine the economic growth of a country.

The starting point of modern economic growth theory is the influential article of Ramsey (1928), but attention was not given to it by economists until 1960s. The paper is about household optimization through time. The paper is not only used in economic growth field but also in fields like consumption theory, business-cycle theory, and asset pricing. The model put emphasize on the importance of saving (Barro & Sala-i-Martin, 1995).

After the influential paper of Ramsey (1928), Harrod (1939) and Domar (1946) attempted to reconcile Keynesian ideas with economic growth during and after the great depression. Their model used production function but there is no substitution between inputs (labor and capital). Their model emphasizes the importance of saving in achieving economic growth. The model opined that for a country to achieve economic growth, it needs to save some portion of its income and invest it in physical capital. Investment in physical capital will ultimately lead to economic growth. Hence, growth in Harrod-Domar model is engineered by saving and investment in physical capital. The application of the model is very limited in today's modern economic growth because of no substitution between factors of production (Barro and Sala-i-Martin, 1995).

The dissatisfaction of economists to use Harrod-Domar model to explain economic growth led to two articles that gave economists more insight into causes of economic growth. These two articles were; Solow (1956) and Swan (1956). The ideas from the two articles formed what is now called Solow-Swan model or simply called Solow model. Their model now serves as the starting point when researchers want to analyze modern income growth or cross-country income differences. The model uses neoclassical production function with the assumptions of a constant return to scale, diminishing returns to factors of production, and the ability to substitute factors of production. The rate of saving is constant in the model (Barro and Sala-i-Martin, 1995). Economic growth in Solow-Swan model is engineered by the accumulation of capital, but if we look at the vast difference in per capita income around the world, the differences in capital accumulation cannot account for differences in per capita income around the world. Thus, the model concluded that growth is also affected by other exogenous variables such as technological progress and that to sustain growth in the

long run, a country has to sustain technological progress (Romer D. , 1996). The shortcoming of the Solow-Swan model is that we have a model that explains everything except the variable (technological progress) that is responsible for sustaining growth in the long run. Moreover, the long-run growth is also affected by a population that is exogenous in the model (Barro and Sala-i-Martin, 1995).

To solve this deficiency (exogenous technological progress) in the Solow model, Cass (1965) and Koopmans (1965) modified neoclassical growth model by introducing Ramsey's household optimization to the model where saving rate becomes endogenous variable. However, even after saving rate become endogenous variable, the sustainability of income growth still depends on technological progress which is still unexplained in the model. Technological progress is the creations of new ideas that enhances the productivity of factors of production. Since ideas are partially nonrival goods and their inclusion in the production function as another type of input would contradict the neoclassical assumptions of a constant return to scale and perfect competition, thus, technological progress remains unexplained variable in Solow model. But in order to have a better understanding of income growth, technological progress needed to be internalized in the model, that is, explained within the model (Barro and Sala-i-Martin, 1995). Some of the first papers that modeled new ideas into economic growth were Arrow (1962) and Sheshinski (1967), they modeled ideas as an unintended by-product of production or investment, which spillover in the economy. If the creation of new ideas is unintended, Romer (1986) believes that perfect competition assumption can be held, however, the result will not be Pareto optimal. If the creation of new ideas comes from purposive R&D and if the benefit of these ideas accrues to other firms gradually over time, then perfect competition cannot hold and Solow model needs to be adjusted to include imperfect competition.

The quest to find a model that explain technological progress led to the introduction of purposive R&D (creation of new ideas) and imperfect competition into economic growth and this started with Romer (1987, 1989). Lucas (1988) has also contributed to the endogenous growth model. Other important contributors to endogenous growth models were; Aghion & Peter (1990) and Grossman & Elhanan

(1993). In the endogenous models, technological change is a positive function of purposive R&D and incentives such as monopoly over newly created ideas. As long as there are new ideas in the economy, income growth will be sustained in the long run. Thus, in the endogenous growth model, the causes of income or economic growth are new ideas that are created through intentional R&D.

Finally, even though these different economic growth models are different in their assumptions, they emphasize the importance of investment and technology in promoting income growth. It is from the emphasize of these growth models that policymakers in many countries open their borders to foreign direct investment (FDI) or provide incentives to attract FDI with the notion that FDI will bring in needed investment and technology which can help them in their quest to start or sustain income growth in their countries. In the next section, the relationship between FDI inflows and income of a country is reviewed in details to understand how FDI affects the income of a country.

2.3. Foreign Direct Investment and Income

Countries at a different level of development see FDI as a source of economic development, innovation, growth in per capita and employment. Hence, countries of all size have opened up their economies in order to attract FDI and to find ways how they can influence domestic conditions so that the benefit from FDI can be maximized (OECD, 2002). The positive impact of FDI on the economies of developing countries is well observed. If the host country internal policies are favorable to FDI and achieved some level of development, FDI can engineer technology spillovers, support human capital development, aid foreign trade integration, promote competition in the host country, and improve enterprise development. All these positive impacts of FDI are ingredients for income growth which in turn can reduce poverty in developing countries. Furthermore, FDI can promote good practices such as transferring "cleaner" technologies and good corporate social practices (OECD, 2002).

The channels through which FDI has a positive impact on income can also have negative side effects. Thus, this study also looks at the potential negative impacts of FDI in the host country. While most of these negative impact of FDI is referred to as "cost" of FDI, they are an indication of the failure of the local policies of the host countries. Some of the negative impacts of FDI in the host country are the deterioration of the balance of payment (BOP) when direct investors repatriate profit, the absence of positive linkage with the local firms, environmental damage that comes from heavy and extractive businesses, and unfair competition in the domestic markets. Furthermore, an increasing dependence on FDI to achieve growth and development if not check can lead to loss of political sovereignty of the host country. The goal of achieving economic growth and development from FDI would remain a dream if the host country cannot take advantage of the transferred knowledge and technologies due to poor internal domestic policies (OECD, 2002). Thus, countries should not only endeavor to attract FDI but should also improve their internal domestic conditions for FDI to have a positive impact on their economies.

The subsection below reviews the theoretical literature by giving the official definition of FDI, types of FDI, analysing the channels through which FDI affects economic growth of the host country, briefly look at the internal domestics conditions that must be in place for FDI to have positive impact on the economic growth of the host country, and review the past empirical studies.

2.3.1. The Definition of FDI

There are many definitions of FDI, but this study adopts the definition given by Organization for Economic Co-operation and Development, OECD (OECD, 2008). FDI is defined by OECD (2008) as:

> *"A category of cross-border investment made by a resident in one economy (the direct investor) with the objective of establishing a lasting interest in an enterprise (the direct investment enterprise) that is resident in an economy other than that of the direct investor" (*OECD, 2008, p.19)

The incentive of the foreign direct investor is to have a long-term strategic affiliation with the direct investment enterprise to make sure that the direct investor has a large degree of influence in the management of the direct investment enterprise. The "lasting interest" is showed if the direct investor owns at least 10% of the voting power of the direct investment enterprise. FDI gives an opportunity to the direct investor to act as an economic agent in the economy of the direct investment enterprise which might be impossible to do without the direct investment. Unlike foreign portfolio investment, FDI tries to have an influence on the day to day running of the direct investment enterprise. FDI includes equity capital, reinvested earnings and intra-company loans. Direct investment enterprise can be subsidiaries where 50% of the voting right is held, associates where the voting right held there is between 10% to 50%, and a quasi-corporation like branches that are 100% control by the parent company (OECD, 2008).

2.3.2. The Channels through Which FDI Affects the Income

Other than serving as a macroeconomic stimulus in terms of increasing the stock of capital stock in the host country, FDI increases total factor productivity (TFP), that is, it increases the efficiency of the resources in the host country. These, in turn, induce economic growth in the host country. The increase in TFP by FDI occurs through three main channels: the link between FDI and international trade flows, the spillovers and other externalities in relation to the business sector of the host country (OECD, 2002). Moreover, De Mello Jr (1997) argued that the sources through which FDI affects the economy of the host country are factor accumulation and TFP. The idea that FDI affects economic growth of the host country comes from recent endogenous growth theories. These growth theories see the capital formation and technological improvement as an engine of economic growth and it is believed that FDI led to the transfer of capital and technology to the host country. Moreover, FDI also enhances the stock of the knowledge of the host country and since TFP is a function of the stock of knowledge in a country, then FDI must have a positive impact on TFP and in turn affects the economic growth of the host country.

There are many empirical studies that opined that FDI has more positive impact on TFP and economic growth relative to DI in the host country. It is extremely difficult to quantify the impact of FDI in the host country because the inflow of FDI to a country normally coincide with high economic growth in the host country which may be triggered by factors other than the inflow of FDI. Sometimes it is stated that the positive impacts of FDI are reduced by FDI crowding out DI, but this claim is ambiguous. There are some studies that found out that FDI complements DI while some concluded that FDI substitutes DI. In spite of everything, the net impact of FDI in the host country is generally positive, because the funds from the DI that has been crowded out are allocated to other areas of the economy (OECD, 2002).

The impact of FDI in the least developed countries is smaller and this is related to the availability of "threshold externalities". Evidently, there is a need for developing countries to achieve basic development in technology, infrastructure, education, and health in order to have full benefit from FDI. The poor state of financial markets in the developing countries also deprives host countries to gain the full benefit from FDI. Absent of strong financial intermediation in the host country has more impact on domestic firms than MTNs because it prevents them from taking advantage of business opportunities that come from the presence of foreign firms **(**OECD, 2002).

The channels through which FDI affects the economy of the host country are many and each channel can affect economic growth positively or negatively or even both (OECD, 2002) .Table 2.1 shows the channels through which FDI affects the economy of the host country (OECD, 2002; Moura & Forte, 2010).

Table 2.1: Channels through Which FDI Inflows Affect Growth

Channels	Positive Impact	Negative Impact
1.Technology transfers	X	X
2.Human capital development	X	X
3.Integration into global economy	X	X
4.Competition	X	X
5.Development of firms	X	
6.Difficulty in implementing policies		X

Source: OECD (2002); Moura & Forte (2010).

1. Technology Transfers

Studies identify technology transfers as probably the most important link through which FDI has a positive impact on the economy of the host country. Multinational (MTN) firms are seen as advanced technological firms because they spend an astronomical amount of money on R&D. Most of the world R&D expenditures are almost being carried out by MTNs (Borensztein, De Gregorio, and Lee, 1998). MTNs establishing a subsidiary or a branch in the host country means they are transferring advanced technology to the host country, this improves the economic performance of the host country (Frindlay, 1978). The technology dispersion the world is experiencing is believed to be from the establishment of firms around the world by MTNs (Ford, Rork, and Elmslie, 2008). Hence, MTNs have the ability to create technological spillovers depending on the sector and contexts they carried their

investments. The transfer and diffusion of technology occur through four interconnected channels (OECD, 2002);

- Vertical Linkages: This involves with suppliers and purchasers.
- Horizontal Linkages: This involves with the firms they compete with and the firms that complement MTNs in the same industry.
- Migration of skill labor.
- Internationalization of R&D.

There have been strong and reliable proofs of positive spillovers in the vertical linkages especially with the domestic suppliers (backward linkages) in the developing economies. However, empirical proofs of horizontal linkages are difficult to get. This is because the entry of MTNs into the economy of developing countries affects the domestic market structure in many ways which researchers cannot control easily. One of the causes of this might be foreign firms trying to prevent the spillover of technologies to their direct competitors. There are recent studies that stated that horizontal spillovers are more vital between firms that are in different sectors (OECD, 2002). The impact of the technologies transferred on the economy of the host country depends on the level of technological development of the host country's business sector. FDI would have positive externalities if the technology transferred has a significance impact on the business sector of the host country rather than only to the enterprise it was initially transferred to. There has been evidence that for FDI to be more productive than domestic investment, the "technological gap" between local firms and foreign investors have to be relatively narrow. If the "technological gap" is large, the domestic enterprises could find it hard to absorb the technology transferred through MTNs (OECD, 2002).

The growth rate of a country's economy depends on its state of technology it uses in transforming inputs to outputs. Developing countries depend on advanced technology brought by MTNs operating in their countries (Borensztein et al., 1998; Lim, 2001). The coming of these new technologies to the host country reduces the cost of R&D of the partnered local firms and through this, the local firms become more competitive (Berthelemy & Demurger, 2000). According to Lougani and Razin (2001),

comparing the gains from these technological transfers to financial investment or purchase of goods and service, the gains from the technological transfers are greater. Since technological transfers lead to increase in the productivity of domestic firms, many types of research have concluded that FDI is a source of economic growth in the host country (Saggi, 2002; Hermes & Lensink, 2003; Varamini & Vu, 2007). The partnership of MTNs and the domestic firms means the local firms supply products on behalf of MTNs, hence, MTNs ensure that the technology they transfer to the local firms will lead to the production of high-quality products (Rodriguez -Clare, 1996). The technologies transferred can also come in the form of training, technical assistance and any other essential information that can improve the quality and quantity of the products produce on behalf of MTNs (OECD, 2002). According to OECD (2002), MTNs help its local suppliers in the purchase of raw materials, intermediate products and improve the qualities of its facilities. Moreover, with the increasing pace of change in the business world and rapid technological change, the most noticeable changes brought by MTNs is the introduction of new products and new production processes, these are all sources of technological change (Bloomström & Kokko, 1998).

Technology transfer as a channel can also have a negative impact. The payment of royalties to the MTNs by the local firms for the use of foreign technology can have a negative impact on balance of payment (BOP) of the host country. Moreover, the MTNs with the objective of having a technological advantage in the host country might transfer technology that enhances their technological advantage but inappropriate for the host country's economy (Sen, 1998). Another negative impact is that the transfer of technology can lead to domestic firms' overdependence on foreign technology, and this leads to decrease in R&D in the host country (Vissak & Roolaht, 2005).

2. Human Capital Development

The major effect of FDI on human capital in developing countries is mainly indirect. The government of the host country plays the major role in enhancing the human capital. In the quest to attract FDI, governments of many developing countries design policies to improve human capital. The human capital of a worker could be improved

once he or she is hired by the MTNs through training and on-the-job learning. The enterprises the MTNs invested in can have an influence on the human capital through their interaction with other local enterprises. The improvement of the human capital can spill over to the whole economy as labor move from one enterprise to another and when some workers go out to form their own businesses (OECD, 2002).

Investment in education and training is the utmost significance in making sure the internal domestic environment is conducive for FDI. The host country should attain some minımum level of educational development in order to attract FDI and to ensure that the spillover of human capital from FDI is maximized. The minimum level of educational development depends on the industry type and the other internal domestic conditions. Education is necessary for significant positive spillovers of human capital to occur in the host country, but it is not sufficient to attract foreign direct investors, other internal domestic conditions such as good governance and good economic institutions also have to be in place. If there is a significant "knowledge gap" between the host country and the country of foreign direct investor, there will be no major human capital spillovers in the host country (OECD, 2002).

One of the internal domestic conditions to create a conducive environment for FDI is the labor market standard in the host country. Preventing discrimination and abuse in the labor market give workers chance and motivations to improve their human capital. A labor market where workers have some degree of security and social acceptance can lead to flexibility which in turn ensure the success of economic strategies and promote human capital. Moreover, it provides an environment where firms from OECD countries can clearly operate and apply the standards of their countries, these, in turn, contribute to the enhancement of human capital in the host country (OECD, 2002).

FDI contributes to economic growth of a host country by bringing expertise in new production and management methods. Furthermore, FDI brings workers that are highly skilled and this, in turn, increases the productivity of the domestic labor force and human capital (Zhang K. H., 2001a). The human capital is enhanced through

informal training provided by MTNs **(**Loungani & Razin, 2001; Alfaro et al., 2004) and via formal training that domestic laborers go through (De Mello, 1999; Oztürk, 2007). FDI is a channel through which advance technology to the host country is transferred, but for this technology to be used efficiently, the labor force should be highly skilled which is not often the case in many developing countries. Thus, MTNs provide both formal and informal training to upgrade the skills of the domestic labor force (Borensztein, De Gregorio, & Lee, 1998). MTNs are one of the main sources of training the domestic firms (OECD, 2002). According to Lim (2001), the workers trained by MTNs go on to establish their own firms using the knowledge they have accumulated while working for the MTNs. These local firms go on to transmit the knowledge to the people they hired in their new firms and this increases the capacity of the labor force in the host country.

The negative impact of FDI on human capital or labor is the need for fewer workers in the host country. The machines brought by MTNs mean less need for workers and this increases the unemployment rate in the host country (OECD, 2002). Since local authorities believe that MTNs provides training, they reduce public spending on training and the net impact of this on the labor force can be negative (Ford et al., 2008). The other negative problem is that highly skilled workers might move to another country since there are no much R&D activities going on because of overdependence on foreign technology (Vissak & Roolaht, 2005).

3. FDI and Integration into Global Economy

Another main contribution of FDI to the host country is its long-term role of integrating the host country into the global economy with both high volumes of imports and export. OECD (2002) stated that FDI helps the host country to integrate into the global economy through the financial flows. This has also been emphasized by Mencinger (2003), who showed a clear link between FDI inflows and the integration of the host country into world trade. The integration of the host country to the global economy generates economic growth and growth increases as the host country opens even more (Barry, 2000).

By copying the MTNs and accumulating knowledge from MTNs, the host country integrates itself into the global economy. MTNs know the process through which a firm or even a country can integrate into the global economy because they have undergone the process (Bloomström & Kokko, 1998)**.** The contacts local firms have with the MTNs help them to become subcontractors and multinational suppliers. This, in turn, leads the domestic firms to become exporters and this induces economic growth in the host country (Bloomström & Kokko, 1998). According to Zhang K. H (2001a), the contacts with MTNs enables the domestic firms to use the brand name of the MTN firms in the international markets.

The domestic firms are integrated into the global economy through the global strategies of the MTNs. This helps the local firms to penetrate the other markets where MTNs already exist or they replace the other suppliers of MTNs in those markets (OECD, 2002). MTNs are part of many associations that have enormous knowledge about the world market, thus, local firms forming a partnership with MTNs enables the domestic firms to have access to this enormous knowledge. Local authorities can respond to the demand of MTNs such as building infrastructures that promotes international trade, this, in turn, promotes the internationalization of domestic firms (OECD, 2002**).** MTNs include domestic firms in their international networks, this enables the local firms to form international links with other firms in the global market (Ford et al., 2008). If the FDI is made in the assembly lines, there will be an increase in the imports of components and increase in exports of final products. This increase in exports improves the productivity of the local firms (Makki, Shiva,and Somwaru, 2004).

The integration of the host country to the global economy is not without negative consequences. According to Mencinger (2003), the impact of FDI on import is far greater than on export and this has a negative impact on the BOP of the host country. The reason why imports are astronomical high relative to exports is that foreign firms need a large volume of inputs into the production process, these imports might be available in the host country but they may lack quality. Thus, they turn to imports to meet their production needs (OECD, 2002). Another reason is that the aim of FDI may

be to supply domestic markets and this does not stimulate export (Ram & Zhang, 2002). FDI is the main source of spreading economic crisis, especially those that are coming from the homes of MTNs (Vissak & Roolaht, 2005). Moreover, the objective of improving the host country's BOP through inflows of FDI might be counterproductive in the long run when the profits made by the MTNs are repatriated back to the home countries of MTNs (OECD, 2002; Ozturk, 2007). The payment of licenses and royalties for the use of the foreşgn technology also have a negative impact on the BOP (Sen, 1998). According to Loungani & Razin (2001), if the initial funds used by MTNs to finance their investments are local credits, the repatriation of the profit will even have more negative impact on the host country relative to when the funds are from external sources.

4. Competition

The competition created by FDI increases the quality of factors of production and encourage the accumulation of capital (Lee & Tchna, 2004). The coming of foreign firms means an increase in the number of suppliers in the host country. For domestic firms to keep their market share, they are forced to stand up to this competition and this ultimately improves productivity, lower the prices and efficiently allocate resources (Pessoa, 2007). As noted by Bloomström & Kokko (1998), the increased in competition forces domestic firms to embark on R&D, this helps them to gain additional market share and becomes multinational suppliers. The response of domestic firms to this competition lead to improvement in their technology, accumulation of equipment and training of their employees (Driffield, 2000; De Mello, 1997; Varamini & Vu, 2007).

The increase in the competition in the host country also produces undesirable effects. The competition may cause closure of many local firms that cannot withstand the competitive pressure from the foreign firms due to the advantage foreign firms have and this causes monopolies (Ram & Zhang, 2002; Zhang, 2001b). For domestic firms to endure this competitive pressure, they merged together to benefit from economies of scale and reduced competition which in turn can also lead to monopolies (Loungani & Razin, 2001). The activities of MTNs can lead to increase in income at the national level, but this comes at the expense of the disappearance of local firms as their income

fall relative to the income of MTNs (Zhang, 2001b; Hanson, 2001). According to Sahoo & Mathiyazhagan (2003), there is a possibility of multinational oligopoly and this causes the disappearance of domestic firms.

The competition also has an impact on access to human resources. The availability of better career prospects and the economic power of MTNs enable MTNs to attract better-skilled workers than the local firms, this hinders the hiring ability of local firms (Sylwester, 2005). Domestic firms depend on government expenditures such as production subsidies, however, this may be reduced when a government wants to balance the books if it incurred a lot of expenditure in attracting FDI, and due to the small size of domestic firms, this can have negative impact on their growth (Vissak & Roolaht, 2005).

The increase in competition also affects the firms' ability to get credit from the financial markets in the host country. Most often investments of MTNs are wholly or partly financed by local financial markets.These financing needs of MTNs increases competition for funds and lead to increase in the cost of borrowing and access to credits can also be difficult. This makes it difficult for domestic firms to obtain loans (Lim, 2001; Sylwester, 2005). Furthermore, competition for loans can cause domestic savings to reduce and makes access to loans even worst (Chakraborty & Basu, 2002). The increase in the cost of funds affects domestic firms more than MTNs because of the structure and low bargaining power of the local firms with financial institutions.The high cost of funds could also prevent local firms to take essential investments that are required for their growth and which may lead to their disappearance.

5. Development of Firms

FDI is seen as one of the main sources of changes in the development and reorganization of firms, this has a positive impact on economic growth of the host country (Hansen & Rand, 2006). There are two main areas where the domestic firms feel these changes. First, foreign firms because of their economic abilities relative to local firms, they enter into markets that have high entry barriers. This alters the structure of the national economy by removing or minimizing monopolies in the sectors where

FDI is carried out (Bloomström & Kokko, 1998). According **to** OECD (2002), if FDI is achieved via takeovers or privatization, their new methods of production and policies are incorporated into the firm that is being taken over or privatized. The adoption of these new policies and procedures create a need to bring in new skilled workers from the other subsidiaries of MTNs. If the new changes, policies, and procedure are more efficient than the existing ones before, there will be efficiency gains. The structure of the local firms can also change if local firms voluntarily adopt the policies and procedures of MTNs with the belief that they are more efficient relative to the ones local firms were using (Hansen & Rand, 2006).

6. The Difficulty of Implementing policies

According to Vissak and Roolaht (2005), FDI inflows are difficult or impossible to predict, hence, they are a source of instability. This has a negative impact on the host country's economic development policies (Sen, 1998; Vissak and Roolaht, 2005). Another negative impact is that if the inflows are sudden and too high, it may lead to inflation in the host country (Sen, 1998). Moreover, the autonomy of the local authorities may be at threat (Duttaray, Dutt, & Mukhopadhyay, 2008). The MTNs have a large impact on the labor force of the host country via their hiring and layoffs and this may give them the advantage to influence the political and economic process in the host country (Zhang K. H., 2001b). The MTNs can put pressures on local authorities to make policies that are beneficial to their operations but at the expense of the economic growth of the host country (Zhang, 2001b; Ram & Zhang, 2002).

2.3.3. The Internal Domestic Conditions

Finally, from Table 2.1, there are many channels through which FDI inflows affect the income of the host country. The impact can be negative, positive or both. What makes these impacts to occur or prevent them from occurring depends on the internal domestic conditions. The internal domestic conditions that must be in place for

a host country to derive maximum benefits from FDI inflows are; Sufficient level of human capital, development of the financial sector, technological development, an open economy, and transparency of the legal system, and the political stability in the host country (Chowdhury & Mavrotas, 2003; Ashegian, 2004**).** The level of human capital, the level of technological development, and the development of the domestic financial sector are the main determinant of the absorptive capability of the host country to adopt the foreign technology and knowledge. The absence of developed domestic financial markets, sufficient domestic technology, and human capital limit the abilities of domestic firms to adopt foreign technology and knowledge. Furthermore, De Mello (1999) argued that the impact of FDI on the economy of the host country depends on the degree of complementarity and substitution between FDI and domestic investment (DI).

2.3.4. Previous Empirical Studies

There have been many studies that investigated the relationship between inflows of FDI and the income of the host country and the findings are mixed. The results of the studies seem to depend on the type of FDI data used (stock or flow) and the methodology employed. However, there are few studies that have been conducted on The Gambia, Ghana, and Senegal especially The Gambia. Table 2.2 shows the empirical studies that have been conducted between FDI and income for The Gambia, Ghana, and Senegal.

Table 2.2: Previous Empirical Studies On FDI and Income Nexus

Study	Sample; Period	Result
Adeniyi and Omisakin (2012)	Ivory coast, Gambia, Ghana, Nigeria, and Sierra Leone for period 1970 – 2005.	FDI has an impact on growth in the Gambia, Ghana, and Sierra Leone depending on the type of variable used as a proxy for financial development. The relationship between growth and FDI in Nigeria is not affected by the level of financial development.
Gibba and Mark (2016)	Gambia; 1970 -2013	FDI has positive impact on growth but not significant
Esso (2010)	Senegal and Ghana and eight other Sub-Saharan African countries: 1970 - 2007	The study found a positive long-run relationship between growth and FDI in Senegal. GDP significantly impact FDI in Senegal. The author could not find result for Ghana
Keho (2015)	Senegal, Ghana and ten other Sub-Saharan African countries; 1970 - 2013	FDI and GDP are positively related in the long run in Ghana. In the short run, there is a bidirectional causality between FDI and growth in Ghana. In the long run, GDP causes FDI in Senegal, and the relationship is positive.
Tekin (2012)	Gambia, Senegal and 16 other African countries; 1970 – 2009	GDP granger-causing FDI in Gambia. Export granger-causing FDI and GDP serves as an auxiliary variable in Senegal

2.4. Conclusion

This chapter reviews the literature for the determinant of income of a country. According to different economic growth models, the sources of income growth is;

investment and technological progress. Policy makers attract FDI in order to promote capital accumulation (investment) and technological progress with the ultimate goal of sustaining per capita income. However, the impact of FDI on income is ambiguous in the literature. FDI inflows have both positive and negative impact on the economy of the host country. The negative impact is usually an indication of the failure of the domestic policies. Thus, if domestic policies can be made to be conducive for FDI inflows, a country can derive maximum benefits from FDI inflows.

There are many influencing factors for FDI to have a net positive impact in the host country or for the host country to derive maximum benefits from FDI inflows, but the main determining factor is the degree to which FDI is a substitute or a complement to domestic investment, DI. For technology and knowledge to transfer as well as diffuse in the host country, FDI inflows have to complement domestic investment. FDI inflows complementing DI means the foreign direct investors and local firms establish positive linkages and this ensures that local firms act as agents of transfers and spillovers in the host country.

The next chapter models the theoretical link between FDI and income of the host country.

Chapter 3: Theoretical Model of FDI-Income and Overview Of FDI

3.1. Introduction

The last chapter reviews the literature on the income-investment nexus by using economic growth models, the channels through which FDI affects the income of the host country, the internal domestic conditions that must be in place for the host country to derive maximum benefit from FDI, and also reviews the results of the past empirical studies on FDI-income in The Gambia, Ghana, and Senegal. This chapter briefly examines the parameter throgh which FDI affects the income of the host country. The chapter also makes a brief overview of FDI in The Gambia, Senegal, and Ghana

3.2. Theoretical Model of FDI and Income

To established the theoretical relationship between income and FDI, the study follows the theoretical framework developed by Barro and Sala-i-Martin (1995) and the technological model suggested by Hermes and Lensik (2003). The model made the following assumptions:

- It assumes that there are three economic agents in the economy; the producers of the final output, innovators (R&D firms), and households.
- The producers hire labor and other intermediate factors of production which they combine to produce the final output.
- The R&D firms allocate their resources to invent new products. R&D firms are given a perpetual patent right once they invented a new product. The patent right enables

innovators to sell their newly invented product at any price they wish. They choose a price that maximizes their profit.

- Households maximize utility subject to the usual budget constraint.
- The producers operate in a competitive market with the aim of maximizing their profits.
-

After the maximization of monopoly profit by the R&D firms, the maximization of profit by the producer of final goods and service in a competitive market and the utility maximization of households', equation [3.1][1] below is obtained.

$$[3.1] \qquad g = (1/\theta)\,[\ (L/\vartheta)\ .A^{1/(1-\alpha)}\ .\ \left(\frac{1-\alpha}{\alpha}\right).\ \alpha^{2/(1-\alpha)} - \rho$$

For equation [3.1] to be valid, $g \geq 0$, this ensures that R&D firms have enough incentives to allocate resources to R&D. Equation [3.1] shows that the determinants of income growth are: the households preference parameters (θ and ρ), the total factor productivity (A), and the cost of inventing a new product (ϑ). If people have more willingness to save (lower θ and ρ), advanced technology (higher A), and lower cost of inventing a new goods (lower ϑ), the economy would experience economic growth and vice-versa.

The next important step is to determine how FDI affects income growth rate, g, in equation [3.1]. How FDI affects income or economic growth rate depends on how FDI affects the determinant of economic growth rate (θ, ρ, A, and ϑ). Borensztein, et al (1998) stated that the cost of R&D, ϑ, is inversely related to the number of foreign firm in the host country. Thus, the cost of R&D is an inverse function of FDI as in equation [3.2];

[1] Check Economic growth text book of Barro and Sala-i-Martin (1995) for the steps involve in the derivation of equation [3.1]

[3.2] $\vartheta = f\ (FDI)$ Such that; $\frac{\partial \vartheta}{\partial FDI} < 0$

Equation [3.2] shows that FDI inflows lower the cost of R&D and this induces economic growth in the host country. If equation [3.2] is substituted into equation [3.1], we have an equation that shows the impact of FDI on income growth through the cost of R&D as in equation [3.3];

[3.3] $$g = (1/\theta)\,[\ f(FDI)^{-1}\ .\ L.A^{1/(1-\alpha)}\ .\ \left(\frac{1-\alpha}{\alpha}\right).\ \alpha^{2/(1-\alpha)} - \rho$$

FDI lower the cost of R&D in the host country because the inflow of FDI into the host country gives domestic firms the opportunity to imitate foreign technology, and imitation is cheaper than innovation. The higher the inflow of FDI in the host country, the higher the chance of imitation, and this leads to technological transfer and diffusion from FDI inflows.

3.3. An Overview of FDI in The Gambia

The government sees the private sector as a key player on the road to achieving economic growth, though, some of the key areas such as groundnut manufacturing, television and radio broadcasting and defense is managed by the government. Legally, there is no different treatment between foreign and local firms. The government efforts

of attracting FDI kick started in 2002 when an organization called The Gambia Investment Promotion and Free Zones Agency (GIPFZA) was established. The job of GIPFZA was to establish and manage Free Economic Zones (FEZs) around Banjul International Airport. In the year 2010, GIPFZA was renamed and called Gambia Investment and Export Promotion Agency (GIEPA). The restructure came because of recognizing trade (export promotion) as a source of growth, and to give support to small business enterprises. After the restructuring, under the GIEPA Act 2010, FEZs become Export Processing Zones (EPZ) and more incentives were created under the act to attract more foreign investors. GIEPA lay down the legal requirements for investing in The Gambia (United States DOS, 2015).

A new business in The Gambia could be registered as a sole proprietorship, partnership, company or other type of businesses (subsidiaries, cooperatives etc.). The new Single Window Business Registration methods shorten the length of time to register a new company. A new company is required to get a registration form, have a special name for the company which cost GMD500 and get a tax identification (TIN) number which cost GMD50. The registration form and the TIN number are taken from the Ministry of Justice. These forms are submitted at the Ministry of Justice with a registration fee of GMD1000. The registration could be done in one day. The new company pays incorporation fee. The amount of incorporation fee depends on the share capital of the new company. The incorporation fee for each share capital is stated below;

Share Capital (GMD)……	Incorporation fee
1-500,000	GMD10, 000
500,000-1,000,000	GMD15, 000
1,000,000 – 10, 000, 000	GMD20, 000
10,000,000 - above	GMD25, 000

The government of The Gambia promote investment in all sectors of the economy, however, there are “priority sector” that are given special investment certificate and incentives such as tax holidays and duty waivers. These “priority sectors

are air services, agriculture, fisheries, energy, light manufacturing, information communication technology, tourism and river transport. A minimum investments of US$100,000.00 and US$250,000.00 by local investors and foreign investors respectively are granted with the following incentives: tax holiday, tariffs and import VAT incentives, export promotion incentives, zone investor incentives, and allocation of land for the site of proposed investment and its infrastructures (United States DOS, 2015).

There are no regulations that require that the nationals own a certain percentage of shares in a foreign firm or that the foreign capital to be reduced over time. Since the establishment of GIPFZA now called GIEPA in 2002, the number of projects awarded was 145. Many of these projects were fully established, and as at December 2013, 54 were in operation. These companies are overseen by GIEPA and they have led to direct job opportunities of more than 5039 jobs. At the end of the year 2013, the total value investments of these projects are believed to be around $240.43 million. The main partners are India, Lebanon, Mauritania, Nigeria, China and The United Kingdom**.** In order to speed up establishing a business, GIEPA has established "One-stop shop" that aimed to make the process of investment more efficient. A delegation from countries such as Turkey, Nigeria, Qatar, Bulgaria, Romania, Poland, Indonesia, Taiwan, India etc. have visited The Gambia to look for investment opportunities in the areas like construction, agriculture, and tourism (United States DOS, 2015).

The restriction on foreign ownership of business does not exist except in the businesses like foreign exchange bureaus, television broadcasting, and defense industries and these business are also closed to the Gambian investors as well. Moreover, foreign investments are not compulsory screen, though, a foreign firm can undergo screening if there is a mistrust of terrorism financing and money laundering. Foreign firms enjoy the same national treatment as the domestic firms and in the event of privatization of state enterprises, foreign firms and domestics firms are treated equally. Foreign investors are encouraged to partake in privatization programs. The only tax foreign investors pay is payroll tax for each expatriate employee of the enterprise. There are no rules that constrain the repatriation of profits or remittances as long as it is carried out via the banking system or registered money transfer firms. The Central Bank of The Gambia introduced foreign currency denominated account in 2001 to enhance foreign trade and FDI. There is no restriction on the amount of remittances of profit,

capital, capital gain, debt service, imported inputs or return on intellectual property. Though, the maximum amount of money a traveler could take through Banjul Airport isUS$10, 000 (United States DOS, 2015).

The 1997 constitution of The Gambia gives the legal channel that protect private property and gives force acquisition of private poverty by the state only if this is essential for public order, defense, public safety, public health and public morality. The Constitution and the Compulsory Acquisition Act provide provision for quick compensation. The Gambia has no laws that require local ownership in a company. The Gambia belongs to International Center for the Settlement of Investment Disputes (ICSID). In order to settle disputes outside the courts system, The Gambia Chamber of Commerce and Industry (GCCI) are looking for sponsor in order to form a Dispute Resolution Center. The Gambia is a member of both Paris Convention for the Protection of Industrial Property and the Bern Convention for the Protection of Literary and Artistic Works. The Gambia has its own copyright since 2003, this right adequately protects intellectual property, copyrights, patents and trademarks. Furthermore, The Gambia is a signatory to WTO TRIPS and WIPO Copyrights Treaty (United States DOS, 2015).

The main sectors that attract FDI are the tourism sector and agro-processing sectors, though, some notable investments have been made in the financial sector, IT sectors, and power generation in the past five years. The service sector is the main contributor to Gross Domestic Product, GDP (62 % of GDP), and tourism is the main contributor to service sector in The Gambia. Agriculture is the second contributor to GDP (23% of GDP) and it contributes to 78.6 percent to employment. It can be seen that FDI is contributing to sectors that are the main contributor to GDP and employment. Lebanese and Malaysians have been forerunners in investing in power generations. There have been many start-ups in IT sector and two mobile operators have been established as well. Most of the investment in the financial sector are foreign owned. Seven of the 12 commercial banks are owned by Nigerians at the start of the year 2014. Two banks are regional, one is British bank, one is Malaysian bank, and the remaining one is with greater Gambian share. Thus, the financial sector in The Gambia

is dominated by foreign investment. The telecommunication sector also has large foreign investment, two of the four cellular enterprises are largely owned by Lebanese interest. The National Water and Electricity Company (NAWEC) responsible for power and water supply also has large Lebanese interest under the group name Global Electrical Group (GEG). The group is also responsible for the country fuel supplies via their huge investment in fuel storage depot in The Gambia. The tourism sector investment is also being dominated by foreign nationals such as Scandinavians, British, French, Spanish, Italian, German, Dutch, and the Lebanese. The trading sector is also being dominated by foreigners. In conclusion, in The Gambia foreign investment dominates many sectors that are essential to the growth of the economy (United States DOS, 2015).

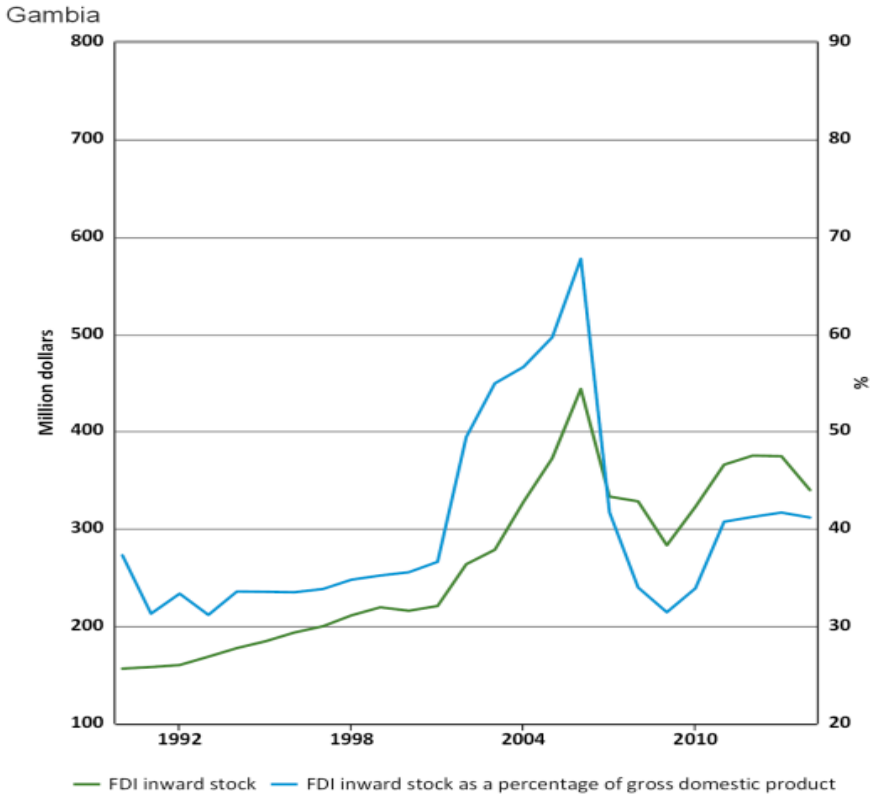
Figure 3.1 shows FDI inwards stock (in millions) and FDI inward stock as a percentage of GDP. The stock of FDI inflow has increased from 1990 to 1999 then it decreased to 216.02 million dollars in 2000. The stock started to increase from 2001 till to 2006 where it recorded its highest value (443.669 million dollars). After 2006, the stock of FDI inflow decreased between 2007 and 2009, this was due to global economic recession. The stock starts to show an upsurge after the global recession until the year 2012 where the figure started to decrease again. Table 3.1 also gives a summary of FDI statistics in The Gambia.

Table 3.1: The Trend of FDI Inflow in The Gambia

Foreign Direct Investment	2013	2014	2015
FDI Inward Flow (million USD)	38	28	11
FDI Stock (million USD)	374.6	339.8	350.4
FDI Inwards (in % of GFCF)	20.9	13.7	6.0
FDI Stock (in % of GDP)	41.7	41.3	39.2

Source: UNCTAD, 2015.

Figure 3.1: The Trend of FDI Inflows in The Gambia



. Source: UNCTAD, 2015.

3.4. An Overview of FDI in Senegal

Senegal has welcoming policies for FDI. The country has a large inflow of FDI at the end of the 1990s. Throughout history, France has been the main investor in its economy. The financial crisis that happened from 2008 to 2009 led to a reduction in FDI inflows by 20 percent. The growth of Senegalese economy hugely depends on European growth. From UNCTAD reports, there was a significant increase in FDI inflows from the year 2012 (USD $276 million) to the year 2014 (USD $343 millions). There was an exploration of the underwater gas field which is position in the Senegalese-Mauritania waters. This gas field has vital resources and has potential to attract FDI in the near future. France is it biggest investors but it shares has been declining as other foreign firms from Togo, Morocco, India, and the United States have done FDI in Senegal. The United States firms have undertaken investment in

information technology sector, pharmaceutical, natural gas, power generation, agribusiness, and oil exploration. A United States organization called Millennium Challenge Corporation (MCC) that gives development grants to countries that are committed to reforms with a per capita income of USD$4,125 or less started a compact project worth USD$540 million to develop transport and irrigation infrastructure in northern Senegal and the development of transport infrastructure in the southern Casamance region (United States DOS, 2015).

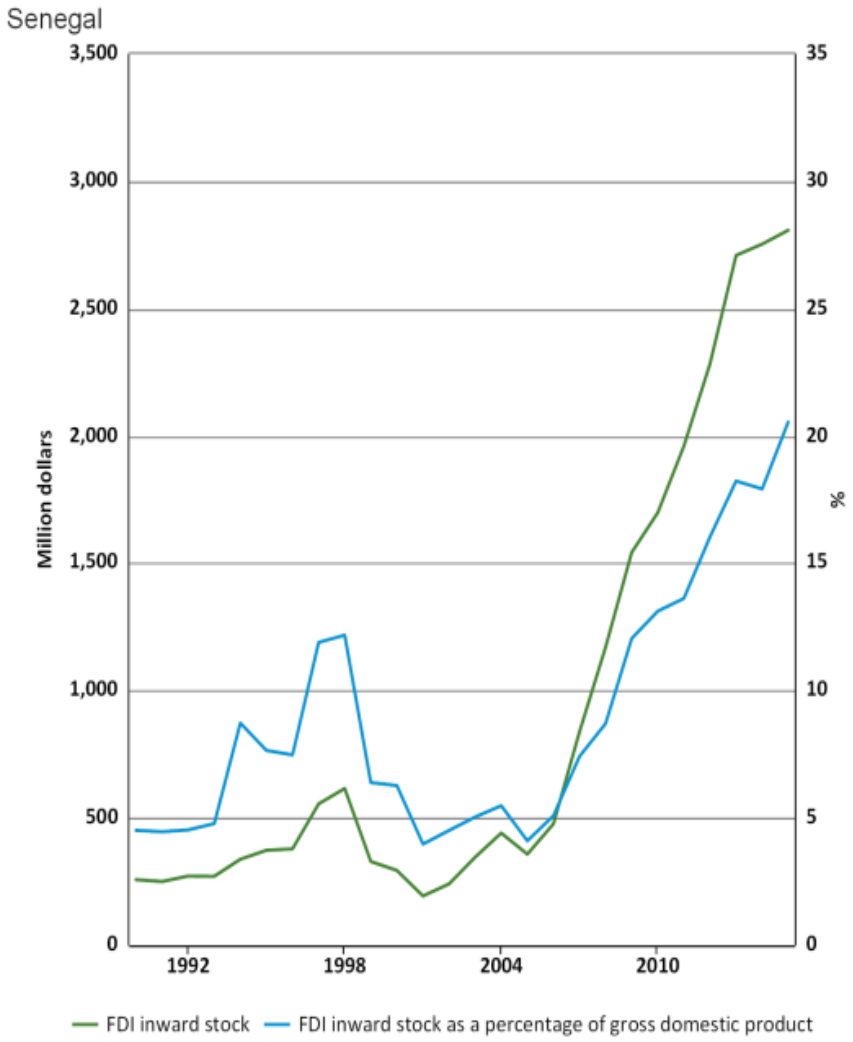
In the World Bank doing Business in 2016, Senegal was ranked 153rd from 189 countries, this is an improvement of three places from the previous year. The stock of FDI is large relative to its region, and the origin of most of the stock of FDI is France. The large influx of FDI in 2014 was caused by a plan called 'Emerging Senegal Plan'. The Emerging Senegal Plan is to invest in infrastructure, power grid, drinking water, healthcare, and agriculture. The yearly inflow of FDI stands at USD$300 million, this can be seen in Table 3.2 that shows the trend of FDI inflows from 2013 to 2015 for Senegal. From the Table 3.2, all the FDI statistics have been increasing from 2013 to 2015.

Table 3.2: The Trend of FDI Inflows in Senegal

Foreign Direct Investment	2013	2014	2015
FDI Inward Flow (million USD)	311	403	348
FDI Stock (million USD)	2709	2753	2808
FDI Inwards (in % of GFCF)	8.3	10.3	9.8
FDI Stock (in % of GDP)	18.2	17.9	20.5

Source: UNCTAD – 2015

Figure 3.2: The Trend of FDI Inflows in Senegal



Source: UNCTAD, 2015.

The evolution of the stock of FDI inflows and the stock of FDI inflows as a percentage of GDP for Senegal can be seen in Figure 3.2 above. The Figure 3.2 shows that both graphs have been increasing over time, hence, the increasing share of the stock of FDI inflows to national income shows the importance of FDI inflows in Senegal.

There is no control over the ownership structure and a foreign investor can have 100 percent ownership of a business in Senegal in many sectors. The restricted sectors where foreign firms cannot have 100 percent ownership are; water, electricity

distribution, and port services. Some foreign investments are screened to ensure that the investment is compatible with the economic development of the country and that it does not violate any environmental regulations. If the government is involved in financing any foreign investment, the financing arrangement is also reviewed by the Ministry of Finance to make sure that financing arrangement is compatible with budget and debt policies. The priority sectors where investment opportunities are for foreign investors are agriculture and agribusiness, tourism, fishing, health care and other sectors. The 2004 Investment Code gives a guarantee of equal treatment of foreign firms as well as repatriation of profit and capital. Senegal is a party to UNCTAD's international network of transparent investment procedures. Senegal is part of West African Economic and Monetary Union (WAEMU), a monetary union form by eight countries. The Senegalese money (CFA franc) is pegged to Euro (1Euro is 655.957CFA). The investment code of Senegal guarantees investors repatriation of capital and earnings and access to foreign exchange subjected to some financial procedures. Transfers by commercial business can be done through financial institutions as quickly as possible. The maximum amount of foreign exchange a traveler leaving Senegal can carry with is 6 million CFA (approximately USD 10,000). Senegal has a Bilateral Investment Treaty with the U.S where investment funds can be transferred freely. The investment code of Senegal protects investor from nationalization of private property or expropriation with exceptions for "reasons of public utility" that would include "just compensation" in advance. In case of dispute, investors can solve the disputes within the Senegal legal system which is based on France model or through arbitration. Senegal is considering to establish commercial courts in order to eradicate the challenge investors' encounter in settling disputes (United States DOS, 2015).

Senegal provides series of investment opportunities depending on the firm size, the location of the investment, the sector, and the capital invested. For a firm to qualify for fairly large incentives it must invest an amount of USD$165,000 or an investment that increases 25 percent of the productive capacity or more. By contrast, investments that are only related to trading activities hardly attract investment incentives. The sectors that qualify for investment incentives are agro-processing and agriculture, livestock, fishing, tourism, manufacturing, mineral exploration and mining, banking, and others. The government exempts firms from import duties, direct and indirect taxes

and another form of taxes provided that the firm meets the criteria of investment incentives. Foreign firms located outside the capital of Senegal (Dakar) enjoy more incentive benefits (United States DOS, 2015).

3.5. An Overview of FDI in Ghana

The abundance of natural resources and the conducive business environment make Ghana one of the highest rank FDI destination in Africa. Most of the FDI investment are in the mining sector. Hence, the challenge the government of Ghana (GOG) is to find ways to promote investment in other sectors such as agriculture, agri-food and other manufacturing sectors by private investors. There are efforts by the government to reduce the complex and long procedures, and providing tax incentives to attract FDI. Being one of the most democratic countries in its region and combine with cheap and huge labor force, large agricultural base, many natural resources, and with the longstanding institution, Ghana is able to attract a lot of FDI. Though, the obstacles to FDI are a low level of productivity, high level of bureaucracy, high cost and difficulty of getting financial services, the poor state of infrastructure, inadequate water, and power supply etc. (United States DOS, 2015).

The inflow of FDI has been steadily increasing in Ghana. Ghana was ranked fourth as the largest recipient of FDI in Sub-Saharan Africa in 2013. Though, the inflow of FDI reduced in 2015 due to a decrease in the price of oil and this lead to more foreign interests in the mining sector. FDI in 2014 was USD 3.4 billion, but this fall by 31% in 2015. The government of Ghana and Turkey signed four agreements in order to encourage FDI. This agreement was undertaken when Turkish President paid a visit to Ghana in March 2016. Ghana is continuously trying to attract investment that will lead to its labor market development. In the World Bank's 2016 Doing Business report, Ghana was ranked 114th out of 189 countries, a big deterioration of the business environment compared to 2015 ranking. Most of the FDI are in mining and oil exploration sector, and most of the FDI come from U.K, China, India, and Lebanon. The minimum infrastructure funding gap for Ghana is USD1.5 billion each year, hence, attracting FDI is high on its policy agenda. The government of Ghana (GOG) realizes

that to attract FDI, its legal environment needs to be conducive for FDI. GOG makes laws to attract FDI and withdrawn laws that are unconducive to foreign investment (United States DOS, 2015).

Any company that wants to do business in Ghana whether a foreign-owned or locally owned are required to register with the Registrar General's Department (RGD) within the framework of either the Partnership Act of 1962 or the Companies Code of 1963. There is no difference between foreign and local investors except in the areas of minimum capital requirement. The data from RGD office shows that 90% of the companies registered are micro firms which have less 99 workers and a maximum fixed assets of $1 million. The “eGov” project conducted by RGD and the Ghana Revenue Authority (GRA) aims to re-register all the previous registered businesses and taxpayers with the goal of modernizing the tax admiration in 2013. Establishing a business also requires the company to obtain Tax Identification Number (TIN) by registering with the Domestic Tax Revenue Division of the GRA (United States DOS, 2015).

The Ghana Investment Promotion Centre (GIPC) Act of 1994 (Act (478) provides guidance on foreign investment. However, the GIPC Act of 2013 (ACT 865) replaced the GIPC Act of 1994. One of the goals of the GIPC Act of 2013 is to cover the provision for all kind of investment whether foreign or domestic. Thus, the GIPC Act of 2013 eradicates sectors that are exempted in the GIPC Act of 1994 and provide provisions for all sectors, this includes mining and petroleum firms. The GIPC is responsible for promoting investment in Ghana and registration, however, foreign investors might be asked to also register with the Minerals commission or Ghana Free Zone Board. This enables the business to apply for both Free Zone and GIPC status (United States DOS, 2015).

The minimum capital requirement asked of foreign firm has exponentially increased. The minimum requirement for foreign-owned business before the GIPC Act of 2013 was US$50,000 to US$500, 000 while for a joint-venture was from US$10, 000 to US$200, 000. For trading companies the minimum capital requirement increase from US$300, 000 to US$1, 000, 000 and it must employ 20 Ghanaians that are skilled. The GIPC Act of 2013 has provision where local partners should not have less than 10% of

the ownership of the business. The transfer of local ownership to a foreigner is prohibited in the provision of Act 865. A business that is not fully owned by a Ghanaian is required to register with the GIPC and it should shows the foreign capital invested. The registration process according to authorities takes 5 working days. If the company is foreign-owned then registration fee is required and the registration must be renewed every two years at a cost of US$500. There is a extra payment for the working permit of foreigners. Moreover, foreign investors have to show that they have transferred their capital and the business plan that includes the capital structure, number of people to be employed, the impact the business will have on the environment, and main activities (United States DOS, 2015).

The GIPC Act of 2013 gives unconditional assurance to foreign investors about the transferability of dividends and remittance or when a company liquidate their enterprises. The Act provides assurance against expropriation and settlement of disputes. There are many incentives that the Act provides to attract FDI, however, the incentives are not explicitly stated in the GIPC Act, but there are many laws within which the incentives may be given. The firms that import their inputs must apply for exemptions on the imported goods or for special privileges. To be exempted from duty, the importing firm must first apply to GIPC with an application fee. The amount of application fee to be paid depends on the invoice of the goods imported. An invoice value of US$100, 000 is required to pay a fee of US$500 while an invoice value greater than US$1 million the fee is US$5, 000 (0.5%). After the application at the GIPC then the importing firm can apply for duty exemption at the Customs Head Office, this happens only when the goods arrive at the port. Since from January 2014, investors that invest in the non-traditional export sector are taxed at a company rate of 8% rather than the standard rate of 25-30% (United States DOS, 2015).

There are many sectors that GIPC Act of 1994 restrict foreigners from participating and the GIPC Act of 2013 included even more sectors. The excluded business are; the taxi business and the rental car business if the vehicles is less than 25 fleet, lotteries, and the barber and beauty business. The business of exercise books and stationary production is also not opened to foreign investors, the operation of pharmaceutical products etc. These restrictions are meant to ensure that some sector are fully-owned by Ghanaians citizen, however, this is in conflict with the treaties of

Economic Community of West African States (ECOWAS) a regional bloc which Ghana belongs to. There are restriction in sectors like fishing, maritime transport and the sub-sector of postal services and firms on the Ghana Stock Exchange. Sectors like oil and minerals require local participation and a government ownership of 10% without at a cost. The constitution of Ghana within Article 266 provides provision that a land cannot be owned by a land in Ghana, however, they are allowed to lease a commercial, agricultural, residential, or industrial for up to 50 years period. The government aims to develop a framework that will enhance the relationship between local land owners and the foreign investors. The ultimate goal of this frame work is to enhance production and without land conflicts with the locals (United States DOS, 2015).

The database of UNCTAD on International Investment Agreements (IIAs) shows that Ghana has signed 26 bilateral investment treaties and eight of these are implemented. These agreements are meant to promote inward foreign investment as the provisions are meant to protect investors from changes in policies, settle disputes between investors and the state. Ghana belongs to Multilateral Investment Guarantee Agency (MIGA) as well as the International Centre for the Settlement of Investment Disputes (ICSID). Ghana has double taxation agreement treaties with Switzerland, South Africa, the Netherlands, Italy, Germany, and Belgium. Table 3.3 shows some trend of FDI statistics in Ghana. Table 3.3 shows that the contribution or the share of stock of FDI to GDP in Ghana has been increasing since 2013 (United States DOS, 2015).

Table 3.3: The Trend of FDI Inflows in Ghana

Foreign Direct Investment	2013	2014	2015
FDI Inward Flow (million USD)	3, 226	3, 357	3, 192
FDI Stock (million USD)	19, 848.1	23,205.1	26,397.4
FDI Inwards (in % of GFCF)	29.6	36.0	37.9

FDI Stock (in % of GDP)	41.5	60.1	73.2

Source: UNCTAD – 2015.

3.6. Conclusion

This chapter model the relationship between income and FDI inflows. The model shows that the impact of FDI inflows on the economy of the host country works through the cost of R&D. The nexus between the cost of R&D and FDI inflows is negative, thus an increase in the flow of FDI into a country reduces the cost of R&D and this ultimately leads to economic growth in the host country. Furthermore, the chapter also briefly reviews the trend, the source, the sector that attracts FDI, and the incentives each country provides to attract FDI.

The next chapter discusses the data and the methodology that is employed to empirically investigate the link between FDI inflow and income.

Chapter 4: Data and Methodology

4.1. Introduction

The last chapter reviews FDI in the countries that are used in this study by looking at the sources of FDI, the trend, and the incentives each country provides to attract FDI. This chapter discusses the data type, the sources of data, and the method (wavelet analysis) that is used to find the empirical relationship between FDI and income of the host country.

4.2. Data Description

The variables used in this study are: per stock of FDI inflows, per capita income, per capita income growth, the total stock of FDI inflow, and total gross fixed capital formation (a proxy for domestic investment, DI). The data is an annual data ranging from 1980 to 2014/2015. The source of the FDI statistics is United Nations Conference on Trade and Development (UNCTAD) while per capita income, per capita income growth and gross fixed capital formation were taken from World Bank development indicators. In the appendix, Table A shows the name of the variables used in the study and their original sources.

4.3. Methodology

Most of the methods used in investigating the empirical relationship between income and FDI used the traditional econometric methods that mostly used time domain analysis. In these previous studies, the relationship between the variables is examined only in the time domain, thus, these studies did not examine the nexus between income and FDI at different frequencies. Moreover, since the previous empirical results study the nexus between FDI and income using aggregate date, it can be concluded that the previous studies assumed that the nexus between FDI and income is the same at all frequencies (scales). According to a Nobel Prize winner in economics in 2003, Clive Granger, there is no reason to assume that the nexus between economic time series at different frequencies is the same. Thus, investigating the nexus between economic variables by taking account of both time and frequency dimensions is paramount important for economic analysis.

In order to reveal the true relationship between income and FDI by taking into account both time and frequency dimensions, this thesis goes beyond the conventional econometric methodologies (time domain analysis) and used wavelet approach. In the wavelet analysis, both time and frequency domains are taken into account when investigating the relationship between variables. Wavelets are like a lens that help the researcher to examine relationships that were unobservable before (Ramsey J. B., 2002). The ability of wavelet to decompose data into time-frequency space at which the inhomogeneity happens, many problems in economic series such as structural breaks and outliers are easily detected by wavelet analysis relative to conventional econometric methodologies. Most time series use in economics and finance are normally non-stationary, nonlinear, and their frequency depends on time. A time series having such complicated characteristics such as unexpected changes, jumps, volatility clustering, and outliers, wavelet transform via filtering is more suitable to evaluate such series than conventional econometric methodologies. What wavelet analysis does is to separate aggregate data into different time-scale components which give a valuable information on the nexus between variables (Ramsey, 2014).

According to Ramsey & Camille (1998a,b), examining economic relationships with respect to different time-scales (time-frequency space or planning horizons) in the data can help increase our understanding of the complex dynamic economic relationships among variables that are nonstationary. Most previous empirical studies that investigated the nexus between income and FDI used traditional methodologies that examined economic relationships on an aggregate level, this veiled some relationships between economic variables. In wavelet analysis, economic variables are decomposed or break down into different time-scale, this reveals many veiled relationships. Decomposing economic date into different time-scale reveals the nexus between economic relationships more accurately relative to using aggregate data.

4.3.1. Wavelet Analysis

In the year 1807, Jean Baptiste Joseph Fourier, a French Mathematician, stated that any kind of periodic function can be expressed as an infinite sum of cosine waves and sine waves at different frequencies, and this led to what is now called Fourier transform (FT). FT helps researchers to determine how many frequencies are in a signal. FT breaks down a signal into complex exponential functions of different frequencies. It does this through equation [4.1];

$$[4.1] \qquad F_X(\omega) = \int_{-\infty}^{+\infty} X(t)\ e^{-i\omega t} dt$$

In equation [4.1], ω stands for frequency, t stands for time, and $F_X(\omega)$ is the Fourier transform of signal *X (t). X (t)* shows signal in time domain where as $F_X(\omega)$ denotes signal in frequency domain. By the virtue of Euler's formula, $e^{-i\omega t} = \cos(\omega t) - isin(\omega t)$.

The main reason why a signal is changed from its time domain to its frequency domain is because the information that cannot be seen in the time domain of a signal is possible to see it in the frequency domain of a signal. It is due to this advantage of frequency domain over time domain, FT was very useful in the nineteenth century in solving a lot of physics and engineering problems. On the other hand, mathematicians, engineers, and physicists in the twentieth century realized the shortcoming of FT. They found out that even though FT tells us how many frequencies exist in a signal, it cannot tell us at what time these frequencies exists, thus, FT is not suitable to examine nonstationary signals.

In order to solve this drawback of FT, short-time Fourier Transform (STFT) was proposed. The idea behind STFT is that the signal is divided into many segments, each segment is assumed to be stationary, and a short-time window is chosen. Then FT is performed within this window as the window pass through each segment of the signal. This enables the STFT to have both time and frequency representations, however, STFT has a drawback as well. The drawback of STFT is that it uses fixed windows, and this does not allow enough resolution for all frequencies. The drawbacks from both FT and STFT can be solved by wavelet transform. The wavelet transform is both time and frequency representations, but unlike STFT, windows that are applied to different segments of the signal are not constant, but they adjust to high and low frequencies.

There are two types of wavelet transforms, discrete and continuous wavelet transforms, but this study uses continuous wavelet transform (CWT) based on the reasons that are more suitable for orthogonal wavelet bases and its efficiency in analyzing the nexus between two variables in time –frequency domain using cross-wavelet tools (Aguiar-Conraria, et al., 2008; Rua & Nunes, 2009).

The continuous wavelet transform, CWT, of a time series *x(t)* with respect to $\psi(t)$ is shown by a convolution in equation [4.2];

$$[4.2] \qquad W_x(\tau, s) = \int_{+\infty}^{-\infty} X(t)\, \psi_{\tau,s}{}^{*}(t)\, dt$$

Where $*$ denotes the complex conjugate. Equation [4.2] shows that wavelet transform breakdown a time series into some basic or elementary functions, $\psi_{\tau,s}(t)$. These basic functions, $\psi_{\tau,s}(t)$, are derived from mother wavelet, $\psi\,(t)$, which are time-localized. The basic functions, $\psi_{\tau,s}(t)$, are derived from time-localized mother wavelet, $\psi\,(t)$, via by dilation and translation (Percival & Andrew T, 2006), and are defined in equation [5.3];

$$[4.3] \qquad \psi_{\tau,s}(t) = \frac{1}{\sqrt{s}}\, \psi\, \left(\frac{t-\tau}{s}\right)$$

Where τ denotes the time position (translation parameter), s denotes the scale (dilation parameter), which is inversely related to frequency, and $\frac{1}{\sqrt{s}}$ is a normalization factor that makes sure that wavelet transform can be compared throughout scales and time series. The translation parameter, τ, shows us the position of the window while parameter s dilates (if $|s| > 1$) or compress (if $|s| < 1$) the length of mother wavelet in order to extract the frequency information from the time series. The mother wavelet is dilated or compressed in order to shows different cycles of the frequencies. In the process of dilating or compressing the mother wavelet, basic wavelets are generated from the mother wavelet which are used to analyze the time series. The wavelet transform, $W_x(\tau, s)$, would be complex if the mother wavelet is also complex. Wavelet transform, $W_x(\tau, s)$, has both real part, $\mathrm{R}\{W_x\}$, and the imaginary part, $\mathrm{I}\{W_x\}$. Wavelet

transform also has both amplitude $|W_x|$, and a phase, $\Phi_x(s,\tau) = tan^{-1}\frac{I\{W_x\}}{R\{W_x\}}$. If equation [4.3] is substituted into equation [4.2] we have;

$$[4.4] \qquad W_x(\tau,s) = \int_{+\infty}^{-\infty} X(t)\,\psi_{\tau,s}{}^{*}(t)\,dt = \frac{1}{\sqrt{s}}\int_{+\infty}^{-\infty} X(t)\;\psi^{*}\left(\frac{t-\tau}{s}\right)$$

There are many types of mother wavelet, but this study uses Morlet wavelet due to Heisenberg uncertainty principle, which states that there is always a tradeoff between localization in time and in frequency. Morlet wavelet provides the correct balance between localization in time and frequency (Grinsted & Svetlana, 2004), this ensures good identification and isolation of periodic signals. Equation [4.5] shows Morlet wavelet;

$$[4.5] \qquad \psi(t) = \frac{1}{\pi^{1/4}}\;e^{-i\omega_o t}e^{-t^2/t}$$

In equation [4.5], ω_o is the central frequency of the Morlet wavelet. Morlet wavelet has a complex sine wave within a Gaussian envelope (Addison, 2002)**.** The complex nature of Morlet wavelet gives both time-dependent amplitude and phase for varying frequencies. If one increases (decreases) ω_o, one achieves better (poor) frequency localization, but gets poorer (better) time localization. The idea is to find a figure for ω_o that gives a good balance between time and frequency localizations. Following Rua and Nunes (2009), the study use, $\omega_o = 6$, this provides a good balance (Grinsted & Svetlana, 2004) and is mostly used in financial and economic studies. For a

function to be a mother wavelet it has to meet these conditions: admissibility condition, must have zero mean, and its square integrates to unity. The admissibility condition enables one to derive the original time series from the continuous wavelet transform. Equation [4.6] shows admissibility condition;

$$0 < C_\psi = \int_0^{+\infty} \frac{|\Psi(f)|}{f}\, df < \infty \qquad [4.6]$$

Where $\Psi(f)$ denotes FT of the wavelet $\psi(.)$ which is defines as, $\psi(f) = \int_{-\infty}^{+\infty} \psi(t)\ e^{-i2\pi ft} dt$. Equation [4.3] implies that wavelet has no zero frequency component, hence, wavelet must have zero mean as in equation [4.7];

$$\int_{-\infty}^{+\infty} \psi(t)\ dt = 0 \qquad [4.7]$$

The zero mean condition in equation [4.7] ensures that values above zero and below zero cancel each out. This makes the wavelet to look like a wave. In order to have a unit energy, a wavelet is normalized, in nutshell, the square of mother wavelet integrates to unity as in equation [4.8];

$$[4.8] \qquad \int_{-\infty}^{+\infty} \psi(t)^2 \, dt = 1$$

Equation [4.8] implies that mother wavelet is limited to an interval of time. Like FT, the inverse of CWT, $W_x(\tau, s)$, can give you the original time series, this is done by using equation [4.9];

$$[4.9] \qquad X(t) = \int_{+\infty}^{-\infty} \int_{+\infty}^{-\infty} \psi_{\tau,s}(t) W_x(\tau, s) \frac{d\tau ds}{s^2}$$

To get the original time series, $X(t)$, in equation [4.9], all time and scale positions are integrated. The notion behind CWT is to use the wavelet as a band pass filter to the time series. The wavelet is extended over time through changing its scale parameter (s) and then normalizing it so that it has unit energy.

There are several measurements within wavelet analysis that can help one to understand a time series and the bivariate relationships between two series. In this thesis, the following quantities of wavelet analysis are used: Wavelet power spectrum (WPS), cross wavelet spectrum (XWT), wavelet coherence (WTC), and wavelet phase difference.

4.3.2. Wavelet Power spectrum (WPS)

WPS measures how each time and scale contribute to the variance of a series. In other words, it measure the local variance of the time series $X(t)$ at different scales.

WPS is defined as $|W_x(\tau, s)|^2$. Since it measures variance at each scale, we have a variance decomposition with a good time localization (Torrence & Compo, 1998). The statistical significance of the peaks in the WPS is tested against a null hypothesis that the time series under investigation is generated by a white noise process. Those areas that are statistically significant at 5% significant level are bordered by a black bold line (Grinsted & Svetlana, 2004; Torrence and Compo, 1998). In CWT, finite wavelets are used to analyze finite time series, this causes border distortions. The border distortion is caused as a result of discontinuities at the beginning and at the end of the WPS as well as for wavelet coherence (WTC). In nutshell, the transform value at the beginning and at the end of the series are always wrongly calculated, that is, the edges are not completely localized in time. The edges of the series affected by this border distortions are called Cone of Influence (COI), this cannot be ignored and must be interpreted carefully (Grinsted & Svetlana, 2004). Following Torrence and Compo (1998) and Aguitar-Conraria et al. (2008), COI here is the e-folding time of the wavelet scale, *s*, that is, COI is the edge of the wavelet power affected by discontinuity that has plunged to e^{-2} of the value at the edge.

4.3.3. Cross Wavelet Transform (XWT)

XWT measures the local covariance between two time series in the time-frequency domain. Given two variables, $x(t)$ and $y(t)$, and their wavelet transforms, $W_x(\tau, s)$ and $W_y(\tau, s)$, respectively. The XWT of the two time series is defined in equation [5.10];

[4.10] $$W_{xy}(\tau, s) = W_x(\tau, s)\, W_y{}^*(\tau, s)$$

4.3.4. Wavelet Coherence (WTC)

WTC measures the local correlation between two series both in time-scale. This study follows Torrence & Webster (1998) where wavelet coherence is defined as the squared absolute value of the smoothed cross wavelet spectra normalized by the product of the smoothed individual wavelet power spectra of each series as shown in equation [4.11];

$$[4.11] \qquad {R_{xy}}^2(\tau, s) = \frac{|S(s^{-1}W_{xy}(\tau, s)|^2}{S(s^{-1}|W_x(\tau, s)|^2) \quad S(s^{-1}\left|W_y(\tau, s)\right|^2)}$$

Where *S* indicates a smoothing operator in both time and frequency (Conraria & Soares, 2010)**.** If smoothing is not performed, the wavelet coherence will be equal to one at all frequencies (Priestley, 1981). The idea behind squared wavelet coherence is like the coherency in Fourier analysis. From equation [4.11], squared wavelet coherence, ${R_{xy}}^2(\tau, s)$, is the ratio of the squared cross wavelet spectrum to the product of the two wavelet spectra, that is, to the squared coefficient of correlation. In nutshell, squared wavelet coherence gives correlation coefficients of two times series around each scale (frequency) over time. Hence, it can be used to measure how strongly two time series are related or move together at each frequency over time. The value of squared wavelet ranges between 0 and 1($0 \leq {R_{xy}}^2(\tau, s) \leq 1$). The closer the value of squared wavelet coherence to one, the stronger the comovement and vice-versa. Thus, the graph of squared wavelet coherence can be used to know the periods in the time-frequency space where the two variables co-vary. Moreover, the graph shows time and scale varying features, this provide a better picture on the nexus between two time series. There is no theoretical distribution for wavelet coherence, thus, Monte Carlo methods are used to determine the 5% statistical significance level. Like WPS, the thick contour defines the regions where the wavelet coherence is significant.

4.3.5. Wavelet Phase Difference

Wavelet phase difference measures the lead-lag relationship between two series, that is, it determines the direction of causality between the variables in the time-frequency space. The phase gives the delays of cycles or oscillation of the two variables under investigation. The wavelet coherence phase difference is defined here by following Torrence and Webster (1998);

$$[4.12] \qquad \emptyset_{xy}(\tau, s) = \tan^{-1}\left(\frac{\Im(W_{xy}(\tau, s)}{\Re(W_{xy}(\tau, s)}\right) \quad with \quad \emptyset_{xy} \in [-\pi, \pi]$$

Where $\Im$ is the imaginary part and $\Re$ is the real part of the wavelet transform. Unlike conventional econometric methods, wavelet phase does not only give us information on the lead-lag relationship between time series, but it also provides an information on how this lead-lag relationship change at different frequencies, that is, it allows one to examine how the direction of causality change in time at different frequencies. The results of phase difference are shown in radians and the values are between $-\pi \; and \; \pi$. If the phase difference is zero, then the time series under investigation move together at a certain scale or frequency. If $\emptyset_{xy} \in [\ 0, \frac{\pi}{2}]$, the two time series are in-phase or move in-phase (positively correlated), and time series *y* leads *x*. If $\emptyset_{xy} \in [-\frac{\pi}{2}, 0\ ]$, the two series are in-phase (positively correlated), and time series *x* leads *y*. If the phase-difference is π or $-\pi$, then the two time series are in anti-phase (negatively correlated). If $\emptyset_{xy} \in [\frac{\pi}{2}, \pi]$, the two time series are in anti-phase (negatively correlated), and *x* leads *y*. If $\emptyset_{xy} \in [-\pi, -\frac{\pi}{2}]$, the two time series are in anti-phase (negatively correlated), *y* leads *x*.

Wavelet phase difference is shown in the wavelet coherence plot by arrows. The arrows are used to determine whether the two series are in-phase (positively correlated) or anti-phase (negatively correlated) and which one of the two variables is leading. Arrows pointing to the right indicates the time series are in-phase (positively correlated) while the arrows pointing to the left indicates the time series are in anti-phase (negatively correlated). Arrows pointing up indicates that the first time series leads the second variable by 90^0, while arrows pointing down means that the second variable leads the first time series by, 90^0. Most often there is a mixture of arrows, for instance, arrows pointing down and to the left indicates that the two series are in anti-phase and the second series leads the first one and vice-versa.

4.4. Conclusion

This chapter briefly explains the data used in the empirical analysis and the source of the data. It also explained in details the methodology that is used to find the empirical relationship between FDI inflows and income. The methodology used is continuous wavelet analysis that has an advantage over the conventional econometrics. The conventional econometrics usually suffers from misspecification and endogeneity problem when finding the empirical nexus between income and FDI, wavelet analysis solves these problems. Moreover, it also reveals a relationship that is veiled when one uses conventional econometric methods.

The next chapter gives the empirical results on FDI and income nexus in each host country.

Chapter 5: Empirical Results

5.1. Introduction

The last chapter gives a description of the data used in the study and the methodology (continuous wavelet analysis) employed to examine the relationship between income and FDI inflows. This chapter gives the empirical results of The Gambia, Senegal and Ghana.

5.2. Empirical Result for The Gambia

This subsection gives the empirical result for The Gambia by examining the impact of per stock of FDI inflows on per capita income (level effect of FDI inflow) and also examining the impact of per stock of FDI inflow on per capita income growth (growth effect of FDI inflow).

5.2.1. The Level Effect of FDI Inflow, The Gambia

Figure 5.1 below shows the wavelet power spectrum (WPS) of per capita income and per stock of FDI inflows (per stock of FDII). In Figure 5.1 below, the color codes range from blue (low power) to red (high power). Y-axis measures scale in the years while X-axis measures the time period. The WPS for per capita income is significant between the year 2003 and 2004 at a scale of 4 years and also significant between 2006 and 2008 at a scale of 5 years. The WPS for per stock of FDII is significant between 1999 and 2005 at a scale of 8 years and also significant between

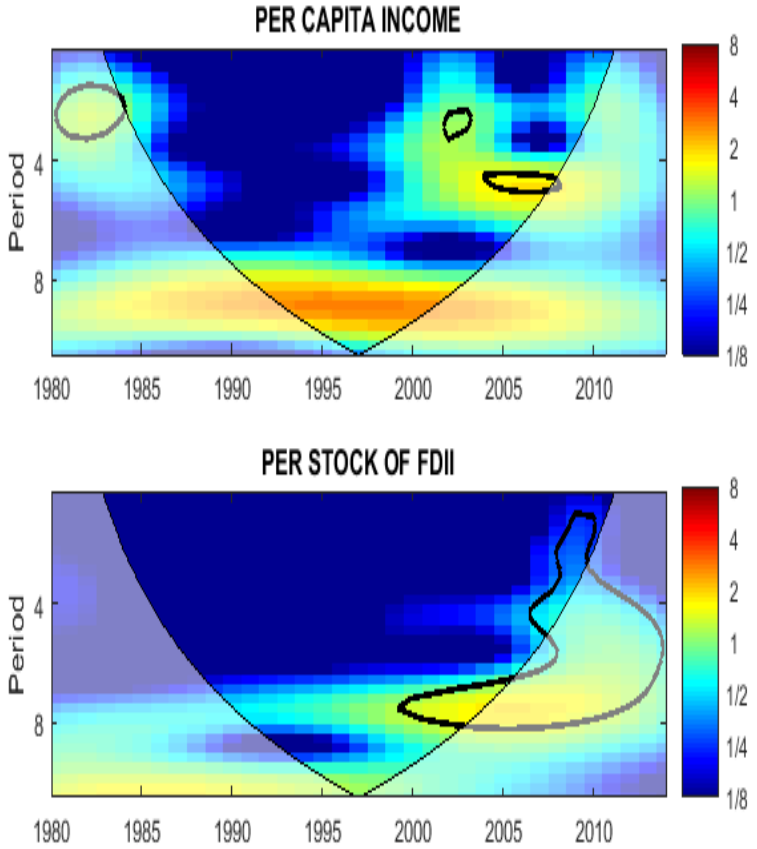
years 2007 and 2010 at a scale of 4 years. To find the bivariate nexus between per capita income and per stock of FDI inflows, cross wavelet transform (XWT) and wavelet coherence (WTC) is examined in Figure 5.2 and Figure 5.3 respectively.

Figure 5.2 below shows XWT between per capita income and per stock of FDI inflows. XWT looks for the regions in time-frequency space where the two series show high common power. In Figure 5.2 below, the color codes range from blue (weak relationship) to red (strong relationship) and the significant nexus is shown by the thick black contour within the cone. Y-axis measures scale in the years while X-axis measures the time period. The XWT shows that there is a significant relationship between per capita income and per stock of FDI inflows between the year 2003 and 2008 at a scale of 3~5 years, the wavelet phase difference shows that the two series are out-of-phase (negatively related) and per capita income is leading per stock of FDI inflows (causality runs from per capita income to per stock of FDI inflow). There is another significant relationship between the two variables between the year 2008 and 2010 at a scale of 1~3 years, the wavelet phase-difference shows that the two-time series are out-of-phase, and per stock of FDI inflow is leading per capita income (that is, the direction of causality runs from per stock of FDI inflow to per capita income. Figure 5.2 findings are summarized in Table 5.1 below.

Figure 5.3 shows the wavelet coherence (WTC) between per capita income and per stock of FDI inflows. WTC looks for regions in time-frequency space where the two-time series co-vary (but does not necessarily have high power). In Figure 5.3 below, the color codes range from blue (weak relationship) to red (strong relationship) and the significant nexus is shown by the thick black contour within the cone. Y-axis measures scale in the years while X-axis measures the time period. In Figure 5.3, there is a significant relationship between the two variables between 1985 and 1989 at a scale of 3~5 years, the wavelet phase difference indicates the two series are in-phase (positively related), and per capita income is leading. The second significant relationship between the two variables is also observed between the year 2000 and 2003 at a scale of 1~2 years, the wavelet phase difference shows that the two series are out-of-phase, and with per stock of FDI inflow leading. The third significant relationship

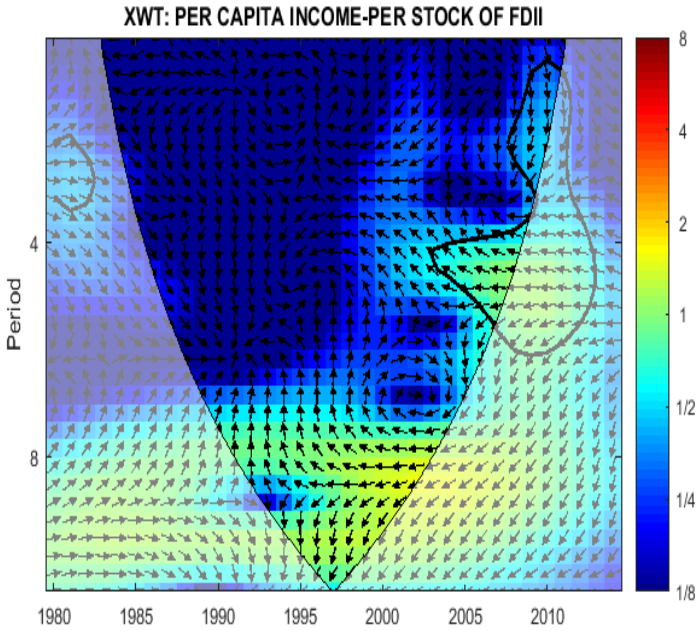
occurs between 2008 and 2010 at a scale of 1~2 years, the wavelet phase-difference shows that the two series are in-phase, and with per capita income leading. Table 5.2 below shows the summary of the finding of Figure 5.3.

Figure 5.1: WPS of Per Capita Income and Per Stock of FDI Inflows, The Gambia



The color codes ranges from blue (low power) to red (high power). Y-axis measures scales in years while X-axis measures the time period. The 5% significance level against red noise is shown as a thick contour within the cone.

Figure 5.2: XWT between Per Capita Income and Per Stock of FDI Inflows, The Gambia



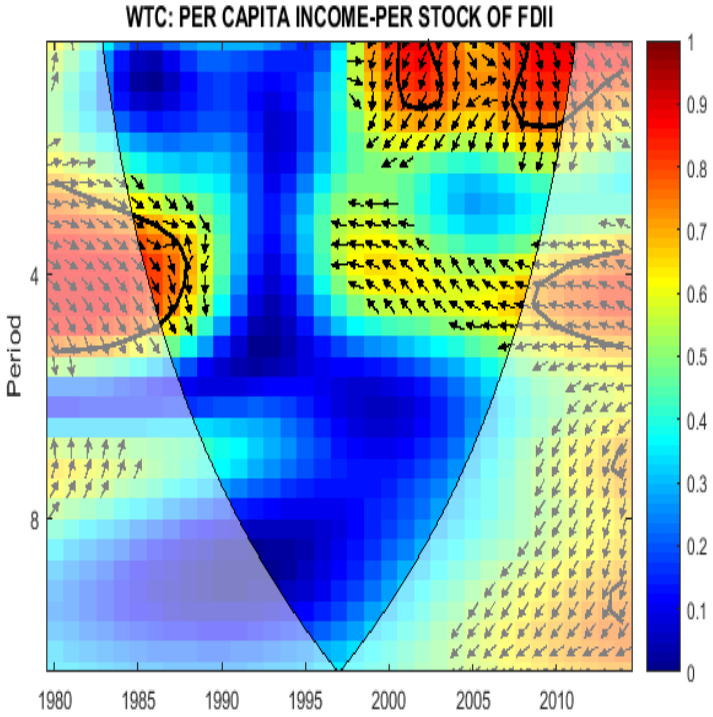
The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income lagging. To the right and down, with per capita income leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X- axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.1: The Level Effect of FDI Inflow (XWT), The Gambia

Method	Year	Scale	Phase	Causality
Cross Wavelet	2003-2008	3~5	Out-of-phase	$output \rightarrow FDI$
Cross Wavelet	2008-2010	1~3	Out-of-phase	$output \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

Figure 5.3: WTC between Per Capita Income and Per Stock of FDI Inflows, The Gambia



The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income lagging. To the right and down, with per capita income leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scale in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.2: The Level Effect of FDI Inflow (CWT), The Gambia.

Method	Year	Scale	Phase	Causality
Coherence	1985-1989	3~5	In-phase	$output \rightarrow FDI$
Coherence	2000-2003	1~2	Out-of-phase	$output \leftarrow FDI$
Coherence	2008-2010	1~2	In-phase	$output \rightarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

5.2.2. The Growth Effect of FDI Inflows, The Gambia

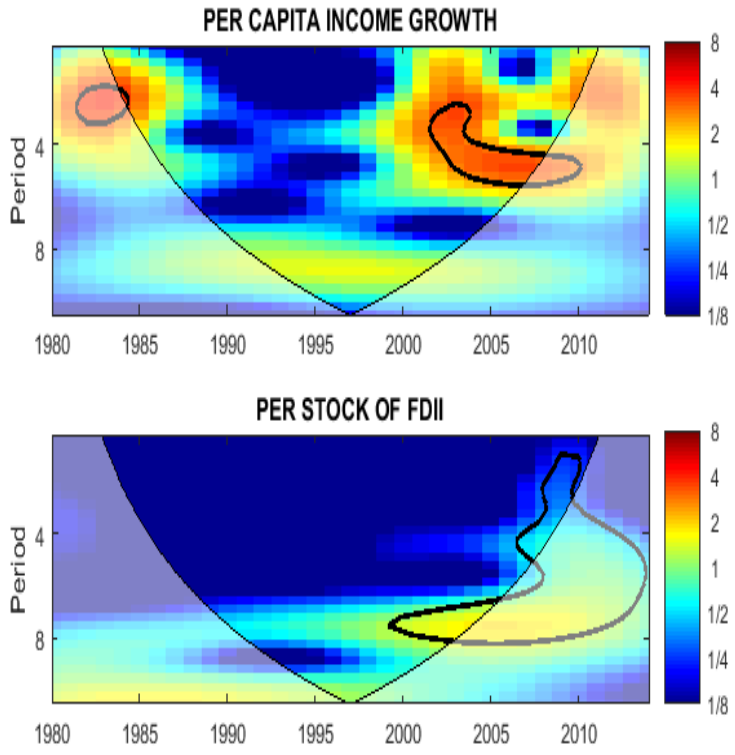
There is a hypothesis that FDI has an only level effect because in the long-run the foreign capital will be subjected to diminishing return, this statement is supported by neoclassical growth theory. Thus, this study examines whether FDI has a growth effect or not.

Figure 5.4 shows the WPS of per capita income growth and per stock of FDI inflow (per stock of FDII. In Figure 5.4 below, the color codes range from blue (low power) to red (high power). Y-axis measures scale in the years while X-axis measures the time period. From Figure 5.4, WPS for per capita income growth is significant between the year 2002 and 2008 at a scale of 3∼6 years. The WPS for per stock of FDI inflow is significant between 1999 and 2005 at a scale of 8 years and also significant between years 2007-2010 at a scale of 1∼4 years. To find the bivariate relationship between per capita income growth and per stock of FDI inflows, XWT and WTC are examined in Figure 5.5 and Figure 5.6 respectively.

Figure 5.5 shows XWT between per capita income growth and per stock of FDI inflows. In Figure 6.5, the color codes range from blue (weak relationship) to red (strong relationship) and the significant nexus is shown by the thick black contour within the cone. Y-axis measures scale in years while X-axis measures the time period. In Figure 5.5, XWT shows that there is a significant relationship between per capita income growth and per stock of FDI inflows between the year 2003 and 2008 at a scale of 3∼6 years, the wavelet phase difference shows that the two-time series are out-of-phase, and per capita income growth is leading per stock of FDI inflows. There is another significant relationship between the two variables between the year 2008 and 2010 at a scale of 1∼3 years, the wavelet phase difference shows that the two time series are out-of-phase, and per stock of FDI inflow is leading per capita income growth, that is, the direction of causality runs from per stock of FDI inflows to per capita income growth. Figure 5.5 findings are summarized in Table 5.3 below.

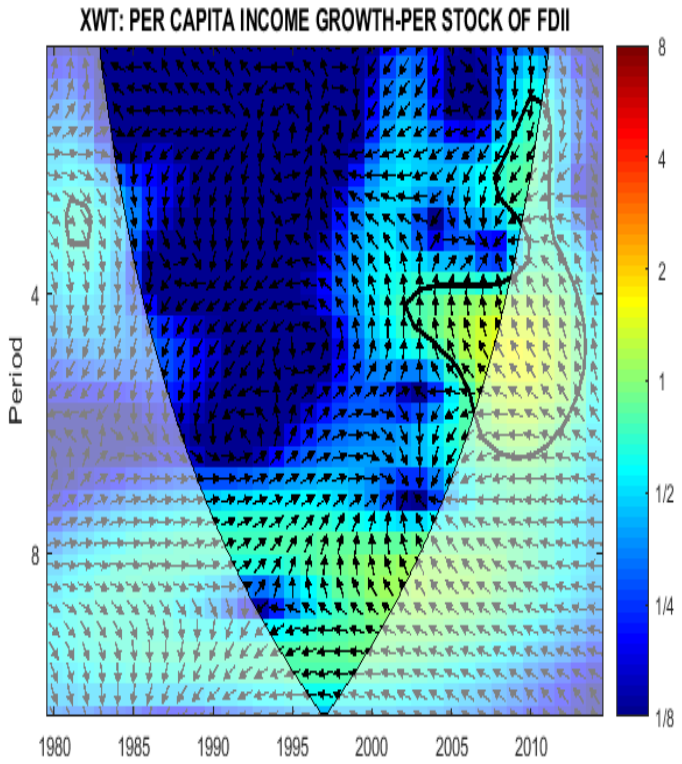
Figure 5.6 shows wavelet coherence between per capita income growth and per stock of FDI inflows. In Figure 5.6 below, the color codes range from blue (weak relationship) to red (strong relationship) and the significant nexus is shown by the thick black contour within the cone. Y-axis measures scale in years while X- axis measures the time period. The WTC in Figure 5.6 shows that there is a significant relationship between the two series between the year 1985 to 1987 at a scale of 3~5 years, the wavelet phase difference shows that the two series are out-of-phase, and with per stock of FDI inflow leading. Figure 5.6 findings are summarized in Table 5.4 below.

Figure 5.4: WPS of Per Capita Income growth and per stock of FDII, The Gambia



The color codes ranges from blue (low power) to red (high power). Y-axis measures scales in years while X- axis measures the time period. The significant power is shown by thick black contour within the cone.

Figure 5.5: XWT between Capita Income Growth and Per Stock of FD, The Gambia



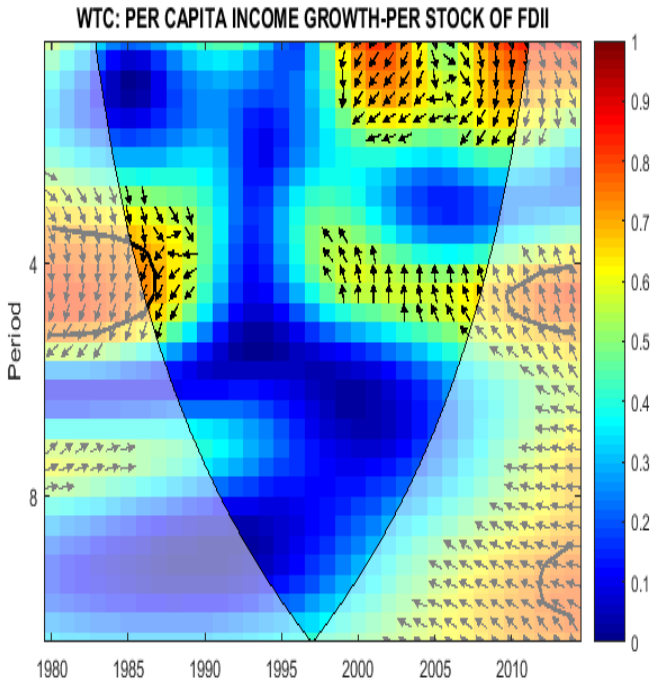
The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone of influence. Y-axis measures scales in years while X- axis measures the time period.

Table 5.3: The Growth Effect of FDI Inflow (XWT), The Gambia.

Method	Year	Scale	Phase	Causality
Cross Wavelet	2003-2008	3~6	Out-of-phase	$growth \rightarrow FDI$
Cross Wavelet	2008-2010	1~3	Out-of-phase	$growth \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

Figure 5.6: WTC between Per Capita Income Growth and Per Stock of FDI Inflows, The Gambia



The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone of influence. Y-axis measures scales in years while X- axis measures the time period.

Table 5.4: The Growth Effect of FDI Inflow CWT), The Gambia.

Method	Year	Scale	Phase	Causality
Coherence	1985-1987	3~5	Out-of-phase	$growth \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

5.3. Empirical Results for Senegal

The last section discusses the empirical results of The Gambia. This chapter discusses the empirical results of Senegal. Two estimation methods (WTC and XWT) are used to determine the level and growth effect of FDI inflow.

5.3.1. The Level Effect of FDI Inflow, Senegal

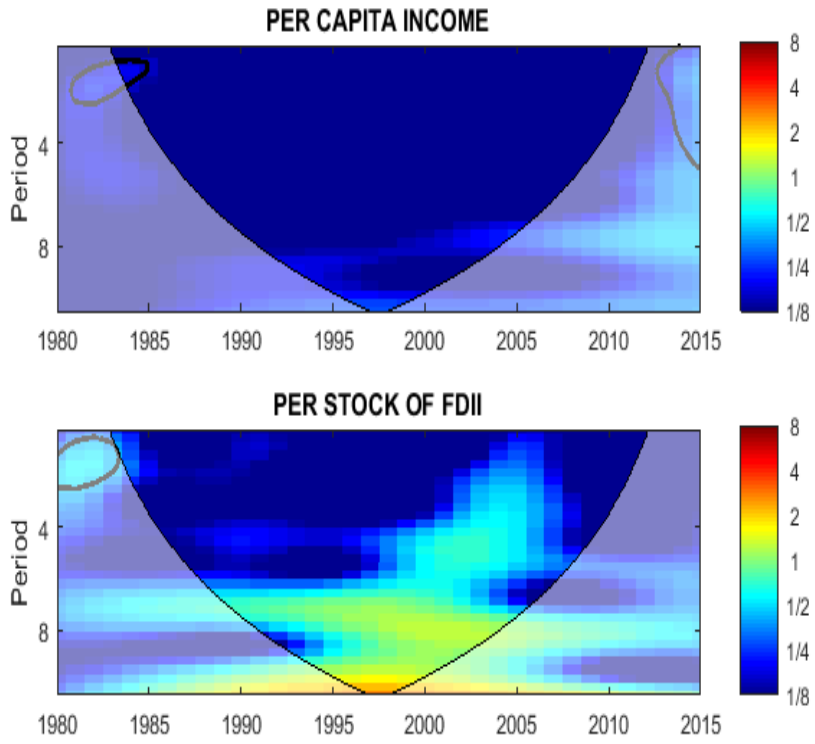
Figure 5.7 shows the WPS of per capita income and per stock of FDI inflows. In Figure 5.7, the color codes range from blue (low power) to red (high power) and the significant power is shown by thick black contour within the cone. Y-axis measures scale in years while X-axis measures the time period. From Figure 5.7, the WPS for per capita income is significant between the year 1984 and 1985 at a scale of 1~2 years. The WPS for per stock of FDI inflows is not observed.

Figure 5.8 below shows the XWT between per capita income and per stock of FDI inflow. In Figure 5.8, the color codes range from blue (weak relationship) to red (strong relationship), the significant nexus is shown by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. From Figure 5.8, there is a significant relationship between the two series between the year 1984 and 1985 at a scale of 1~2 years, the wavelet phase difference indicates that the two series are in-phase, and per stock of FDI inflow is leading. The summary of the findings in Figure 5.8 is summarized in Table 5.5 below.

Figure 5.9 below shows the WTC between per capita income and per stock of FDI inflows. In Figure 5.9, the color codes range from blue (weak relationship) to red (strong relationship), the significant nexus is shown by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. From Figure 5.9, there is a significant relationship between the two variables between the year 1984 and 1985 at a scale of 1~3 years, and the wavelet phase different

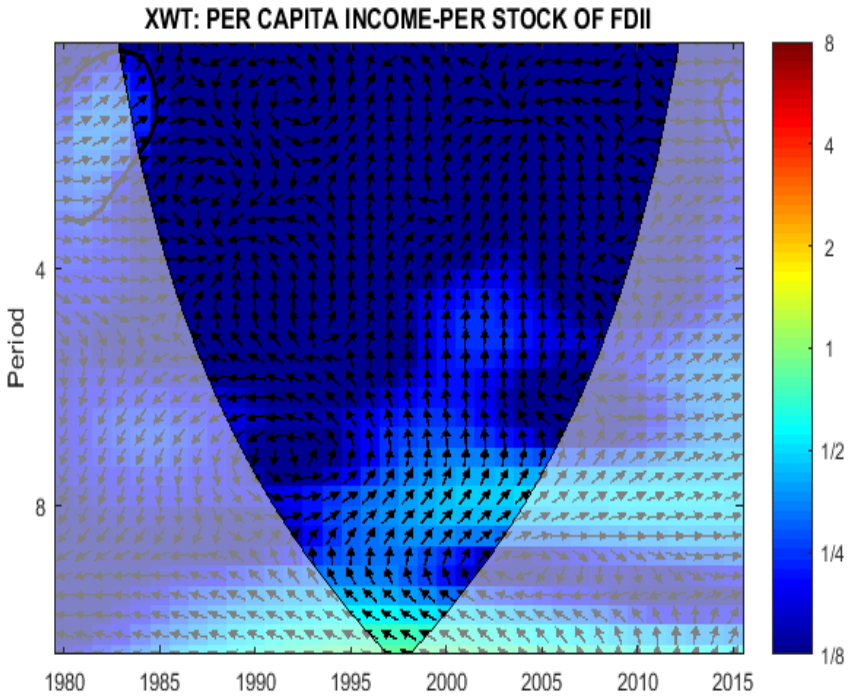
indicates that the series are in-phase with per stock of FDI inflows leading. There is another significant nexus between the two series between the year 1996 and 2005 at a scale of 3~6 years, the wavelet phase difference shows that the two variables are in-phase with per stock of FDI inflows leading. Table 5.6 summarizes the results of Figure 5.9.

Figure 5.7: WPS of Per Capita Income and Per Stock of FDI Inflow, Senegal



The color codes range from blue (low power) to red (high power). The significant power is shown by the thick black contour within the cone. Y-axis measures scales in years while X- axis measures the time period

Figure 5.8: XWT between Per Capita Income and Per Stock of FDI Inflows, Senegal



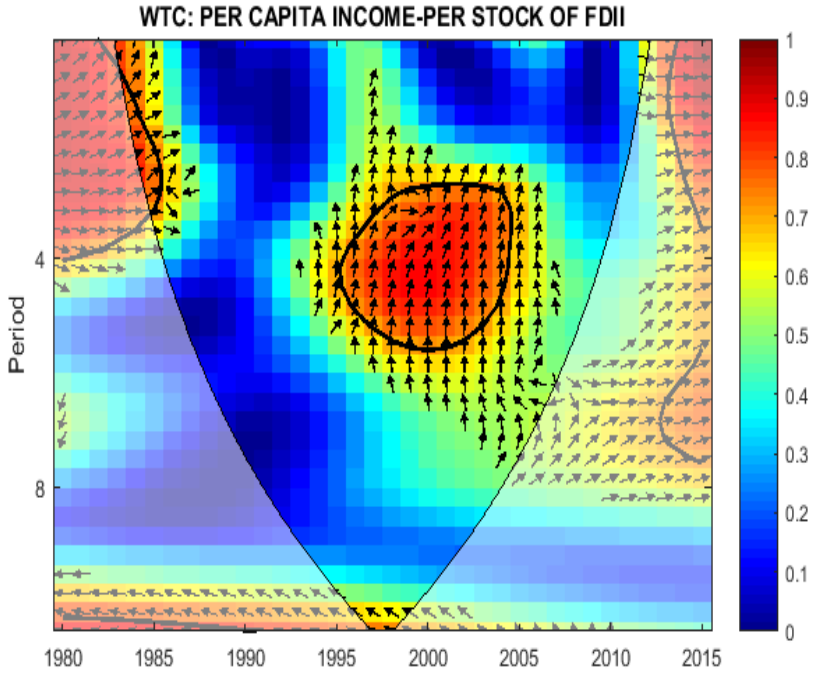
The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income lagging. To the right and down, with per capita income leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone .Y-axis measures scale in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.5: The Level Effect of FDI Inflow (XWT), Senegal

Method	Year	Scale	Phase	Causality
Cross- Wavelet	1984-1985	1~2	In-Phase	$Income \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

Figure 5.9: WTC between Per Capita Income and Per Stock of FDI Inflows, Senegal



The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income lagging. To the right and down, with per capita income leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.6: The Level Effect of FDI Inflow (CWT), Senegal

Method	Year	Scale	Phase	Causality
Coherence	1984-1985	1~3	In-Phase	$Income \leftarrow FDI$
Coherence	1996-2005	3~6	In-Phase	$Income \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale, that is, the higher the scale, the lower the frequency and vice versa. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

5.3.2. The Growth Effect of FDI Inflow, Senegal

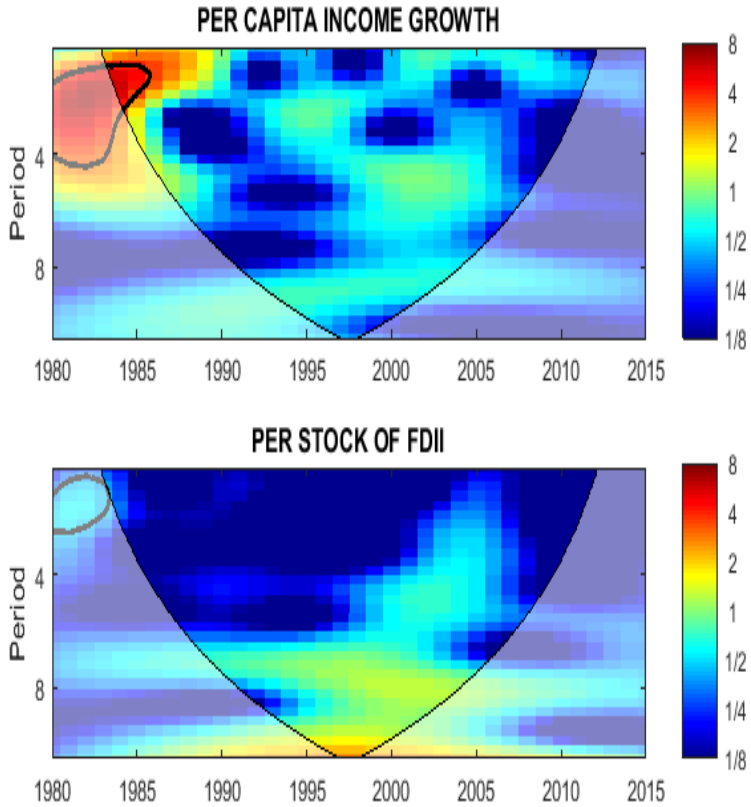
Figure 5.10 shows the WPS of per capita income growth and per stock of FDI inflows. In Figure 5.10, the color codes range from blue (low power) to red (high power), the significant power is shown by the thick black contour within the cone, and Y-axis measures scale in the years while X-axis measures the time period. From 5.10, the WPS for per capita income growth is significant between the year 1984 and 1986 at a scale of 1~2 years. The WPS for per stock of FDI inflow is not observed.

Figure 5.11 below shows the XWT between per capita income growth and per stock of FDI inflow. In Figure 5.11, the color codes range from blue (weak relationship) to red (strong relationship), the significant nexus is shown by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. From Figure 5.11, there is a significant relationship between the two series between the year 1984 and 1985 at a scale of 1 year, the wavelet phase difference indicates that the two series are in-phase and per stock of FDI inflow is leading. There is another significant relationship between the two series between 1984 and 1985 at a scale of 2 years, the wavelet phase difference indicates that the two series are in-phase and they move together. The summary of the findings in Figure 5.11 is summarized in Table 5.7 below.

Figure 5.12 below shows WTC between per capita income growth and per stock of FDI inflows. In Figure 5.12, the color codes range from blue (weak relationship) to red (strong relationship), the significant nexus is shown by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. From Figure 5.12 there are many nexuses between the two series. Between the year 1985 and 1986 at a scale of 1~3 years, there is a significant relationship between the two series, and wavelet phase difference indicates that the series are in-phase and they move together. Between the year 1986 and 2010 at a scale of 3~6 years, there is a significant relationship between the variables, and the wavelet phase difference shows that the series are in-phase and that per stock of FDI inflow is leading. The final significant relationship between the two variables occur between the year 2001 and

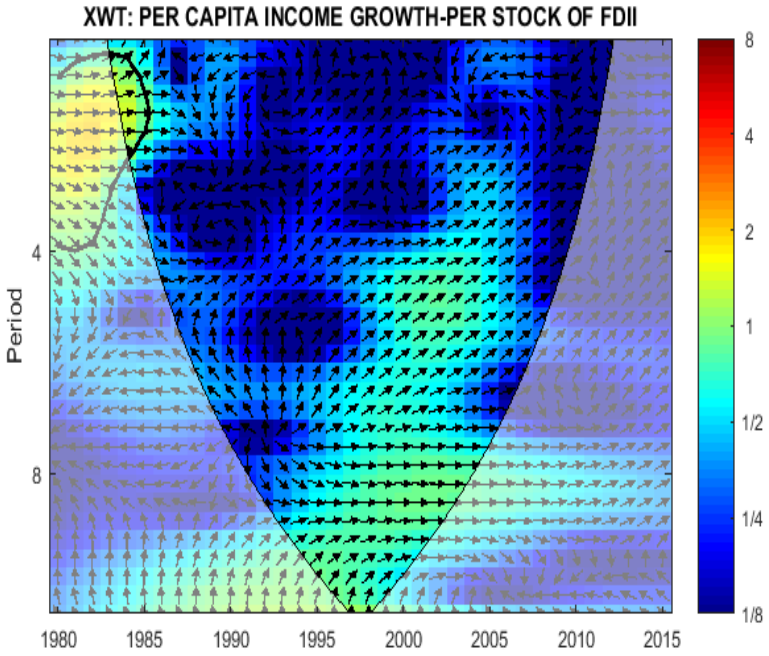
2006 at a scale of 7~8 years, the wavelet phase difference indicates that the two series are in-phase and they move together. The results of Figure 5.12 is summarized in Table 5.8 below.

Figure 5.10: WPS of Per Capita Income Growth and Per Stock of FDI Inflow, Senegal



The color codes range from blue (low power) to red (high power). The significant power is shown by the thick black contour within the cone. Y-axis measures scale in year while X-axis measures the time period

Figure 5.11: XWT between Per Capita Income Growth and Per Stock of FDI Inflow, Senegal



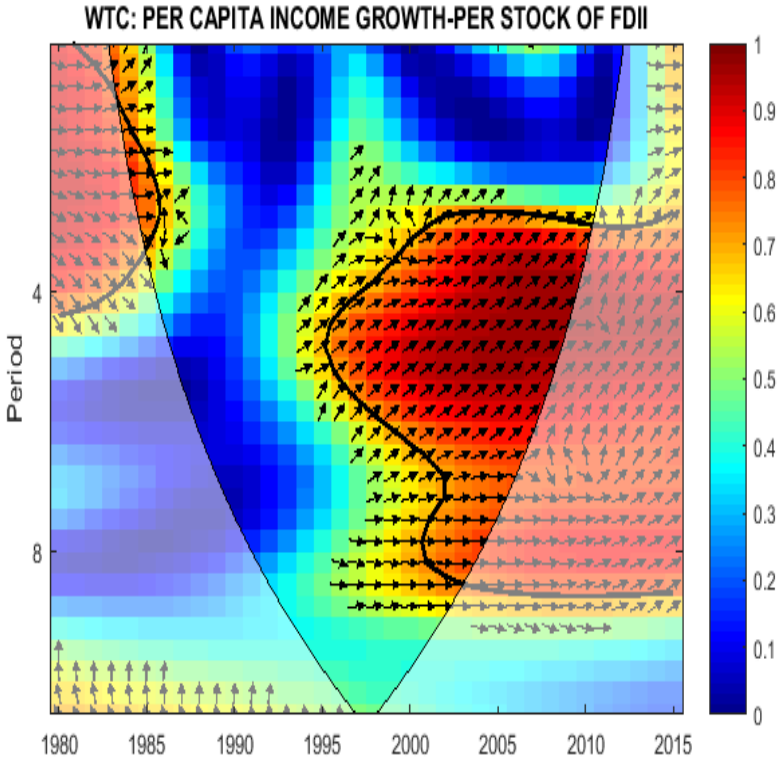
The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the. Y-axis measures scales in years while X- axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.7: The Level Effect of FDI Inflows (XWT), Senegal

Method	Year	Scale	Phase	Causality
Cross-wavelet	1984-1985	1	In-Phase	$growth \leftarrow FDI$
Cross-wavelet	1984-1985	2	In-Phase	$Move\ Together$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

Figure 5.12: WTC between Per Capita Income Growth and Per Stock of FDI Inflow, Senegal



The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X- axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.8: The Level Effect of FDI Inflows (CWT), Senegal

Method	Year	Scale	Phase	Causality
Coherence	1985-1986	1~3	In-Phase	*Move together*
Coherence	1996-2010	3~6	In-Phase	$growth \leftarrow FDI$
Coherence	2001-20069	7~8	In-Phase	*Move together*

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

5.4. Empirical Result for Ghana

The last section gives the empirical results of Senegal. The empirical results of Senegal show that per stock of FDI inflows has a positive impact on both per capita income and per growth. This section investigates the level and growth effect of FDI inflows in Ghana.

5.4.1. The Level Effect of FDI Inflows, Ghana

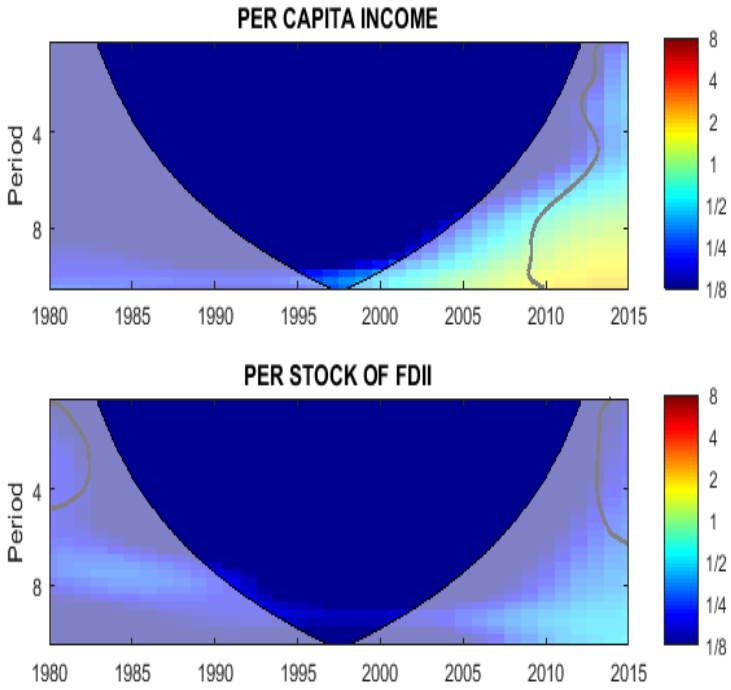
Figure 5.13 shows WPS of per capita income and per stock of FDI inflows. In Figure 5.13, the color codes range from blue (low power) to red (high power), significant power is shown by thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. In Figure 5.13, there is no significant wavelet power for both per capita income and per stock of FDI inflows.

Figure 5.14 shows the XWT between per capita income and per stock of FDI inflows. Since there is no significant wavelet power for both series, then there would be no XWT between the two series. In nutshell, XWT finds the nexus between two series where they have high common power, and since there is no wavelet power for the two series, then cross wavelet could not find a relationship between per capita income and per stock of FDI inflows.

Figure 5.15 shows the WTC for per capita income and per stock of FDI inflow. In Figure 5.15, the color codes range from blue (weak relationship) to red (strong relationship), areas where the nexus between the two variables are shown by thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. In Figure 5.15, the two series have many significant relationships at different periods and at a different scale. Between the year 1984 and 2000, there is a significant relationship between the variables at a scale of 1∼3 years, and the wavelet

phase difference shows that the two series are in-phase with causality running from per capita income to per stock of FDI inflow. Between 1989 and 1990, there is a significant nexus between the two series at a scale of 6~7 years and the wavelet phase difference indicates that the two series are in-phase with causality running from per stock of FDI to per capita income. The other significant relationships between per capita income and per stock of FDI inflows in Figure 5.15 is summarized in Tale 5.9 below.

Figure 5.13: WPS of Per Capita Income and Per Stock of FDI Inflows Ghana



The color code for power ranges from blue (low power) to red (high power). Significant power is indicated by thick black contour within the cone and Y-axis measures scale in years while X-axis measures the time period.

Figure 5.14: XWT between Per Capita Income and Per Stock of FDI Inflows, Ghana

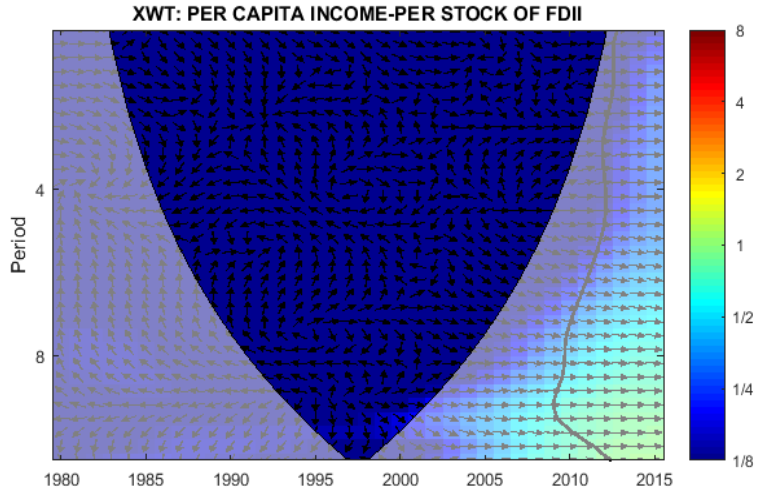
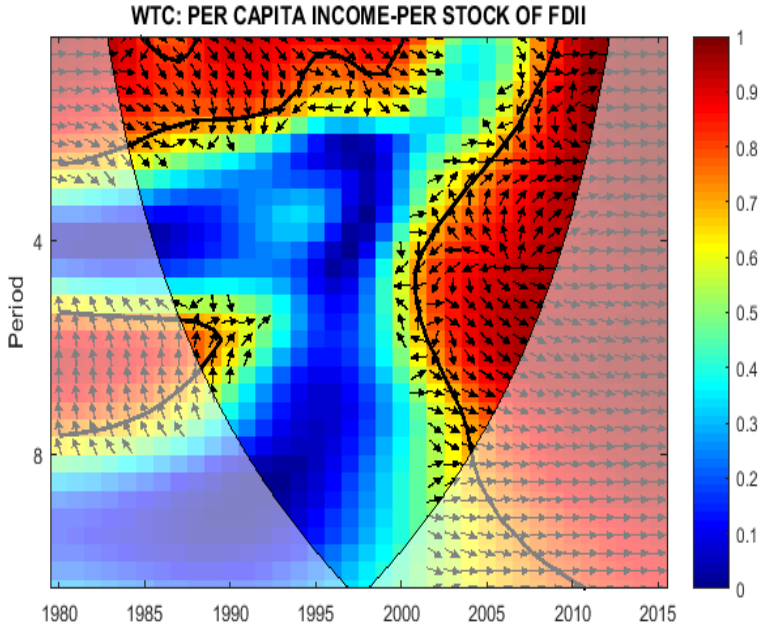


Figure 5.15: WTC between Per Capita Income and Per Stock of FDI Inflows, Ghana



The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income lagging. To the right and down, with per capita income leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.9: The Level Effect of FDI Inflows (WTC), Ghana

Method	Year	Scale	Phase	Causality
Coherence	1984-2000	1-3	In-Phase	$Income \rightarrow FDI$
Coherence	1989-1990	6-7	In-Phase	$Income \leftarrow FDI$
Coherence	2009-2011	1	In-Phase	$Move\ together$
Coherence	2009-2011	3	In-Phase	$Income \rightarrow FDI$
Coherence	2005-2010	3-4	In-Phase	$Income \leftarrow FDI$
Coherence	*2004-2006*	*4*	*Out-of-Phase*	$Income \rightarrow FDI$
Coherence	*2003-2006*	*5*	*Out-of-Phase*	$Income \leftarrow FDI$
Coherence	2001-2008	5-8	In-Phase	$Income \rightarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

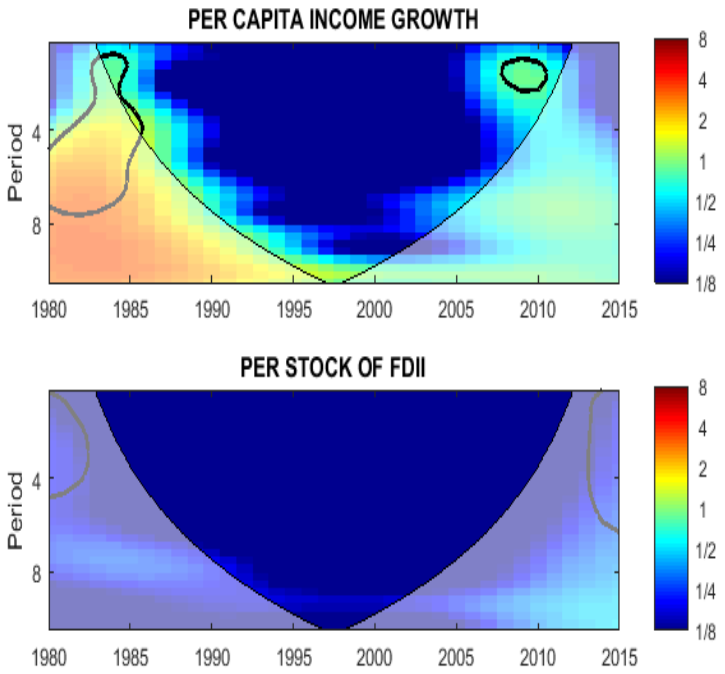
5.4.2. The Growth Effect of FDI Inflows, Ghana

Figure 5.16 shows the WPS of per capita income growth and per stock of FDI inflows. In Figure 5.16, the color codes range from blue (low power) to red (high power), the area of significant power is indicated by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. In Figure 5.16, the wavelet power of per capita income growth is significant between 1984 and 1986 at a scale of $1\sim4$ years and also between 2009 and 2010 at a scale of $1\sim2$ years. Per stock of FDI inflow has no significant power during the sample period.

Figure 5.17 shows the XWT between per capita income growth and per stock of FDI inflows. In Figure 5.17, there is no significant relationship between per capita income growth and per stock of FDI inflows. XWT looks for nexus where the two series have high common power and since per stock of FDI inflows has no power, XWT could not determine any relationship.

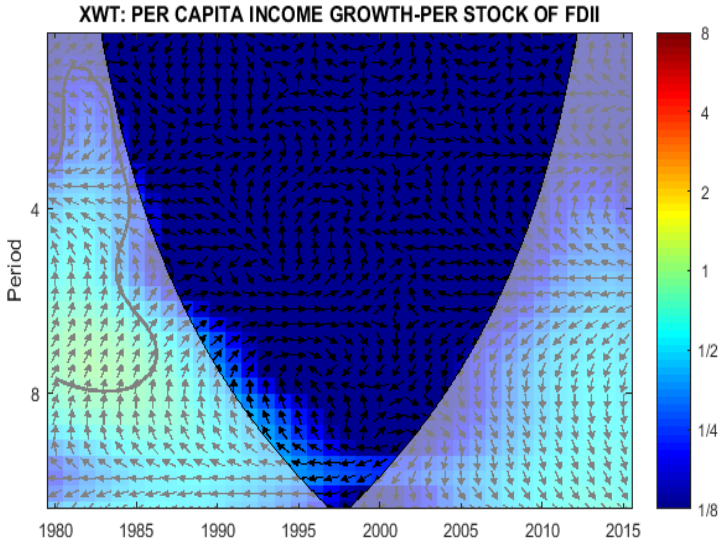
To find a bivariate relationship between the two series without taking into account high common power, CWT is employed. CWT looks regions in time-frequency space where the two-time series co-vary but does not necessarily have high power. Figure 5.18 shows the WTC between per capita income growth and per stock of FDI inflows. In Figure 5.18, the color codes range from blue (weak relationship) to red (strong relationship), the area of significant nexus is indicated by the thick black contour within the cone, and Y-axis measures scale in years while X-axis measures the time period. In Figure 5.18, there is a significant relationship between the two series between 1989 and 1991 at a scale of 6~7 years, and the wavelet phase difference shows that the two series are in-phase with causality running from per stock of FDI inflow to per capita income growth. The results of Figure 5.18 is summarized in Table 5.10 below.

Figure 5.16: WPS of Per Capita Income Growth and Per Stock of FDI Inflows, Ghana



The color code for power ranges from blue (low power) to red (high power). Significant power is indicated by thick black contour within the cone and Y-axis measures scale in years while X-axis measures the time period.

Figure 5.17: XWT between Per Capita Income Growth and Per Stock of FDI Inflows, Ghana



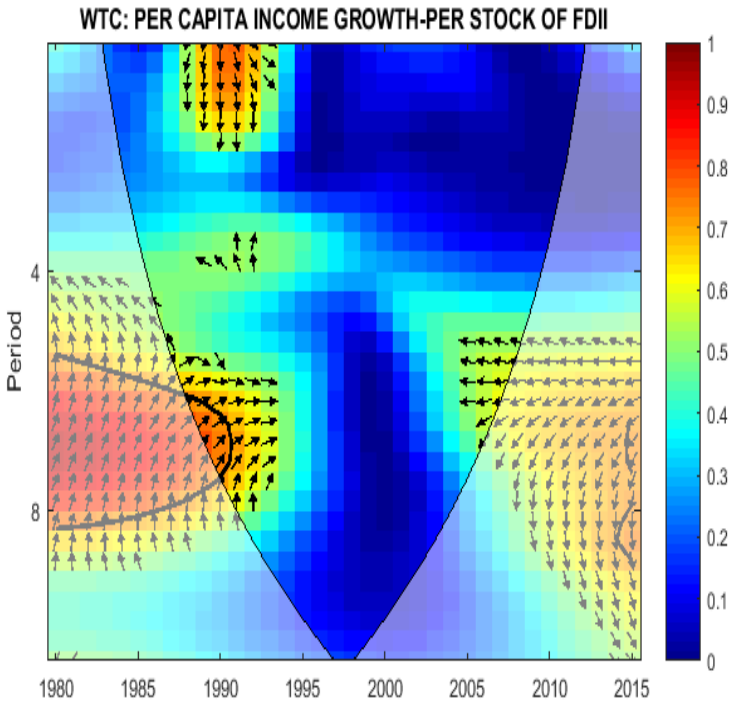
The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

Table 5.10: The Growth Effect of FDI Inflows (WTC), Ghana

Method	Year	Scale	Phase	Causality
Coherence	1989-1991	6-7	In-Phase	$Growth \leftarrow FDI$

Out-of-phase means the variables are negatively related while in-phase means the variables are positively related. Frequency is negatively related to scale. $X \rightarrow Y$, means causality runs from X to Y. $X \leftarrow Y$, means causality runs from Y to X.

Figure 5.18: WTC between Per Capita Income Growth and Per Stock of FDI Inflows, Ghana



Wavelet Coherence between per capita income growth and per stock of FDI inflows -The phase difference between the two series is indicated by arrows. Arrows pointing to the right mean that the variables are in phase (positively related). To the right and up, with per capita income growth lagging. To the right and down, with per capita income growth leading. Arrows pointing to the left mean that the variables are out of phase (negatively related). To the left and up, with per stock of FDI inflow lagging. To the left and down, with per stock of FDI inflow leading. The focus is on the 5% significance areas shown by the thick black contour within the cone. Y-axis measures scales in years while X-axis measures the time period. The color codes range from blue (weak relationship) to red (strong relationship).

5.5. Conclusion

This chapter examines the empirical relationship between per stock of FDI inflow and income (level effect and growth effect of FDI inflows) in The Gambia, Senegal and Ghana. Two estimation methods (cross wavelet and wavelet coherence) are used to find the empirical nexus between FDI inflows and income.

The Gambia: XWT shows that the impact of per stock of FDI inflows on per capita income (level effect) and per growth (growth effect) is negative. Using XWT, the causality between per capita and per stock of FDI inflows is bidirectional and also between per growth and per stock of FDI inflows is bidirectional depending on time and scale. WTC shows that per stock of FDI inflows have both positive and negative impact on per capita income (level effect) while the impact of per stock of FDI inflows on per growth is negative (growth effect). Using WTC, the causality between per capita income and per stock of FDI inflows is bidirectional while the causality runs from FDI inflows to per growth.

Senegal: XWT shows that the impact of per stock of FDI inflows on per capita income (level effect) and per growth (growth effect) is positive. XWT also shows that causality runs from per stock of FDI inflows to per capita income while causality either runs from per stock of FDI inflows to per growth or per stock of FDI inflows and per growth move together. WTC shows that per stock of FDI inflows have a positive impact on per capita income and per growth in Senegal. WTC also shows that causality runs from per stock of FDI inflows to per income while causality either runs from per stock of FDI inflows to per growth or per stock of FDI inflows and per growth move together.

Ghana: XWT does not find any significant relationship between per stock of FDI inflows and per capita income (level effect). It also does not find any significant nexus between per stock of FDI inflows and per growth (growth effect). CWT shows that per stock of FDI inflows has both positive and negative impact on per capita income, but the positive impact dominates. Moreover, CWT also finds that the impact of per stock of FDI inflows on per growth is positive. The causality runs from FDI inflows to per growth while between FDI inflows and per income is bidirectional depending on time and scale.

The next chapter analyzes the empirical results by comparing the results of the three countries and investigating why Senegal derives more benefit from FDI inflows than The Gambia and Ghana.

Chapter 6: Analysis of the Empirical Results

6.1. Introduction

This chapter compares the empirical results among the countries used in this study. It further examines why one country derives more benefit from FDI inflows than the other. In comparing the countries, only WTC is used because it served as a local correlation coefficient and also captures relationships at all level regardless of whether the two series have high common power or not, thus, it reveals more relationships between the variables more than XWT. XWT captures nexus in regions where the two series have high common power only, thus, it does not capture all the nexus between two series. It is due to these reasons that CWT is preferred in this chapter to compare the empirical results of the countries.

6.2. The Level Effect level of FDI Inflows

Figure 6.1 below shows the impact of per stock of FDI inflows on per capita income (the level effect in different countries using CWT). In Figure 6.1, the figure at the top left corner represent CWT for The Gambia, the figure at the top right corner represents the CWT for Senegal, and the one at the bottom represent the CWT for Ghana. In Figure 6.1, per stock of FDI inflows have a more significant impact in Senegal and Ghana than The Gambia. The impact of per stock of FDI inflows on per capita income is both positive and negative in The Gambia and Ghana, but the net impact of per stock of FDI inflows on per capita income in both countries is positive. On the contrary, in Senegal, the impact of per stock of FDI inflows is only positive. The net positive impact is greater in Senegal and Ghana than in The Gambia. The comparison in Figure 6.1 is summarized in Table 6.1 below.

Figure 6.1: CWT between Per Capita Income and Per Stock of FDI Inflows

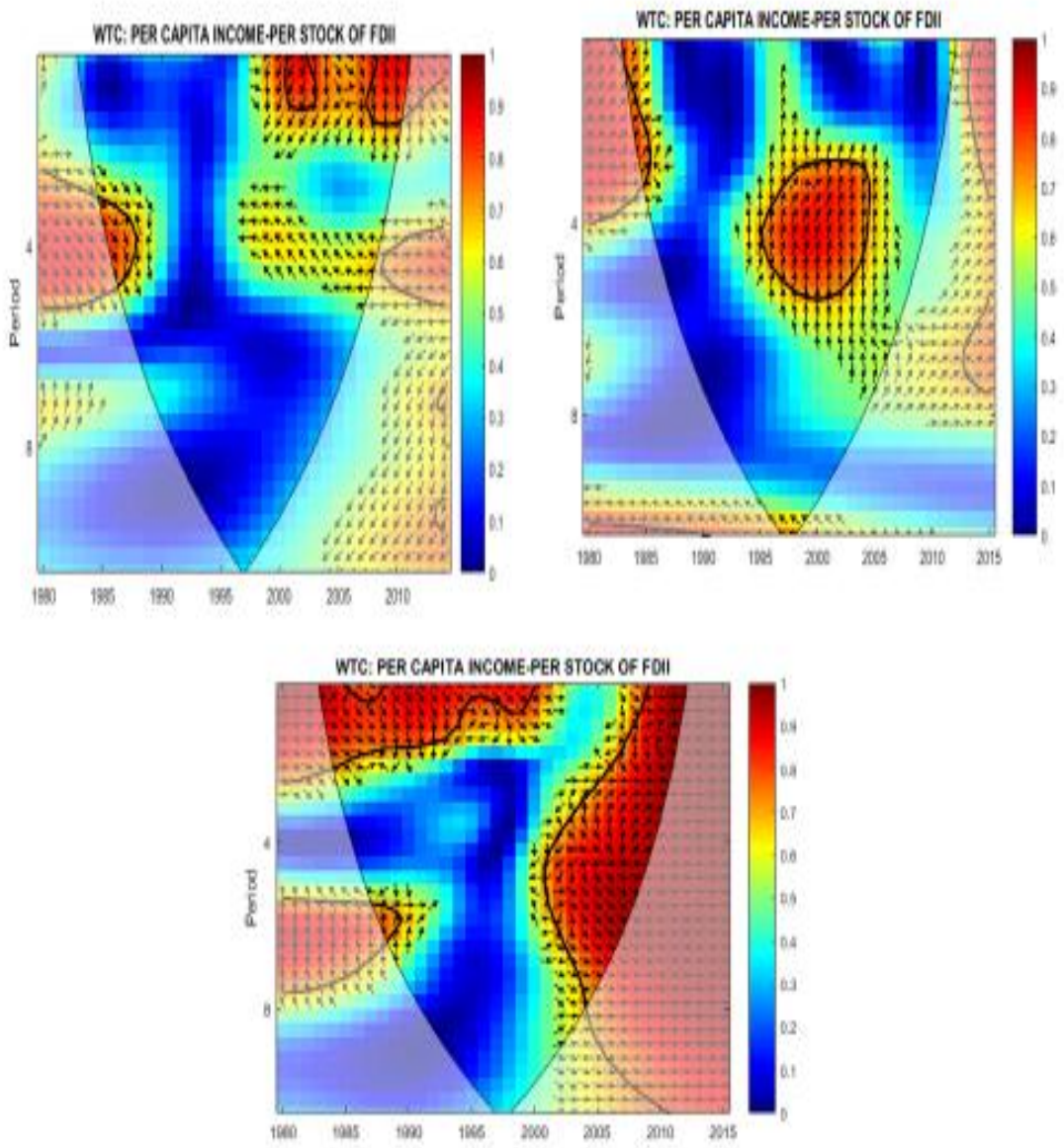


Table 6.1: The Level Effect of FDI Inflow

Country	Wavelet Coherence		Net Impact on Per Capita Income
	Correlation	Causality	
Gambia	+ & -	bidirectional	+
Senegal	+	$Income \leftarrow FDI$	+
Ghana	+ & -	bidirectional	+

Table 9.1: The + & - sign means wavelet coherence (local correlation) shows that FDI inflows have both positive and negative impact on per capita income.

6.3. The Growth Effect of FDI Inflow

Figure 6.2 shows the impact of per stock of FDI inflows on per capita income growth in different countries using wavelet coherence (WTC). In Figure 6.2, the figure at the top left corner represent the WTC for The Gambia, the figure at the top right corner represents the WTC for Senegal, and the one at the bottom represent the WTC for Ghana. In Figure 6.2, there is a small significant impact of FDI inflows on per growth in The Gambia and Ghana, however, there is a large significant impact of FDI inflows on per growth in Senegal. The impact of per stock of FDI inflows on per capita income growth is negative in The Gambia, positive in Ghana, and positive in Senegal. The positive impact of FDI inflows is greater in Senegal than in Ghana, thus, among the three countries in terms of growth effect of FDI inflows Senegal derives the most benefit from FDI inflows. The comparison in Figure 6.2 is summarized in Table 6.2 below.

Figure 6.2: WTC between Per Capita Income Growth and Per Stock of FDI Inflows

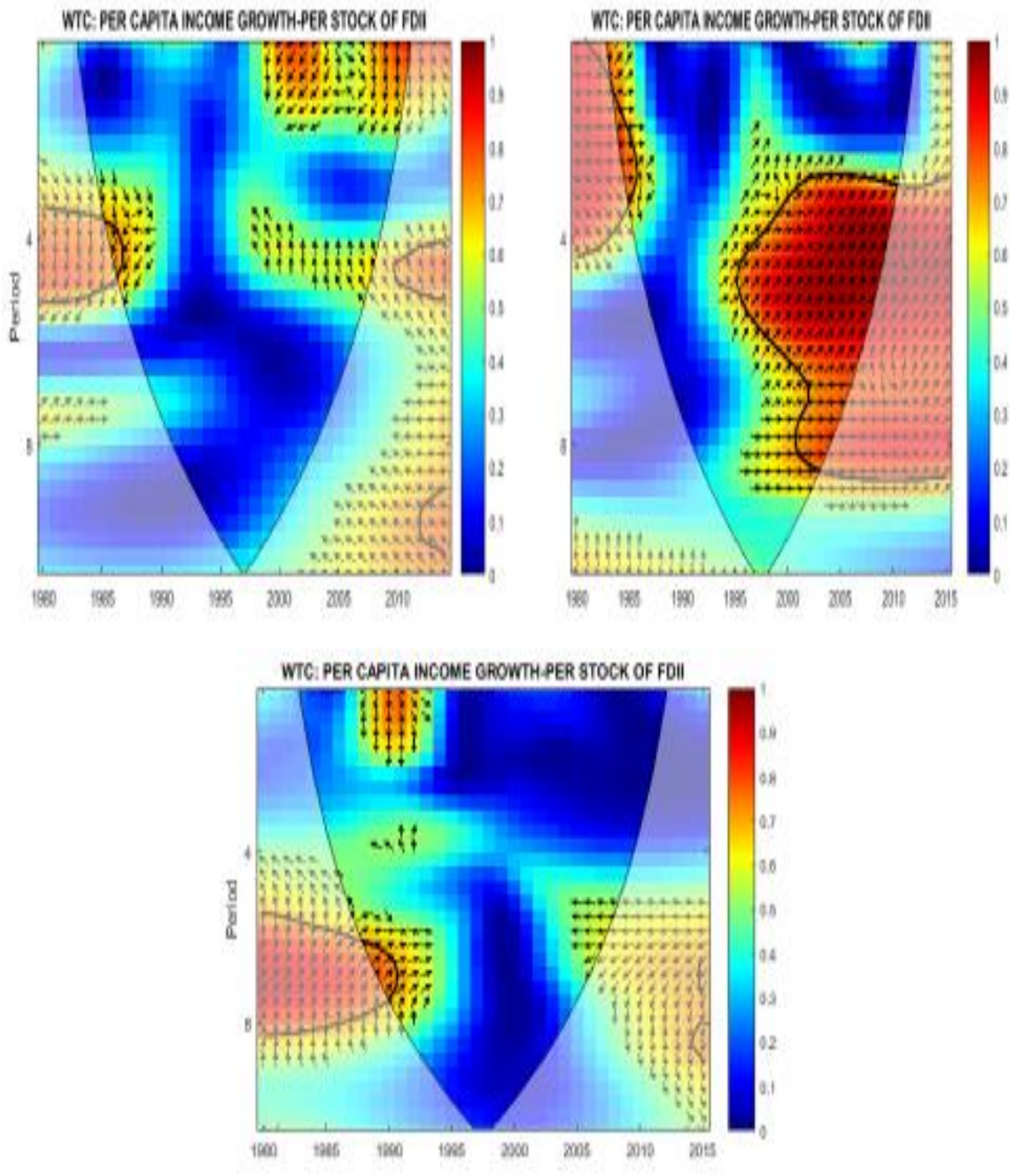


Table 6.2: The Growth Effect of FDI Inflow

Country	Wavelet Coherence		Net Impact on Per Capita Income
	Correlation	Causality	
Gambia	-	$growth \leftarrow FDI$	-
Senegal	+	$growth \leftarrow FDI$	+
Ghana	+	$growth \leftarrow FDI$	+

The natural questions are why Senegal and Ghana derive more benefit from FDI inflows more than The Gambia in terms of the level effect of FDI inflows? Why Senegal derives the most benefit from FDI inflows in terms of growth effect? In the FDI literature, it is believed that the final impact of FDI inflows on the economy of the host country depends on the interaction of FDI and domestic investment (DI) as stated in the below quote;

> "Although FDI is expected to boost long-run growth in the recipient economy via technological upgrading and knowledge spillovers, it is shown that the extent to which FDI is growth-enhancing depends on the degree of complementarity and substitution between FDI and domestic investment" (De Mello, 1999, p.133)

To find answers to the above questions, the study modeled the linkage between FDI inflows, DI, and income, and also empirically test the interaction of FDI inflows, DI, and income. Equation [6.1] shows how the interaction of FDI inflows and DI affect TFP (*A*) which ultimately affects the income of the host country.

$$A = h\,(FDI * DI) \qquad [6.1]$$

Suh that, $\frac{\partial A}{\partial FDI*DI} > 0$ if FDI complements DI & $\frac{\partial A}{\partial FDI*DI} < 0$ if FDI substitutes DI

Equation [6.1] shows that If DI is not independent of FDI inflows, the interaction of FDI inflows and DI would have an impact on the total factor productivity (TFP) in the host country. If FDI inflows complement DI, local firms will imitate the foreign technology and this will ultimately lead to increase in TFP **(**Kinoshita, 1998; Sjöholm, 1999). However, if FDI substitutes domestic investment or makes domestic technology obsolete (Khan, 2007; Makki & Somwaru, 2004), this will reduce TFP.

To find the linkage between FDI inflows, DI, TFP, and income, equation [6.1] is substituted into equation [3.3] to form equation [6.2] below:

[6.2] $$g = (1/\theta)\,[\ f(FDI)^{-1}\ .\ L.\ h(FDI * DI)^{1/(1-\alpha)}\ .\ \left(\frac{1-\alpha}{\alpha}\right).\ \alpha^{2/(1-\alpha)} - \rho$$

Equation [6.2] shows that if FDI complements domestic investment, the impact of FDI on income growth would be unambiguous because of the lower cost of R&D and an increase in TFP. However, in a case where FDI crowd out domestic investment, the net impact of FDI on income growth would not be clear cut this is because FDI would have both positive and negative impacts on growth. The positive impact comes from low cost of R&D while the negative impacts is caused by lower domestic technlogy which in turn lead to lower TFP. The empirical results of the impact of the interaction between FDI inflows and DI (interaction term, the product of total stock of FDI inflows and total domestic investment) on per capita income and per growth is shown by wavelet coherence in Figure 6.3 and 6.4, respectively.

Figure 6.3 below shows how the interaction of FDI inflows with DI (interaction term) affects per capita income in different countries using wavelet coherence. In Figure 6.3, the figure at the top left corner represent the wavelet coherence for The Gambia, the figure at the top right corner represents the wavelet coherence for Senegal, and the one at the bottom represent the wavelet coherence for Ghana. It can be seen from Figure 6.3 that the significant nexus between the interaction term and per capita income is small in The Gambia and Ghana while in Senegal is large, this means there is a more significant linkage between local firms and foreign firms in Senegal compare to The Gambia and Ghana. The significant nexus in The Gambia is negative, in Senegal the overall nexus is positive, and in Ghana is positive. Positive nexus also means FDI inflows complement DI while negative nexus means FDI inflows substitute DI in the host country. Thus, the reason why Senegal and Ghana derive more benefits from FDI than The Gambia in terms of the level effect of FDI inflows is because FDI inflows complement DI in enhancing per capita income in Senegal and Ghana while the FDI inflows substitute DI in The Gambia.

Since FDI inflows substitute DI in The Gambia, there might be no or few local firms acting as agents of technological diffusion in The Gambia relative to Senegal and Ghana, hence, The Gambia could not maximize the benefit of FDI inflows through technological transfer and diffusion. The empirical information in Figure 6.3 is summarized in Table 6.3 below.

Figure 6.3. The Impact of the Interaction of FDI inflows and DI on Per Capita Income

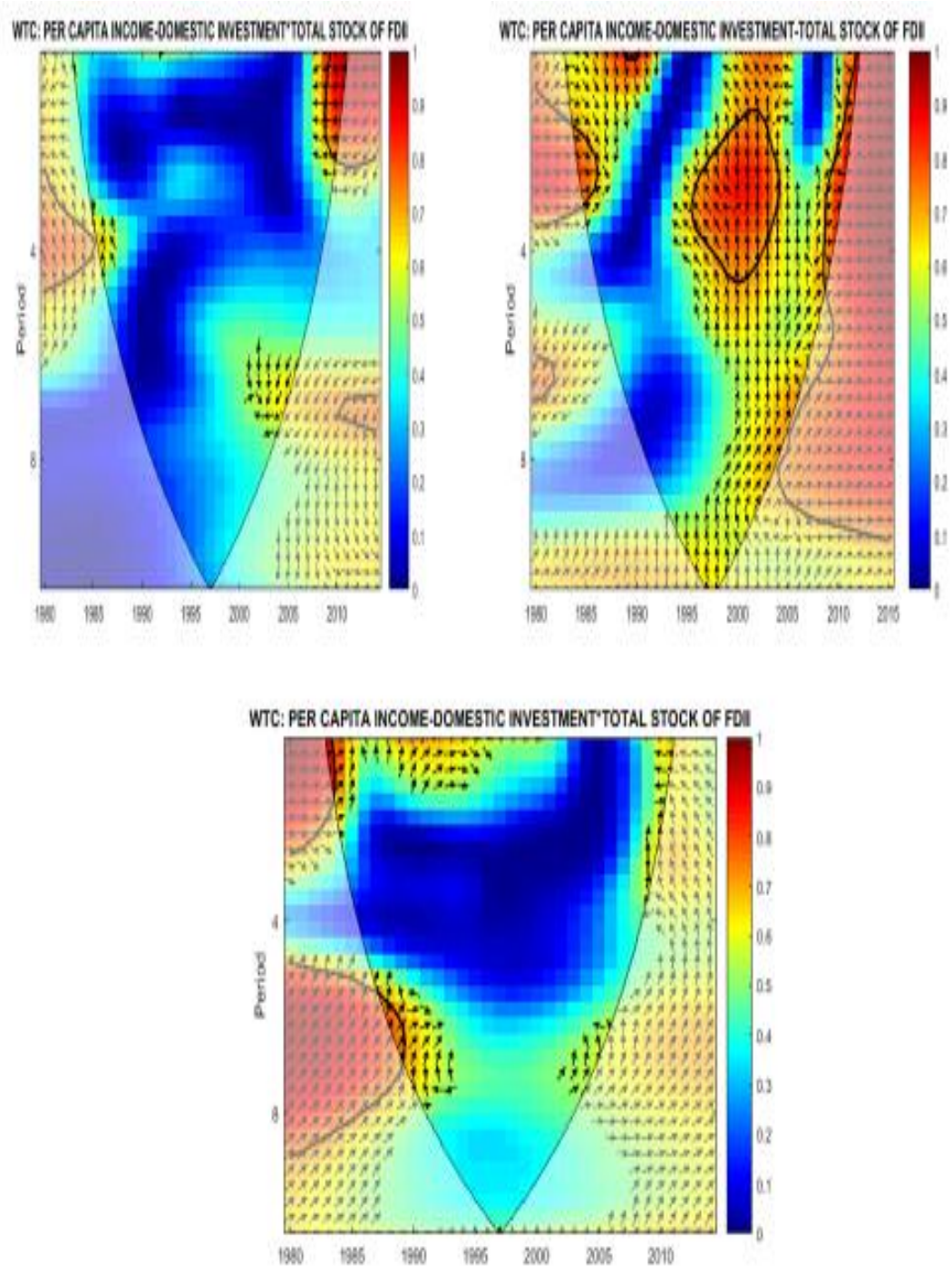


Table 6.3: The Impact of the Interaction of FDI inflows and DI on Per Capita Income

Country	Year	Scale	Phase	Net Impact of FDI on DI
Gambia	2009-2011	1-2	Out-of-phase	Negative
Senegal	1984-1986	2	In-Phase	Positive
Senegal	1984-1986	3	In-Phase	Positive
Senegal	1996-1999	2-5	Out-of-Phase	Negative
Senegal	2010-2012	1-5	In-Phase	Positive
Ghana	1985	1-2	In-Phase	Positive
Ghana	1978-1988	6-7	In-Phase	Positive

Note: Out-of-phase means the interaction of FDI and DI has a negative impact on per capita income while in-phase means the interaction between FDI and DI has a positive impact on per capita income.

Figure 6.4 below shows how the interaction of FDI inflows with DI (interaction term) affects per capita income growth in different countries using wavelet coherence. In Figure 6.4, the figure at the top left corner represents the wavelet coherence for The Gambia, the figure at the top right corner represents the wavelet coherence for Senegal, and the one at the bottom represents the wavelet coherence for Ghana.

In Figure 6.4, it can be seen that there is a more significant interaction between FDI inflows and DI in Senegal than both The Gambia and Ghana. In The Gambia the interaction between FDI and DI has a negative impact on per growth, this also means FDI inflows substitute DI in The Gambia. In Senegal, the interaction between FDI inflows and DI has a positive impact on per growth, this also means FDI inflows complement DI in Senegal. In Ghana, the interaction between FDI inflows and DI has no impact on per growth. Thus, it can be concluded that Senegal derives more positive benefits in terms of growth effect of FDI inflows than The Gambia and Ghana because there are a larger positive linkages between foreign firms and local firms in Senegal

relative to The Gambia and Ghana, this enables more foreign technology to be transferred and diffused easily in Senegal than in The Gambia and Ghana. Table 9.4 below summarizes the empirical findings in Figure 6.4 below.

Figure 6.4. The Impact of the Interaction of FDI inflows and DI on Per Capita Income Growth

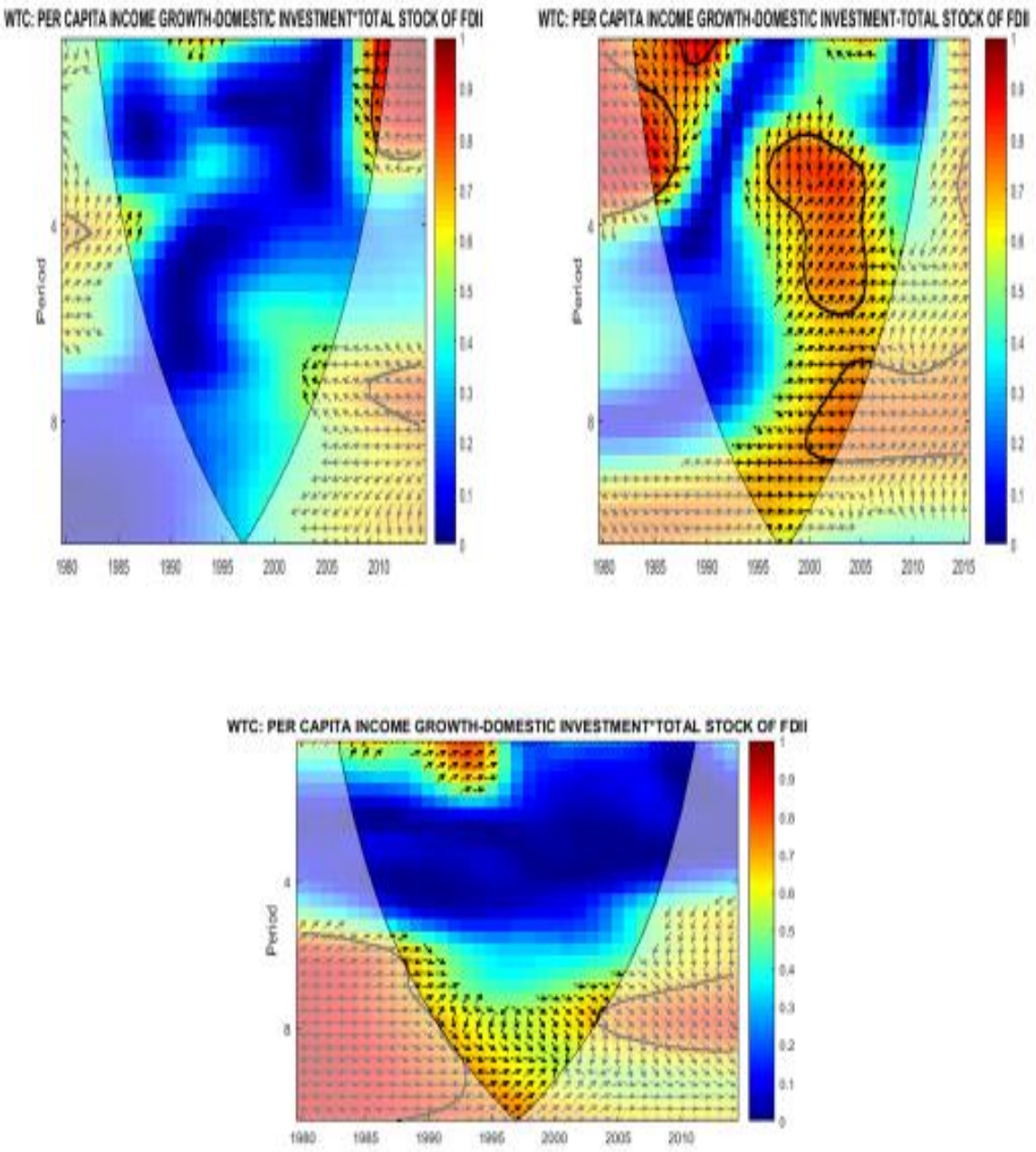


Table 6.4: The impact of the Interaction of FDI inflows and DI on Per Capita Income Growth

Country	Year	Scale	Phase	Impact of FDI on DI
Gambia	2009-2011	1-2	Out-of-phase	Negative
Senegal	1984-1987	1-3	In-Phase	Positive
Senegal	1989-1993	1	In-Phase	Positive
Senegal	1997-2005	2-6	In-Phase	Positive
Senegal	2000-2006	7-9	In-Phase	Positive
Ghana			No nexus	No nexus

Note: Out-of-phase means the interaction of FDI and DI has a negative impact on per capita income growth while in-phase means the interaction between FDI and DI has a positive impact on per capita income growth.

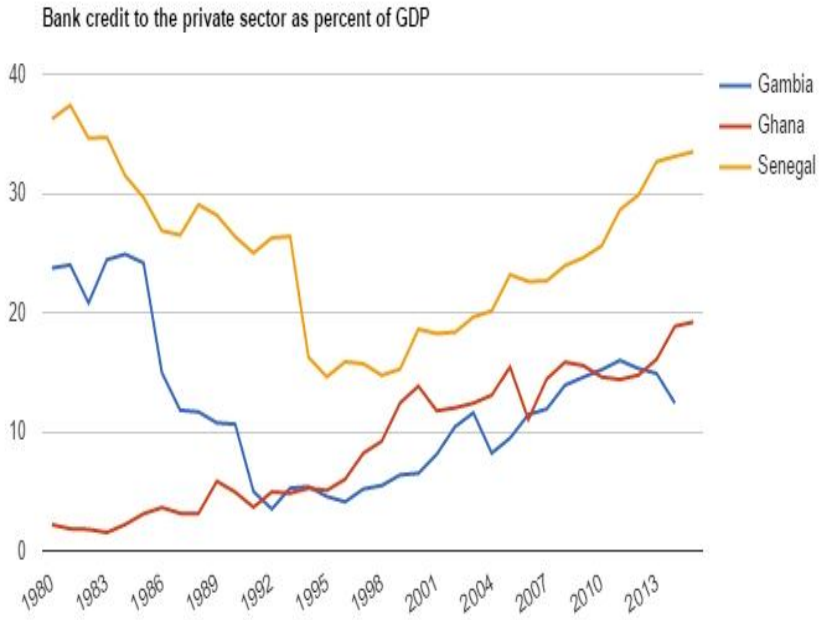
In the FDI literature, other than the interaction of FDI inflows and domestic investment (the linkage between foreign direct investors and the local firms), the impact of FDI on the economy of the host country also depends on the following factors in the host country;

- The level of development of the domestic financial sector (Hermes & Lensink, 2003)
- The level of the development of the domestic technology (OECD, 2002)
- The level of development of the human capital (Borensztein, et al., 1998)

As aforementioned in the literature review chapter, if the level of development in technology, in human capital, and in the financial sector is high, the ability of the host country to absorb foreign technologies is enhanced and vice-versa. Thus, the study examines the level of development in technology, in human capital, and in the financial sector in each country. Examining the level of development in these areas would shed more light on the empirical results. In this study, the proxy for the level of development

of the domestic financial sector is the bank credit to the private sector as a percentage of GDP while the proxy for the level of development of technology and for the level of development of human capital is the innovation index.

Figure 6.5: Bank Credit to the Private Sector as Percent of GDP



Source: TheGlobalEconomy.com, World Bank

Figure 6.6: Innovation Index

Figure 6.5 shows the bank credit to the private sector as a percentage of GDP. In Figure 6.5, Senegal has the highest level of Bank credits to the private sector. The Bank credit to the private sector for The Gambia is greater than that of Ghana until the year 1992 when Ghana starts to outperform The Gambia after 1992, thus, overall Ghana outperforms The Gambia. According to Hermes and Lensink (2003), the level of the development of the financial sector of the host country is an essential precondition for FDI to have a positive impact on the growth of the host country, this is because a developed financial sector promotes technological spillover related with FDI. Levine (1997) argued that the impact of financial development on economic growth work through two channels; capital accumulation and technological innovation. Financial sector mobilizes savings and this provides funds for foreign firms to carry out their FDI in the host country. Moreover, the financial sector also provides funds to the local firms for financing the cost of imitating the foreign technologies. Thus, financial sector provides resources to ensure foreign direct investors to carry out their innovative

activities in the host country and also enables the domestic firms to finance the cost of adopting the new technologies.

Figure 6.6 shows the innovation index.[2] In Figure 9.6, Senegal and Ghana outperform The Gambia. The innovation index measures both human capital and technology level in each country. Borensztein, et al. (1998) argued that FDI would have a higher productivity in the host country if the host country has a minimum threshold of human capital. The use of these advanced technologies brought by foreign direct investors requires the availability of high human capital stock in the host country.

In conclusion, the reasons why Senegal derives more benefit from FDI inflows more than Ghana, and why Ghana derives more benefit more than The Gambia is because;

- There are more significant positive linkages between local firms and foreign direct investors in Senegal than Ghana and more in Ghana than in The Gambia.
- The level of financial development in Senegal is higher than in Ghana and higher in Ghana than The Gambia as shown by the bank credits to the private sector in Figure 6.5.
- The level of human capital and technology development in Senegal and Ghana is greater than in The Gambia as shown by innovation index in Figure 6.6 above.

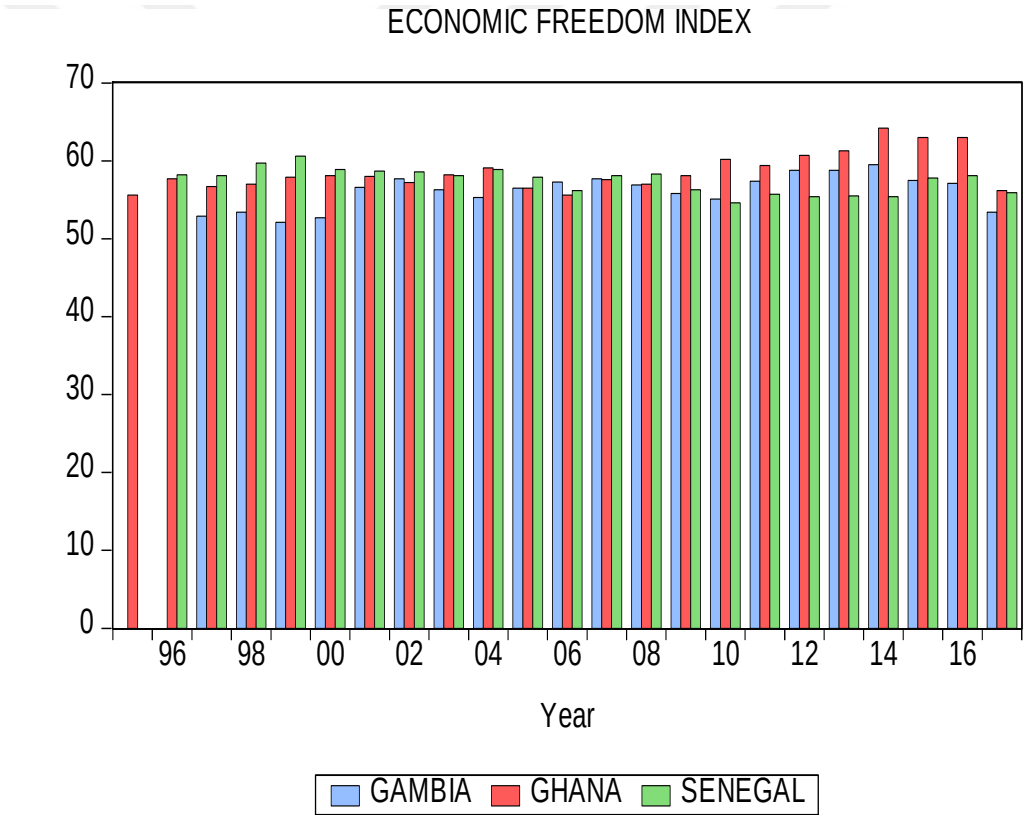
Moreover, the conduciveness of the internal domestic conditions are also preconditions for a country to derive maximum benefit from FDI inflows. This study uses The Heritage freedom index[3] as a proxy to measure the internal domestic conditions of each country. Figure 6.7 shows the Freedom index for The Gambia, Senegal and Ghana. The Freedom Index score for The Gambia in year 2017 is 53.4, for

[2] The Global Innovation Index includes two sub-indices: the Innovation Input Sub-Index and the Innovation Output Sub-Index. The first sub-index is based on five pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication. The second sub-index is based on two pillars: Knowledge and technology outputs and Creative outputs. Each pillar is divided into sub-pillars and each sub-pillar is composed of individual indicators (TheGlobalEconomy.com, Cornell University, INSEAD, and the WIPO)

[3] The Heritage freedom index is the sum of the following indexes; rule of the law, regulatory efficiency, open markets and government size.

Senegal is 55.9 and for Ghana is 56.2. The rest of the previous years can be read in Figure 6.7. In Figure 6.7, overall, Senegal and Ghana outscore The Gambia. Out of the 23 years, Ghana outscore The Gambia and Senegal for twelve years, Senegal outscores Ghana and The Gambia for ten years and Gambia outscores Senegal and Ghana for only one year (2006). Hence, another reason why Senegal and Ghana derive more benefit from FDI inflows than The Gambia is because the overall internal domestic conditions (political or economics conditions) are better in Ghana and Senegal than The Gambia.

Figure 6.7: The Economic Freedom Index



6.4. Conclusion

This chapter summarizes the empirical results, compares the empirical results of the three countries used in this study, and give reasons why one country benefits more from FDI inflows than the other country.

From the analysis of the empirical results, Senegal benefits more from FDI inflows than The Gambia and Ghana, this is because FDI inflows complement domestic investment (DI) more in Senegal than in The Gambia and Ghana. FDI inflows complementing DI means foreign firms and local firms established positive linkages and this leads to technological transfer and diffusion in the host country by local firms acting as agents of technological spillover, this ultimately has a positive impact on both the level of income and growth in the host country. Another reason why Senegal derives the most benefit from FDI inflows is because Senegal has better developed financial sector than the other two countries. A developed financial system enhances technological diffusion in the host country by providing funds for the local firms and foreign direct investors for carrying out innovation activities.

After Senegal, Ghana benefits more from FDI inflows. The reason why Ghana could not derive the most benefit from FDI might be the little linkage between domestic firms and foreign firms and the low level of financial development relative to Senegal. The Gambia derives the least benefit from FDI inflows, this might be attributed to the fact that FDI inflows only crowded out DI, hence, technological transfer and diffusion could not be maximized in The Gambia by the local firms since the linkage between them and foreign firms is negative. Moreover, the level of human capital, technological development and the economic freedom (used as a proxy to measures the conduciveness of the host country for FDI) are low in The Gambia relative to Senegal and Ghana, these might be extra reasons why the local firms could not absorb the foreign technology.

The next chapter concludes this study by giving policy recommendations and also recommends possible research areas that could help our understanding of the impact of FDI on the economy of the host country.

Chapter 7: Conclusion and Recommendations

Throughout this study, the ultimate goals were to find out whether per stock of FDI inflows affects income (per capita income and per growth) and to determine the direction of the causality at different scales over time. The empirical results show that the impact of FDI inflows on income and direction of causality is country-specific, that is, it has a different impact in different countries and causality is bidirectional depending on time and scale. The impact in each country depends on whether there is an interaction between FDI inflows and domestic investment or whether there is a linkage between foreign direct investors and the local firms. If there is a positive linkage between foreign direct investors and local firms (i.e., if FDI inflows complement domestic investment), a country tends to benefit more from FDI inflows than if there is a negative linkage between foreign direct investors and the local firms (i.e., if FDI inflows substitute domestic investment).

A positive linkage between foreign and the domestic firms or FDI inflows complementing domestic investment ensures that domestic firms imitate the foreign technologies, this ultimately leads to technological transfer and diffusion in the host country. However, in a situation where there is a negative linkage, technological transfer and diffusion might not occur or will be minimal because the agents of technological transfer and spillover (local firms) are crowded out of the local markets.

The most important channel through which FDI inflows can have a positive impact on the economy of the host country is through technological transfer and spillover. However, for the host country to experience technological transfer and spillover there should be a positive linkage between foreign direct investors and the local firms. Thus, in order to ensure transfer of technology and spillover in the host

country, policymakers in the host country should provide incentives that would encourage the foreign and the local firms to voluntary form partnerships, this would ensure positive linkage and there could be technological transfer and spillover in the host country. For FDI to have a net positive impact on the economic growth of the host country, local authorities have to implement internal domestic policies that will strengthen the positive channels and eradicate or minimize the negative channels in Table 2.1 because FDI alone cannot have a positive impact on growth.

The positive linkage between domestic firms and foreign direct investors is a necessary condition for FDI inflows to have a greater positive impact on the economy of the host country but is not a sufficient condition. The level of the development of the local financial sector, the quality of human capital, and the level of technological development in the host country all serve as preconditions for FDI to have a positive impact on the income of the host country. Thus, before host countries embark on providing incentives in order to attract FDI, they should strive to achieve some threshold level of development in the financial sector, human capital, and technology. This would help them to absorb the foreign technology.

Moreover, most of the studies on FDI and income nexus explore how the linkage between foreign direct investors and local firms affect the economy of the host country, but how the interaction of FDI and households affect the economy of the host country is not studied. There is a possibility that FDI inflows affect the hourly wage rate and the saving behavior of the households in the host country and this, in turn, has an impact on the welfare of the household and the economy as a whole. Empirically examining the linkage between FDI inflows and households of the host country could provide new perspectives on how FDI inflows affect the income or the economy of the host country.

APPENDIX:

Table A: Source and Definition of Data

Varıable	Source	Definition
Foreign Direct Investment, FDI	UNCTAD	"Foreign direct investment (FDI) is defined as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) of an enterprise resident in another economy (FDI enterprise or affiliate enterprise or foreign affiliate). FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in another economy. The investor's "lasting interest" is evidenced when the investor owns at least 10% of the voting power of the FDI enterprise. FDI involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates. It covers equity capital, reinvested earnings and intra-company loans"
Per Capita Income	World Bank national	"GDP per capita is gross domestic

(GDP per capita, constant 2010 US$)	accounts data, and OECD National Accounts data files.	product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars"
Per Capita Income Growth (GDP per capita growth, annual %)	World Bank national accounts data, and OECD National Accounts data files.	"Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources"
Gross fixed capital	World Bank national	"Gross fixed capital formation

formation	accounts data, and OECD National Accounts data files.	(formerly gross domestic fixed investment) includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are in constant 2010 U.S. dollars. Source World Bank national accounts data, and OECD National Accounts data files"

References

Addison, P. S. (2002). *The Illustrated Wavelet Transform Handbook: Introductory Theory and Applications in Science, Engineering, Medicine and Finance*. CRC Press.

Adeniyi, O., Omisakin, O., Egwaikhide, F. O., & Oyinlola, A. (2012). Foreign direct investment, economic growth and financial sector development in small open developing economies. *Economic Analysis and Policy, 42*(1), 105-127.

Aghion, P., & Howitt, P. (1990). *A model of growth through creative destruction* (No. w3223). National Bureau of Economic Research.

Aguiar-Conraria, L., Azevedo, N., & Soares, M. J. (2008). Using wavelets to decompose the time–frequency effects of monetary policy. *Physica A: Statistical mechanics and its Applications*, *387*(12), 2863-2878.

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: the role of local financial markets. *Journal of international economics, 64*(1), 89-112.

Arrow, K. J. (1962). The Economic Implications of Learning by Doing. *The Review of Economic Studies*, *29*(3), 155-173.

Asheghian, P. (2004). Determinants of economic growth in the United States: The role of foreign direct investment. *The international trade journal*, *18*(1), 63-83.

Avi-Yonah, R. S. (2000). Globalization, tax competition, and the fiscal crisis of the welfare state. *Harvard law review*, 1573-1676.

Barro, Robert J. and Xavier Sala–i-Martin (1995). *Economic Growth,* New York, McGraw Hill.

Barry, F. (2000). Foreign direct investment, cost competitiveness and the transformation of the Irish economy. *Development Southern Africa, 17*(3), 289-305.

Berthelemy, J.-C., & Demurger, S. (2000). Foreign direct investment and economic growth: theory and application to china. *Review of Development Economics,* 4(2), 140-155.

Bloomström, M., & Kokko, A. (1998). Multinational corporations and spillovers. *Journal of Economics Survey,* 12(3), 247-277.

Borensztein, E., De Gregorio, J., & Lee, J.-W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics,* 45(1), 115-135.

Cass, D. (1965). Optimum growth in an aggregative model of capital accumulation. *The Review of economic studies,* 32(3), 233-240.

Chakraborty, C., & Basu, P. (2002). Foreign direct investment and growth in India: A cointegration approach. *Applied Economics,* 34(9), 1061-1073.

Chowdhury, A., & Mavrotas, G. (2003). FDI and Growth: What causes what? WIDER Conference on *"Sharing Global Prosperity".* WIDER, Helsinki, 6-7 September, 1-18.

Conraria, L. A., & Soares, M. J. (2010). *Business Cycle Synchronization and the Euro: a Wavelet Analysis* (No. 36/2010). NIPE-Universidade do Minho.

De Mello Jr, L. R. (1997). Foreign direct investment in developing countries and growth: A selective survey. *The Journal of Development Studies*, 34(1), 1-34.

De Mello, L. R. (1999). Foreign direct investment-led growth: evidence from time series and panel data. *Oxford economic papers*, 51(1), 133-151.

Domar, E. D. (1946). Capital expansion, rate of growth, and employment. *Econometrica, Journal of the Econometric Society*, 137-147.

DOS, U.S. (2015). *U.S Department of State, Investment Climate Statements*. Washington, D.C: U.S Department of State.

Driffield, N. (2000). The impact on domestic productivity of inwards investment into the UK. *The Manchester School*, 69(1), 103-119.

Duttaray, M., Dutt, A., & Mukhopadhyay, K. (2008). Foreign direct investment and economic growth in less developed countries: an empirical study of causality and mechanisms. *Applied Economics*, 40(15), 1927-1939.

ESSO, J. L. (2010). Long-run relationship and causality between foreign direct investment and growth: Evidence from ten African countries. *International Journal of Economics and Finance*, 2(2), 168.

Ford, T., Rork, J., & Elmslie, B. (2008). Foreign direct investment, economic growth, and the human capital threshold. *Review of International Economics*, 16(1), 96-113.

Frindlay, R. (1978). Relative backwardness, direct foreign investment, and the transfer of technology: a simple dynamic model. *The Quarterly Journal of Economics*, 92(1), 1-16.

Gibba, A., & Molnar, M. (2016). AN EMPIRICAL STUDY ON FACTORS OF ECONOMIC GROWTH IN THE GAMBIA: LESSONS FROM AGRICULTURE AND EXPORTS. *VADYBA*, 2(29), 63-69.

Grinsted, A. J., & Svetlana, J. (2004). Application of the cross wavelet transform and wavelet coherence to geophysical time series. *Nonlinear processes in geophysics*, 11(5/6), 561-566.

Grossman, G. M., & Helpman, E. (1993). *Innovation and growth in the global economy*. MIT press.

Hansen, H., & Rand, J. (2006). On the causal links between FDI and growth in developing countries. *The World Economy*, *29*(1), 21-41.

Hanson, G. H. (2001). *Should countries promote foreign direct investment?* (Vol. 9). UN.

Harrod, R. (1939). An essay in dynamic theory. *The economic journal*, 49(193), 14-33.

Hermes, N., & Lensink, R. (2003). Foreign direct investment, financial development and economic growth. *The Journal of Development Studies*, 40(1), 142-163.

Jones, C. (1998). *Introduction to Economic Growth*. New York: W.W. Norton & Company Inc.

Keho, Y. (2015). Foreign Direct Investment, Exports and Economic Growth: Some African Evidence. *Journal of Applied Economics & Business Research*, 5(4).

Khan, M. A. (2007). *Foreign direct investment and economic growth: the role of domestic financial sector* (No. 2007: 18). Pakistan Institute of Development Economics.

Kinoshita, Y. (1998). *Technology Spillovers through Foreign Direct Investment* (No. 221). William Davidson Institute at the University of Michigan.

Koopmans, T. C. (1965). *On the Concept of Optimal Economic Growth* (No. 163). Cowles Foundation for Research in Economics, Yale University.

Lee, M., & Tchna, M. (2004). The color of money; the effects of foreign direct investment on economic growth in tradition economies. *Review of World Economics*, 140(2), 211-229.

Levine, R. (1997). Financial development and economic growth: views and agenda. *Journal of economic literature*, *35*(2), 688-726.

Lim, M. E. G. (2001). *Determinants of, and the relation between, foreign direct investment and growth: a summary of the recent literature* (No. 1-175). International Monetary Fund.

Loungani, P., & Razin, A. (2001). How beneficial is foreign direct investment for developing countries? *Finance and Development*, *38*(2), 6-9.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, 22(1), 3-42.

Makki, S. S., & Somwaru, A. (2004). Impact of Foreign Direct Investment and Trade on Economic Growth: Evidence From Developing Countries. *American Journal of Agricultural Economics*, 86(3), 795-801.

Mencinger, J. (2003). Does foreign direct investment always enhance economic growth?. *Kyklos*, *56*(4), 491-508.

Moura, R., & Forte, R. (2010). *The effects of foreign direct investment on the host country economic growth-theory and empirical evidence* (No. 390). Universidade do Porto, Faculdade de Economia do Porto.

Organization for Economic Co-operation and Development. (2008). *OECD Benchmark Definition of Foreign Direct Investment 2008*. Paris: OECD Publishing.

OECD. (2002). *foreign direct investment for development: maximizing benefits, minimizing costs*. Paris: OECD Publishing.

Oztürk, I. (2007). Foreign direct investment -growth nexus: a review of the recent literature. *International Journal of Applied Econometrics and Quantitative Studies*, 4(2), 79-98.

Percival, D. B., & Walden, A. T. (2006). *Wavelet methods for time series analysis* (Vol. 4). Cambridge university press.

Pessoa, A. (2007). *FDI and Host country productivity: a review* (No. 251). Universidade do Porto, Faculdade de Economia do Porto.

Priestley, M. B. (1981). Spectral analysis and time series. *Probability and mathematical statistics*.

Ram, R., & Zhang, K. H. (2002). Foreign direct investment and economic growth: Evidence from cross-country data for the 1990s. *Economic Development and Cultural Change*, *51*(1), 205-215.

Ramsey, F. P. (1928). A mathematical theory of saving. *The economic journal*, 38(152), 543-559.

Ramsey, J. B. (2002). Wavelets in Economics and Finance: Past and Future. *Studies in Nonlinear Dynamics & Econometrics*, *6*(3), 1-29.

Ramsey, J. B., & Camille, L. (1998a, b). Decomposition of economic relationships by timescale using wavelets. *Macroeconomic Dynamics*, 2(01), 49-71.

Rodriguez -Clare, A. (1996). Multinationals, linkages and economic development. *American Economic Review*, 86(4), 852-873.

Romer, D. (1996). *Advanced Macroeconomics*. New York: McGraw-Hill companies.

Romer, P. (1989). *Endogenous Technological Change* (No. 3210). National Bureau of Economic Research, Inc.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of political economy*, *94*(5), 1002-1037.

Romer, P. M. (1987). Growth based on increasing returns due to specialization. *The American Economic Review*, 77(2), 56-62.

Romer, P. M. (1988). *Capital accumulation in the theory of long run growth* (No. 123). University of Rochester-Center for Economic Research (RCER).

Rua, A., & Nunes, L. C. (2009). International comovement of stock market returns: A wavelet analysis. *Journal of Empirical Finance*, 16(4), 632-629.

Saggi, K. (2002). On technology transfer from trade and foreign direct investment. *World Bank Research Observer*, *17*(2), 191-236.

Sahoo, D., & Mathiyazhagan, M. K. (2003). Economics growth in India: Does foreign direct investment inflow matters? *Singapore Economic Review*, 48(2), 151-171.

.

Sen, H. (1998). Different arguments for and against the role and impact of foreign direct investment on the development potentials of developing countries: an overview. *Journal of Economics and Administrative Sciences*, 13(1), 181-190.

Sheshinski, E. (1967). Optimal accumulation with learning by doing. *Essays on the theory of optimal economic growth*, 31-52.

Sjöholm, F. (1999). Technology gap, competition and spillovers from direct foreign investment: evidence from establishment data. *The Journal of Development Studies*, *36*(1), 53-73.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, *70*(1), 65-94.

Swan, T. (1956). Economic growth and capital accumulation. *Economic record*, 32(2), 334-361.

Sylwester, K. (2005). Foreign direct investment, growth and income inequality in less developed countries. *International Review of Applied Economics*, 19(3), 289-300.

Tekin, R. B. (2012). Economic growth, exports and foreign direct investment in Least Developed Countries: A panel Granger causality analysis. *Economic Modelling*, 29(3), 868-878.

Torrence, C., & Compo, G. P. (1998). A practical guide to wavelet analysis. *Bulletin of the American Meteorological society*, 79(1), 61-78.

Torrence, C., & Webster, P. J. (1998). The annual cycle of persistence in the El Nño/Southern Oscillation. *Quarterly Journal of the Royal Meteorological Society*, 124(550), 1985-2004.

UNCTAD (1999c). *World Investment Report 1999: Foreign Direct Investment and the Challenge of Development.* New York and Geneva: United Nations.

UNCTAD. (2015). *World Investment Report*. Geneva and New York: UNCTAD.

Varamini, H., & Vu, A. (2007). Foreign direct investment in Vietnam and its impact on economic growth. *International Journal of Business Research*, 7(6), 132-139.

Vissak, T., & Roolaht, T. (2005). The negative impact of foreign direct investment on the Estonian economy. *Problems of Economic Transition*, 48(2), 43-66.

Wang, M. (2009). Manufacturing FDI and economic growth: evidence from Asian economies. *Applied Economics*, 41(8), 991-1002.

Zhang, K. H. (2001a). Does foreign direct investment promote economic growth? Evidence from East Asia and Latin America. *Contemporary Economic Policy*, 19 (2), 175-185.

Zhang, K. H. (2001b). How does foreign direct investment affect economic growth in China? *Economics of Transition*, 9(3), 679-693.