THE EFFECTS OF INVESTMENT CLIMATE ON PRODUCTIVITY OF FOOD AND BEVERAGES INDUSTRIES IN SWAZILAND

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Date: April 2018

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AGES INDUSTRIES IN SWAZILAND

ABSTRACT

Food security and job creation is among the priorities of the government of Swaziland. To address these priorities, the government have made substantial investment on infrastructure. Regardless of the intervention, Swaziland imports 90% of food and unemployment is still high. The purpose of study is to examined the influence of investment climate on productivity of food and beverages industries in Swaziland. Cross-sectional data from the World Bank was used. A Cobb-Douglas production function for Swaziland manufacturing industries was estimated to produce a measure of TFP for each industry. Further an extended Cobb-Douglas production function was estimated with investment climate variables for selected manufacturing industries (food and beverages and garments industries).

The results showed that industries in Swaziland are labour intensive. Average number of days to claim goods from custom, informal payments and uneducated workforce, have significant negative effects on TFP of food and beverages industries. Investment climate indicators such as pressure from domestic competition and number of days to obtain telephone lines have positive effects on productivity of food and beverages industries. Appropriate measures should be put in place to regulate informal sectors.

Index words: Investment Climate, Productivity, Food and beverages Industries, Swaziland.

DEDICATION

This thesis is dedicated to my mother Florah Dlamini.

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ABBREVIATIONS

EU	European Union
GDP	Gross Domestic Product
ISIC	International Standard Industrial Classification
USA	United States of America

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The economic growth in Swaziland has fallen behind to that of its neighbours. Since 2001, the real GDP growth has an average of 2.8%, nearly 2% lower than GDP growth in other Southern African Customs Union (SACU) member countries. The economy of Swaziland consists of agriculture, forestry and mining industries which account to about 13% of the countryṏs GDP, other manufacturing industries which contributes about 37% to the GDP and services industry which contributes about 50% to the GDP of the country (Wikipedia, 2017).

The economy of Swaziland is closely linked to the economy of South Africa, from which it receives over 90% of its imports and exports about 70% of goods. Other key trading partners are the United States and the European Union (EU), from which Swaziland received preferences for textile exports under the African Growth and Opportunity Act (AGOA) to the USA and sugar exports to the EU. Both textile and sugar exports did well under these agreements with rapid growth and a strong inflow of foreign direct investment (FDI). Between 2000 and 2005 the textile exports grew by over 200% and the sugar exports by more than 50%. In 2014, the export sector was threatened by the removal of the trade preferences for textiles and phasing out of the preferential prices for sugar to the EU markets (Central Bank of Swaziland (CBS), 2016).

Swaziland is now facing the challenge of remaining competitive in the changing global environment. The investment climate is a crucial factor in addressing this challenge. Firms in Swaziland are less productive than firms in most middle-income countries in other regions. Productivity of firms in Swaziland can be compared much easily with firms from lower middle income countries but it is difficult to do so because firms in Swaziland are hindered by inadequate government arrangements and infrastructure (World Bank, 2007).

In 2015, the World Bank approved a loan of $25 million to help the country to improve the environment for private sector development and to catalyze new investments. The roject aims at supporting the economic diversification and gribusiness and tourism sectors. Another aim of the project is to help in implementation of the countryôs Investor Road Map. The main objective of the Investor Road Map is to create an enabling business climate. Private sector competitiveness project has to improve the investment environment which focus on regulatory reform and export facilitation to increase international and domestic investments and to increase exports. Through the private sector competitiveness project, the financial sector has to develop in order to improve access to finance for Micro, Small and Medium Enterprises (MSMEs). The development of the financial sector will help in the reviewing of the Export Credit and Small Scale Enterprise Guarantee Schemes and assist in the implementation of revised Schemes. These improvements has to facilitate private sector activity across sectors, including agribusiness and tourism (Wikipedia, 2017).

Swaziland mainly export sugar which is called the ñSwazi Goldò. She is the fourth largest producer of sugar in Africa and is 25th in production of sugar in the world. Many studies in the country have focused on the sugar industry. There are no known studies conducted on the food industry of Swaziland generally. This study focuses on the performance of food and beverages industries in Swaziland. The main industries of Swaziland according to the Commonwealth Network of Nation Report (2017) are: coal, sugar, textiles, soft drinks concentration and wood pulp. Other industries are cotton yarn, refrigerators, citrus and canned fruits (Wikipedia, 2017). Food and beverages industries of Swaziland include: sugar, maize, citrus and canned fruits, livestock and poultry and dairy.

1.2 Problem Statement

Swaziland faces crisis arising from combined effects of HIV/AIDS, poverty and natural disaster. Although Swaziland is considered a low middle income country, 69% of the population lives on or below the poverty line of US$1 per day. It is also estimated that 25.7% of the population is unemployed (World Food Programme, 2017).

Job creation and food security are among the priorities of the government of Swaziland as articulated in the national development plan. This can be achieved through import substitution by strengthening agro-processing, especial food industries.

ntervene to address the challenges of unemployment and 1998, Swaziland Investment Promotion Authority (SIPA) was established through an Act of Parliament to attract, promote and facilitate foreign and local investment and trade (COMESA Regional Investment Agency, 2017). In 2015, the government of Swaziland instructed SIPA to implement the investor Road Map that will create good business climate and also help in the creation of jobs. Swazi government in 2014 introduced farm input subsidy through the ministry of agriculture to reduce food insecurity.

Regardless of the governmentøs efforts, Swaziland still imports about 90% of food (Wikipedia, 2017). This shows that Swaziland faces some challenges in the changing global environment thus there is a need to investigate the impact of the investment climate of Swaziland on productivity of industries in the country.

1.3 Objectives

The main objective of the study is to examine the influence of investment climate on the productivity of food and beverages industries in Swaziland. The specific objectives are to:

1. Examine the characteristics of food and beverages industries in Swaziland.
2. Investigate the most serious obstacles facing industries in Swaziland.
3. Estimate total factor productivity of food and beverages industries in Swaziland.
4. Examine the effect of investment climate on the productivity of food and beverages industries.

1.4 Hypothesis

The hypothesis of this study are as follows:

1. H_0: There are no differences in the total factor productivity of food and beverages industries in Swaziland.

   H_1: There are differences in the total factor productivity of food and beverages industries in Swaziland.

2. H_0: There are no differences in the effects of investment climate on the productivity of food and beverages industries.

; in the effects of investment climate on the productivity dustries.

1.5 Significance of the study

The study will contribute to a broader understanding of investment climate factors affecting the food and beverages industries in Swaziland. Findings of this study will assist the government of Swaziland to understand the most important investment climate variables in order to design focused policy interventions.

There is little or no known research studies that has been carried out or published about the investment climate on food and beverages industries in Swaziland. However, the world bank have conducted a survey on the investment climate of Swaziland. Hence, the study will add on the academic literature of the investment climate of Swaziland.

1.6 Plan of the study

The rest of the study is arranged as follows: **Chapter 2** presents the relevant literature review of the study. **Chapter 3** describes the methodology that will be used to analyse the objectives of the study. **Chapter 4** presents and discusses the results and findings of the study. **Chapter 5** presents the summary, conclusion and policy recommendation of the study.

1.7 Definitions of terms

Investment Climate: is the set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs and expand. The factors are the policies, institutional and regulatory environment in which firms operate.

Productivity: is the effect of variables affecting the production process.

Gross Domestic Product (GDP): is a measure of the ñ value of a countryôs overall output of goods and services (typical during one fiscal year) at market prices, excluding net income from abroadò.

Food and beverages industry: are all companies involved in processing raw food materials, packaging and distributing them. This include fresh, prepared foods as well as

...nd non-alcoholic beverages. Any product meant for human ...aceuticals, passes through this industry (globalEDGE, not dated).

1.8 Limitations of the study

Business environment variables are subjected to measuring errors. Most of the investment climate factors are qualitative variables of perception. In the surveys, some firms did not report the full range of the measures of the investment climate. However, the study still give a clear picture of what is happening.

1.9 Summary

This chapter present the background of the study. It also consists of the problem statement, objectives and hypothesis of the study. Also outlines are the significant and limitations of the study. Lastly the definition of important terms is also found in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Framework

2.1.1 Neoclassical Theory

This study is based on Neoclassical theory. In neoclassical theory, the level of production depends on the production factors which are, capital (K) and labour (L). Thus the production function is as follows:

$$Y = f(K, L) \quad (1)$$

According to neoclassical theory, firms are regarded to be technically efficient. Firms produces maximum output from the factors of production. Following the neoclassical theory, firm production in this study does not only depend on capital and labour but also on the investment climate variables. Thus the production function of a firm is:

$$Y = f(K, L, IC) \quad (2)$$

The production function (2) states that government policies, institutions and regulations play a major role in production of a firm just like capital and labour. While technology in the different firms is assumed to be the same.

2.1.2 Estimating firm level Productivity

Kinda, Plane and Veganzoes-Varoudakis (2008) states that productivity can be measured by either Productivity of Labour (LP), Total Factor Productivity (TFP) and Technical Efficiency (TE). In this study productivity is measured using Total Factor Productivity.

2.1.2.1 Measuring Total Factor Productivity

According to Subramanian, Anderson and Lee (2005) measurement of Total Factor Productivity (TFP) is either based on time series data or on cross sectional data. In this study TFP will be measured using cross sectional data at firm level.

ta on individual firms. Cross-sectional analysis defines

n □

$$\emptyset_{\square} = \frac{\square_{\square}}{\square(\square_{\square}\square_{\square}\square\square_{\square})} \qquad (3)$$

such that $\emptyset = 1$ shows the central tendency of TFP in the cross section. If $\emptyset$ is greater than 1 shows that TFP is high relative to the firms in the cross section. On the other hand if $\emptyset$ is below 1, it shows that TFP is low. Equation (3) can be rearranged as:

$$\square_{\square} = \square\square\square_{\square}, \square_{\square}, \square\square_{\square}\square\emptyset \qquad (4)$$

assuming Cobb-Douglas production technology and the productivity index can be written as $\emptyset_{\square} = \square^{\square_{\square}}$, then equation (4) is specified as:

$$\square_{\square} = \square\square^{\square}_{\square}\square^{\square}_{\square}, \square\square_{\square}\square^{\square_{\square}} \qquad (5)$$

Equation (5) can be transformed into a Translogarithmic form:

$$\square\square\square_{\square} = \square\square\square + \square\square\square\square_{\square} + \square\square\square\square_{\square} + \square\square\square_{\square} + \square_{\square} \qquad (6)$$

Where Y is value added, K is capital, L is labour, IC is investment climate variables and v is error term.

Since, this study is based on cross-sectional data at firm level. It is worth noting that in a cross section study, data is collected in one year or over a relatively short interval and all firms have access to the same technology. Hence variation in productivity can be due to variation in efficiency rather than variation in technology. However, improvement in technology may increase the level of variance across firms as some firms are more successful than others when moving to the new productivity frontier.

Productivity can be estimated by using either parametric or non-parametric approach. Parametric approach is when the production functions are linear in the parameters and can be estimated by simple linear regression techniques. In non-parametric approach, the regression analysis does not need the specification of the functional relationship between e dependent variables. In this study, the parametric

2.1.3 Relationship between Investment Climate (IC) and Productivity

To explain the relationship between IC and firm level productivity several methods have been developed. The methods include: OLS, Solow growth model, fixed effect regression, production frontier method, stochastic frontier production and the efficiency model (Ajagbe and Ajetomobi, 2017). The study will use the production frontier method. The common ones are the Cobb-Douglas and the Translogarithmic production functions. This study will adopt both of them because they are easy to read and interpret. Cobb-Douglas production function is widely used because it has many attractive characteristics. The characteristics are marginal product, output elasticity and return to scale.

Marginal product is the change in total production, when there is an infinite change in the input. Marginal product is given as follows:

$$\frac{\square\square}{\square\square}$$

In Cobb-Douglas production function, marginal product is given as:

$$\frac{\square\square}{\square\square} = \square\square\ \square\square\square - 1\square\square\ \square \qquad (7)$$

If the marginal product is positive, L or K increases also total output will increase. Another attractive characteristic of Cobb-Douglas is output elasticity. Output elasticity is the change in respond to a change in levels of either labour or capital.

$$\frac{\frac{\square\square}{\square}}{\frac{\square\square}{\square}} = \frac{\frac{\square\square}{\square\square}}{\frac{\square}{\square}} \qquad (8)$$

If the production function is elastic, then output elasticity is greater than 1 and vice versa. In Cobb-Douglas production function, output elasticity can be calculated quite easily:

$$\frac{\frac{\square\square}{\square}}{\frac{\square\square}{\square}} = \frac{\frac{\square\square}{\square\square}}{\frac{\square}{\square}}$$

$$= \frac{\beta A K^{\alpha} L^{\beta - 1}}{\left[\frac{A K^{\alpha} L^{\beta}}{L}\right]}$$

$$= \frac{[\beta A K^{\alpha} L^{\beta - 1}]}{[A K^{\alpha} L^{\beta - 1}]}$$

$$= \beta \qquad (9)$$

Output elasticity with respect to labour is constant and equal to β. If β is 0.2 and labour increases by 10% then output will increase by 2%.

α and β are output elasticities of capital and labour, and are constant.

Another attractive characteristic of Cobb-Douglas production function is the returns to scale. Returns to scale calculate how much additional output will be obtained when all factors change proportionally. There is an increasing return to scale if output increases more than proportionally. Decreasing returns to scale if output increasing less than proportionally. In Cobb-Douglas production function, to look how much output increase when all factors increase proportionally, we multiple all inputs by a constant factor c.

$$Q^{c} = A (cK)^{\alpha} (cL)^{\beta}$$

$$= A c^{\alpha} K^{\alpha} c^{\beta} L^{\beta}$$

$$= c^{\alpha} c^{\beta} A K^{\alpha} L^{\beta}$$

$$= c^{\alpha + \beta} Q \qquad (10)$$

If all input change by a factor of c, output increases by $c^{(\alpha + \beta)}$.

Therefore:

If $\alpha + \beta = 1$, the production function has a constant returns to scale.

If $\alpha + \beta > 1$, the production function has an increasing returns to scale.

If $\alpha + \beta < 1$, the production function has a decreasing returns to scale (EconomicPoint, 2013).

2.1.4 The Food and Beverages Industries in Swaziland

The food and beverages industries of Swaziland include: sugar, maize, citrus and canned fruits, livestock and poultry and dairy. Sugar production being the major source of employment and income (World CIA factbook).

Major companies in the sugar industry are the Royal Swaziland Sugar Corporation (RSSC) and Ubombo Sugar. Swaziland Sugar Association (SSA) regulates the sugar industry. The SSA also manage the marketing and sales to international markets (COMESA, EU, SACU and world market). In 2013 South Africa companies became more involved in the sugarcane industry of Swaziland. The sugar industry employ about 3000 Swazis. Sugar is the largest foreign exchange earner in Swaziland (New Agriculturalist, 2000). It contributes large in the Gross Domestic Product (GDP) of the country which is about 12% (CBS, 2009).

In 2009 the export earnings from the sugar industry declined because of the termination of the trade arrangements with the EU markets. The EU price declined by 21.6% in 2009 (CBS, 2009).

In 2015/16 harvesting season, sugar production increase by 1.3% reaching a recording of 695,408 metric tonnes from 686, 778 metric tonnes produced the previous year. There was an additional 941 hectares harvested in 2015/16 which improved the sugar production. The LUSIP projects together with the expansions undertaken by big growers also boosted sugar production in 2015/16 (CBS, 2016).

Sales from sugar increased by 1.4% in 2015/16 due to the increase in production. The SSA tries to diversify its market mix by selling most of its sugar to the domestic SACU and regional markets as opposed to the EU markets where prices are falling (CBS, 2016). The sugar industry is not promising at the medium term outlook due to the effects of drought. Sugar production is expected to drop by 20% to 560,420 tonnes in 2016/17 harvesting season (CBS, 2016).

2.1.4.2 Soft drinks concentration industry

Swaziland Breweries is a 10% Swazi owed company, employing 300 people (JETRO, 2000). According to South African Institute of international Affairs (2017) Swaziland breweries supplies its soft drink concentrate to sixty bottling companies across the world.

…dustry

…ry consists of cattle, poultry, pigs and sheep. In 2014 the total cattle population declined to 594, 240 from 620, 034. Due to drought in 2015, cattle slaughters decreased by 22.4%. Export of cattle slaughters decrease by 62.4% in 2015. Beef exports were send to France, Mozambique, Norway and EU. Due to the severe drought experienced in the past two years, the prospects for the livestock sector remain bleak. The high mortality rate of cattle stock is expected to affect livestock production in the medium term (CBS, 2015).

Meanwhile, poultry sector is fast growing in terms of generating income. Local producers of chickens are protected from foreign competition by import permits which are granted only under special circumstances. The largest abattoir and processor of chickens is the Swaziland Poultry Processor (SPP), which supply 60% of the domestic required chickens.

2.1.4.4 Citrus and canned fruits industry

Swazican is responsible to export canned fruits and juice (New Agriculturalist, 2000). Citrus industry export half of its production and the rest its sold in the local markets. Production fell by 11.7% from 1,183 hectares in 2014 to 1,044 hectares in 2015. The decrease in production was a result of shift in climatic conditions (CBS, 2016). Performance of the industry is threatened by increasing input costs. The high input costs reduce profits of the industry (CBS, 2016).

The industry benefitted from improved cooperation between the Southern Africa region and EU, resulting to an increase in the volume of citrus export by 18.6% from 14, 371 tonnes in 2014 to 17, 042 tonnes in 2015. Lower increase in production coupled with a noticeable increase in export resulted to lower sales in the local market (CBS, 2016).

2.1.4.5 Maize industry

Maize is the staple food of Swaziland and it is grown on subsistence farming. Production of maize depends on climatic conditions thus the production volumes fluctuate. To supplement local production the deficit is imported from South Africa (CBS, 2008). Production of maize increased to 87.2 thousand hectares in the 2014/15 season from 86.8 thousand hectares planted in the 2013/14 season. The increase was due to the above average rains received in the beginning of the 2014/15 planting season, ease of access of rnment subsidies in agricultural inputs. Erratic weather he second half of the 2014/15 season had a negative impact on maize production. As a result, the maize yield fell by 19% from 1.16 tons per hectare in 2013/14 to 0.94 tons per hectare in 2014/15 (CBS, 2016).

Imports of maize are expected to increase in the 2015/16 crop season because of the poor performance of maize crops in the country. There was an increase of 66% of the selling price of domestic white maize. The price is expected to increase even more due to the shortage in maize, experienced in the Southern Africa region (CBS, 2016).

2.1.4.6 The Dairy industry

Annual demand for milk product is estimated to excess about 56 million litres. However, local production is about 8.4 million litres. The deficit of about 48.2 million litres is imported from South Africa (CBS, 2013). Farmers have a huge challenge in accessing inputs and selling output which result to the low performance and underdevelopment of the industry.

The Swaziland Dairy Development Board (SDDB) has played a major role in encouraging farmers in dairy production by conducting technical training.

2.1.5 Competing Industries

Competing industries to food and beverages industries in Swaziland include textile, wood pulp, mining and cotton industries. The products are sold in the domestic market and also exported to other countries.

2.1.5.1 Textile industry

In January 1, 2015, Swaziland textile industry took a hit after Swaziland was excluded from the list of countries eligible to get benefit under the AGOA. A lot of textile companies closed and relocate in South Africa. In April 1, 2016, textile industry regain life when the Preferential Trade Agreement between MERCOSUR and the Southern African Customs Union (SACU) entered into force. MERCOSUR is South Americaôs leading trading bloc known as the Common Market of the South. Its members are Argentina, Brazil, Paraguay and Uruguay, Bolivia, Chile, Colombia, Ecuador and Peru.

e agreements but remain outside the blocôs customs union 6).

2.1.5.2 Wood pulp industry

Montigny Investments limited is a company that produces wood pulp after the closer of Usutu Forest Products Company from SAPPI Limited in 2014 (Montigny, 2017). Montigny Investment Limited is a Swazi owned company. Montigny is one of the major employers in Swaziland. She also work with local subcontractors.

2.1.5.3 The Mining industry

The decrease in mineral prices, especial iron ore prices, saw iron ore production in Swaziland being terminated in September 2014. The closure of the iron ore production resulted to a loss of about E400 million worth of revenue in 2016. Also coal production declined by 20.3% in 2015. Due to low output and depressed prices of coal resulted to a decrease of coal sales revenue by 15% in 2015 (CBS, 2016).

2.1.5.4 Cotton yarn industry

In the SADC region cotton is produced in South Africa, Namibia, Swaziland, Botswana, Malawi, Angola, Mozambique, Tanzania, Democratic Republic of Congo (DRC), Zambia and Zimbabwe. 50% of cotton lint come from Swaziland. Cotton is important smallholder cash crop in Swaziland (New Agriculturalist, 2000).

The cotton industry has not been doing well until in 2008/9 season. In 2008/9 season, 4000 hectares of cotton were cultivated. Production rose from 394 tonnes in 2007/08 to 1566 tonnes in 2008/09 season. About 774 tonnes was sold to South Africa (CBS, 2010).

Despite the good harvest, challenges of the industry were not overcomed. The challenges include among others: drought, high costs of inputs, lack of irrigation infrastructure and lack of financial support (CBS, 2010).

The severe drought experienced in 2015/16 planting season put more strain on cotton industry in Swaziland. Few farmers were able to plant and most farmers could not plant. The few that planted, the seed could not germinate due to the drought conditions that prevailed. Only 612 hectares was planted in 2015/16 compared to 1,730 hectares of the ners participated in 2015/16 season dropped to 600 season. Due to the decrease year after year, the ginnery could not process any seed cotton in 2015/16. This put more financial strain on the struggling cotton growers whoôs income drop by 50% in the previous season due to low output and prices of cotton (CBS, 2016).

2.2 Conceptual Framework

2.2.1 Factors of Production

Productivity is defined as the output one worker produces. Factors affecting productivity are capital, labour, investment climate and firm characteristics.

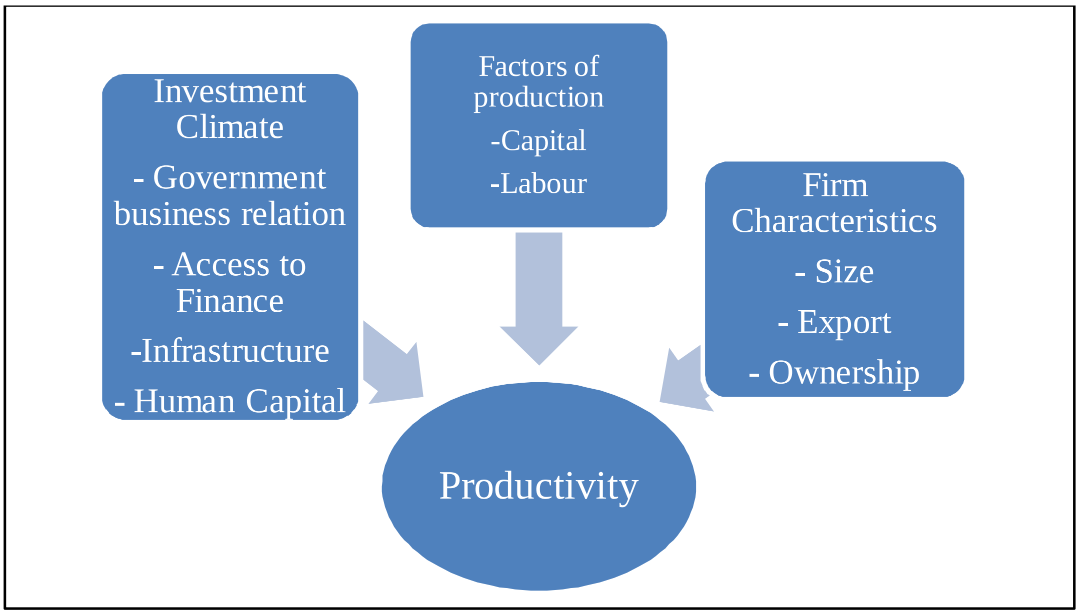

Figure 2.1. Factors affecting Productivity

Labour is the number of workers in a firm. Capital is the gross value of property, plant and equipment. Firm characteristics also affect productivity. Export can improve productivity by learning from customers and facing international competition. Ownership especial foreign may increase productivity if the foreign investors bring new technologies and management techniques. Firm size can increase returns to scale, market imperfections and product heterogeneity linked to technological innovation (Afrooz, 2011).

Investment Climate is the business environment available for doing business in a country (Jorge, 2009). The World Bank (2007) defines investment climate (IC) as ña set of location - specific factors shaping the opportunities and incentives for firms to invest productively, create jobs and expandò. Investment climate include infrastructure, access to rk, corruption and security (absence of crime) dimensions. pment Resource Centre (2010) defined investment climate as the set of factors in a given location that shape firmsô incentives and opportunities to invest, grow and create jobs.

2.2.2 Importance of Investment Climate

The IC dimensions create a good or bad environment which encourages or discourages domestic and foreign investments. Good IC dimensions provide an efficient environment for existing producers (World Bank, 2007). A better investment climate decreases the number of problems of investments, allowing investments to operate more efficiently, encouraging investments to use their scarce resources for productive purposes (Hacihasanoglu, 2013). Stimulating the economic growth in the process. The World Bank Development Report (2005a) states that ñimproving the climate for investment in developing countries is essential to provide jobs and opportunities for young people and to build a more inclusive, balanced and peaceful world. A good investment climate should benefit everyone in two ways. First, it serves society as a whole, rather than just firms, including through its impact on jobs creation, lower prices and broadening the tax base. Second, it embraces all firms not just large or influential firms (World Bank, 2007).

2.2.3 Measurement of Investment Climate

Most investment climate studies in developing countries use survey data from the World Bank. The World Bank looked at different investment climate indicators that affect firmsô productivity in developing countries. Each developing country has its own survey on investment climate done by the World Bank. The investment climate indicators may differ from country to country (Hacihasanuglu, 2013). Examples of investment climate indicators are: number of inspections per year, management time dealing with regulations, unofficial payments as percentage of sales, days to obtain a phone line, share of firms with overdraft facility and days to clear a cheque (Dollar et al.,2005).

2.2.4 Investment Climate in Swaziland

Swaziland holds the 135th competitive economy (Commonwealth Network of Nations Report). The World Bank classified Swaziland 111th out of 185 countries for ease of doing business (Doing business organisation, 2017). The country has a conducive eration of local businesses. Also the country is in 128th . The following are the IC indicators for Swaziland. According to an assessment of the investment climate in Swaziland main report (2007), Swaziland has low crime rate relative to other SACU economies. But firms located in Matsapha are affected more by security costs and losses due to theft than firms in Mbabane and Manzini. Access to Finance is the main constraint to start a business in Swaziland (World Bank, 2007). Banks in Swaziland finance firms less than banks in other SADC countries (World Bank, 2007).

The Doing Business Report (2017) states that, taxation is high in Swaziland than in other SADC countries. Kransdorff (2010) states that tax play a major role in attracting investments (Foreign Direct Investment (FDI)) in developing countries. Many studies have addressed the relationship between tax and FDI. The conclusions of the studies are inconsistent. Barlow and Wender (1955) in Kransdorff (2010) found that tax is not a significant determinant of investment decision. In 1996 Hines, found that tax significantly affect FDI. Hinesôs finding was supported by the study of Wei (1997). All this studies were focused on developed countries. Then Dethier and Madies (2010) conducted a study to determine if tax policies affect FDI in developing countries. They found that tax policies do affect FDI.

Corruption is defined as bribes and special payments for export and import licenses, loans, tax assessment (Kandiero, 2006). Corruption marks the fourth constraint for firms in Swaziland (World Bank, 2007). Bribing of government inspectors to speed up firmsô operations is common in Swaziland. But corruption in Swaziland is lower than in other low income countries in Sub-Saharan Africa. Swaziland ranking 121st out of 163 countries in terms of corruption (Gelb, 2007). Wei (2000) states that a country with less corruption attract Foreign Direct Investment (FDI). According to the Fortune of Africa (not dated), Swaziland scored 43 points out of 100 points and ranked number 69 least corrupt nation out of 175 countries on the Corruption Perceptions Index. This demonstrates that there is no excessively high perception of corruption occurring in Swaziland. A study conducted by Wei (1997), show a clear evidence that where corruption is high, FDI will be affected negatively. The impact of corruption on a firmôs ability to attract FDI was significant determined by the study of Wei (1997). Hence, the corruption related to a country should be considered an important determinator.

at labour regulations are not a severe constraint to doing business in Swaziland. Labour regulations are less constraining in Swaziland than in South Africa. Foreign investors do not worry much about labour regulations when investing in Swaziland. Most African governments spend too much time in registering companies thus affect the investment climate (North, 1990).

The World Bank investment survey of Swaziland indicates that over 50% of managers in Swaziland reported that worker absenteeism due to sickness is high than in other countries in Southern Africa. IRIN (2009) said that HIV/AIDS cases in Swaziland makes investors to think twice wanting to invest in the country.

Poor infrastructure creates barriers to investments and economic growth (Rajan and Zingales, 2003). Investments with access to modern infrastructure invest more and their firms are more productive. The World Development Report (WDR) (2005a), states that there are inadequacies in infrastructure in developing countries. Most Sub-Saharan African countries have poor infrastructure development to accommodate the needs of foreign investors. Infrastructure includes: transportation, telecommunication, power, water and sanitation (Nnadozie, Katjomuise and Kruger, 2007).

2.3 Overview of empirical studies on Investment Climate and Productivity

There are a number of studies that have been conducted around the world on the relationship between investment climate and productivity. Some of the studies are discussed in this section:

Kefyalew (2011) investigated the link between investment climate and performance of manufacturing firms in Ethiopia. Main objective of the study was to examine the effects of the following investment climate variables: total number of years of managersô experience, education status of managers, investment of firm in research and development, working hours of firms, amount of time spent by management in government regulations, power interruption, value of collateral of a firm and access to overdraft on the operation of manufacturing firms. The study concentrated on small scale producers in Ethiopia using investment climate survey dataset collected by the World Bank (2006). Data was analysed using descriptive and economic techniques. The author [illegible]s based on the theory of profit maximization. In the study [illegible]no (2007) approach was reformulated such that in the short run, firms which decide to produce will expect a positive net profit from their activities. Zero sunk costs is one of the assumption such models are based. To enter into a business, the decision can be given as follows;

[illegible] – [illegible]([illegible], [illegible]) > 0 (11)

Where, p is the unit output price, q is the volume of production, c is the cost of production q and x is vector of investment climate and firm level characteristics. Hottellingôslema was applied to the profit maximization problem which produced the supply function of a firm given by equation 12;

[illegible] = [illegible] (12)

Since firms are less likely to reveal their profits, annual sales were used. Equation 12 was then modified as follows;

[illegible] = [illegible] = [illegible] (13)

The model that was used in the study was based on Cobb-Douglas specification of revenue and set of firm specific and climate investment variables. Model used was as follows;

[illegible] = [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible]([illegible]) + [illegible]([illegible]) + [illegible] + [illegible] + [illegible] (14)

The variables with expected signs were: In(R): total annual sales adjusted at 2000 prices in logarithm (+) , In(K): netbook value of buildings, machinery and equipment in logarithm, In(L): number of permanent employees in logarithm (+), In(MGEXP): total number of years of managersô experience in logarithm (+), MGEDU: dummy for the

manager has BA and above and 0=otherwise (+), RD: arch and development and 0=otherwise (+), CPU: capacity utilization in percent (+), In(HRS) (+): number of working hours per week of a firm, INTSO: percentage shares of internal sources of finance out of total working capital (+), MGTIME: amount of managerôs time spent for government regulations in a week as a percentage of its total weekly working hour (ï), POWERI: dummy 1= power interruption reported and 0 = otherwise (ï), WEBPAGE: dummy 1= firms uses webpage and 0=otherwise (+), COLLATERAL: value of collateral as a percentage of loan size (ï) and OVERDRAFT: dummy 1= firm access to overdraft facility and 0=otherwise (+).
Using the descriptive analysis, the results revealed that infrastructural costs share to the yearly sales account 52 % in the small size firms. The quality of the infrastructure was not enough. Access to finance was not easy because of the high value of collateral requirements. Taxes and tax administration were problematic to the small size firms. Municipal services were not satisfactory.

The econometric result of the study was consistent with the descriptive evidence. There was a negative significant for power interruption dummy which shows the effect of poor infrastructure. Financial variables that affect the performance of firms were the value of collateral requirement and access to overdraft facility. The author concluded that the investment climate was not attractive.

Ajagbe and Ajetomobi (2017) investigated the impact of investment climate on total factor productivity of manufacturing industries in Nigeria. The objective of the study was to examine the influence of investment climate on productivity of manufacturing industries in Nigeria. Specific objectives were: to estimate the total factor productivity across manufacturing industries in Nigeria and to analyse the effects of investment climate on the total factor productivity of manufacturing industries in Nigeria. In the conduct of the research Ajagbe and Ajetomobi (2017) used two phases: in the first phrase, an econometric production function for Nigerian manufacturing industries was estimated to produce a measure of TPF for each firm. The second phrase, the variation in the TFP was statistically related to indicators of the investment climate as well as firm characteristics. The data that was used for the study was from 2009 World Bank Enterprise survey data on Nigeria. The TFP in the study was estimated using the [illegible] Cobb Douglas function. The Cobb Douglas model was

[illegible] (15)

In logarithmic form,

[illegible] (16)

Where Y = gross output, K = capital input, L = labour input, M = material input, e = unobserved productivity shock and i index industries. The study assumed that all firms were price takers and wages diverge across various industries. Number of employees was used to define labour variable instead of value units. The natural logarithm of the TFP index was estimated as the residual term in the econometric production function. TFP was analysed based on cross sectional data at the firm level collected in one year or over a relatively short interval. Thus it was assumed that all firms had access to the same level of technology. The quality of the firmsô management was controlled, thus the year of schooling (educ) of the firmsô manager was included in the model. Model 2 was then expressed as:

[illegible] (17)

Equation 16 and 17 were estimated using the ordinary Least Square (OLS) method. Industry dummies were included in the model. The model became:

[illegible] (18)

[illegible] (19)

Industry in the equations stands for industry dummies. Industry dummies were controlled for unobservable traits such as industrial disputes, trade distortions and influence of industry-specific policies. Assumption of common technology for validity was tested by allowing the regression coefficients to vary by industry. The equations were as follows:

[illegible] (20)

[illegible] (21)

The model that was used to analyse the data of the study was:

[illegible] (22)

Where TFP = Total Factor productivity, F = vector of firmsô characteristics, X = vector of investment climate variables, industry = industry dummy variables, a, b, c = regression coefficients and v_i = disturbance term.

The study revealed that the following investment climate indicators have a significant negative effects on TFP of manufacturing industries in Nigeria: tax burdens, power outage, unofficial payment and loss in transit due to breakage or spoilage. TPF could be reduced by 0.06% when power outage is increased by one hour. TPF may decreased by 1.8% when unofficial payment increase by 1%. Investment climate indicators that have a positive effect on TFP of manufacturing industries are management time dealing with regulation and percentage of firms owned by private domestic individuals, companies and organisations.

Afrooz (2011) investigated on Total Factor Productivity in Food industries of Iran. The study examined the level of labour, total productivity and technical changes in food industries. Food industry was compared with other industries of Iran over the period of 1971- 2006.The study used data from the Annual Survey of Manufacturing Industries published by the Statistical Centre of Iran. In the conduct of the research Afrooz (2011) compiled the annual data on output, value added, capital and labour for the food industries and other industries for the period 1971 ï 2006. Afrooz (2011) deflated the variables using price index of each group on the base year 1997 published by Central Bank of Iran. The index method was applied first to measure total productivity levels in the study. Econometrics method was then used to estimate TFP growth.

...es output as a function of the stock capital, employment and a shift factor (t), time.

$$Q_t = F(K_t, L_t, t) \qquad (23)$$

Assuming that the argument ñtò was separable from K and L;

$$Q_t = A_t f(K_t, L_t) \qquad (24)$$

A_t is said to be exogenous, disembodied and Hicks- neutral technical progress and was measured by how output changes and time elapsed with the input bundle held constant. Therefore, productivity was:

$$A_t = Q_t / f(K_t, L_t) \qquad (25)$$

The Kendrick Index of total factor productivity for the value added as output and two inputs was as follows:

$$A_t = V_t / (wL_t, rK_t) \qquad (26)$$

Where: A_t = value of index in a given year.

V_t = added value.

W and r = factor rewards of labour and capital respectively in the base year.

The econometric estimation of production functions using the parametric approach to infer contributions of different factors and of an autonomous increase in production over time, independent of inputs was as follows:

$$Q = A_0 e^{\lambda t} L^{\alpha} K^{\beta} \qquad (27)$$

Where: Q = output.

L = labour.

K = capital.

respectively for labour and capital.

A_0 = initial conditions.

ঌ = technological change at a constant rate.

When there was a shift in the production function, it was assumed to be disembodied and Hicks-neutral thus K/L ratio remain unchanged at constant prices. The log-linear form was:

□□□ = □□□$_□$ + □□+ □□□□ + □□□□ (28)

Afrooz (2011) found that total factor productivity and labour productivity in food industries were lower than the average of the other industries over the period. The estimation of technical changes has shown that the measure of technical change for other industries was 0.16% and that of food industries was 0.09% over time.

Ahmed (2012) investigated on Malaysia's food manufacturing industries productivity determinants. The study attempts to fill the gap in existing research on the drivers of factor productivity growth (TFPG) in Malaysian's food industries. In the conduct of the research Ahmed (2012) employed a parametric statistical method. The production function was as follows:

□$_□$ = □(□$_□$, □$_□$, □$_□$, □$_□$) (29)

Where: Q = output.

K = capital input.

L = labour input.

M = intermediate input.

T = time.

the Divisia index because it was applicable to the above ecomposes the output growth into the changes in inputs (labour, capital and materials input growth) and TFPG. In the study, Ahmed (2011) used the parametric approach. The steps were as follows:

$$\Delta \ln Q_{i,T} = \Box + \text{Ŭ}(\Delta \ln K_{i,T}) + \text{ɓ}(\Delta \ln L_{i,T}) + \text{ə}(\Delta \ln M_{i,T}) + e_{i,T} \qquad (30)$$

i = 30 and T = 1970 – 2000

Where: i = indexes of the industries.

t = indexes of time.

Ŭ= output elasticity with respect to capital.

ɓ = output elasticity with respect to labour.

ə = output elasticity with respect to material.

□ = intercept.

$e_{i,T}$ = residual term.

Δ = proportionate change rate and the difference operator.

To reduce the problem of heteroskedasticity all the variables have been log-transformed. The intercept had no role in the calculation of growth rate and contribution of the productivity indicators. A second step was proposed to calculate the growth rates and contribution of the productivity indicators. Equation (30) was transformed as follows:

$$\Delta \ln TFP_{i,T} = \Delta \ln Q_{i,T} - [\text{Ŭ}(\Delta \ln K_{i,T}) + \text{ɓ}(\Delta \ln L_{i,T}) + \text{ə}(\Delta \ln M_{i,T})] \qquad (31)$$

i = 30 and T= 1970 – 2000

Where: $\Delta InQ_{i,T}$ = growth rate of output.

Ŭ($\Delta InK_{i,T}$) = contribution of capital.

ɓ($\Delta InL_{i,T}$) = contribution of labour.

ə($\Delta InM_{i,T}$) = contribution of intermediate inputs.

$\Delta InTFP_{i,T}$ = TFPG.

growth rate of output into the contributions of the rates of ...aterial inputs and a residual term TFPG. The results of the study based on the model were: individual contribution of capital, labour and material as well as the combined contributions of quality of these inputs expressed as TFPG were the factors affecting output growth in Malaysian food industries. The food manufacturing sector showed a low productivity levels. The TFP contribution growth for the 13 out of 27 food industries was negative during the full period of analysis (1971 ï 2000) and the sub period 1987 ï 2000. Industries that contributed negatively to TFPG over 1971- 1979 and 1980 ï 1986 were eleven. It was due to the low quality of inputs into these food industries, which were input-driven rather than TFPG-driven.

Dollar, Wang and Shi (2004) investigated on improving city competitiveness through the investment climate: ranking 23 Chinese cities. The objective of the study was to examine reasons for the performance variation in firms in Chinese cities. The total factor productivity was estimated using the following production function:

$$\square\square\square_{\square\square} = \square_{\square} + \sum_{\square\square\,\square}^{\square} \square_{\square\square\square}\square\square_{\square\square}\square\square\square_{\square\square} + \square_{\square\square}\square\square\square_{\square\square}\square + \square_{\square} + \square_{\square\square} \quad (32)$$

Where: $\square_{\square\square}$ = value added for firm □and period □

$\square_{\square\square}$ = number of employees.

$\square_{\square\square}$ = capital stock.

$\square_{\square\square\square}$ = dummy variable, 1 if firm is affiliated with sector □

$\square_{\square} + \square_{\square\square}$ = error term.

To examine the effect of the investment climate on performance, the following regression was estimated:

$$\square_{\square\square} = \square_{\square} + \square_{\square}\square + \square_{\square}\square\square_{\square} + \square_{\square\square} \quad (33)$$

Where: □ = either sales growth rates, labour growth rates, the investment rate or TFP.

□ = sets of control variables, including industry dummies (to permit the performance to have an industry-specific mean), the logarithm of the number of employees, market share, log city population and log average income of the city.

□□ = vector of indicators related to investment climate.

…rmance differs greatly in the cities of Chinese because of the differences in investment climate. Firms in large cities had lower growth rates and investment rate. Medium sized cities had an advantage in expansion. Advanced cities had higher productivity level but had lower growth rates and investment rates.

The results also revealed that larger firms had significantly higher productivity, growth and investment rates. There were higher sales and labour growth rate in firms with higher market shares. Younger firms had better performance.
Results of the study revealed that investment climate played a major role in firm performance. Infrastructure and government regulations does not affect the performance of firms in Chinese. While corruption in the finance sector affected the performance of firms in Chinese.

Subramanian et al. (2005) conducted a study on the impact of the investment climate on total factor productivity in the case of China and Brazil. Objective of the study was to examine the effect of the investment climate on total factor productivity of firms in China and Brazil. The authors used cross sectional data at firm level. In the conduct of the research Subramanian et al. (2005) collected data on firmôs characteristics and investment climate indicators. The investment climate indicators were: days for customs clearance, email usage, loss of sales due to electricity failure, losses due to breakage, theft and spoilage and workersô education. Two steps were conducted to analyse the data. First, an econometric production function was estimated to produce a measure of TFP at the firm level. Then variation in TFP across firms was statistically related to indicators of the investment climate as well as firm characteristics.

Subramanian et. al (2005) estimated the TFP using the following model:

$$\ln Y_{ij} = \ln A + \alpha \ln K_{ij} + \beta \ln L_{ij} + v_{ij} \qquad (34)$$

Where: Y = value added obtained by subtracting materials and energy costs from the total value of sales.

K = capital, defined as the total book value of assets.

L = labour, defined as the total number of employees (including contractual at the firmøs main production facility at a given time.

The results of the study revealed that in both countries, customs clearance delays and utility service interruptions had a significant negative effect on total factor productivity. In China if customs clearance time was reduced by one day, TFP could increase by 2-6 %. On the other hand, the results revealed that email usage had a positive effect on TFP in both countries. In China, the results showed that state owned firms and firms located in the interior were less productive than privately owned firms and firms located in the East. While in Brazil there was contrast between the apparel industry and the electronics industry. In the apparel industry, high productivity was seen in older firms in competitive markets while in the electronics, high productivity was seen in newer firms with higher market shares.

Veeramani and Goldar (2004) investigated on the impact of investment climate on the level of total factor productivity (TFP) in the organised manufacturing sector across the major Indian states. In the conduct of the research Veeramani and Goldar (2004) used data from the World Bank survey pertaining certain quantitative indicators of IC in various industries across 12 Indian States. The authors of the study used the descriptive analysis of TFP in the states manufacturing aggregate and TFPs of the individual industries across the three states were compared. Also the authors undertook an econometric analysis to investigate the impact of the various dimensions of IC on TFP of the states manufacturing industries in India.

Veeramani and Goldar (2004) used two alternative econometric approaches to examine the effect of IC on TFP. The regression equation was estimated first which relates the multilateral TFP index to various available indicators of IC in the states.

□ □□□ = □ + □$_□$□□$_□$ + □$_□$□□$_□$ + . . + □$_□$□□$_□$ + □ (35)

Where: □ □□□ = multilateral TFP index, based on the value added function in industry($_i$), State ($_s$) and year ($_y$). To estimate MTFP, the productivity level in one industry (i.e., Textiles) in Maharashtra in 1981 ï 82 was taken as the base and the productivity level in each state-industry-year (i.e., Punjab in Transport equipments in 1997-98) is compared to this base.

riables. There are the various available indicators of IC.

The second approach of the study, the authors adopted the approach used in CII-World Bank (2002) study. Regression equation related gross value added-labour ratio to capital-labour ratio and real wage rate for each industry ($_i$), state ($_s$) and year ($_y$) along with IC. The relationship was in log-linear in gross value added-labour ratio, capital- labour ratio and real wage rate. Thus, the regression equation was expressed as follows:

$$\ln\left(\frac{Y}{L}\right) = \alpha + \beta_1 \ln\left(\frac{K}{L}\right) + \beta_2 \ln(w) + \gamma_1 IC_1 + \gamma_2 IC_2 + \ldots + \gamma_n IC_n + \varepsilon \qquad (36)$$

Where: Y = real gross value added.

L = total labour force engaged in manufacturing.

K = capital stock.

w = real wage rate.

In the study $\ln\left(\frac{Y}{L}\right)$ was regressed on $\ln\left(\frac{K}{L}\right)$ along with other determinants of productivity. As $\left(\frac{K}{L}\right)$ was included as one of the variables to explain $\left(\frac{Y}{L}\right)$, the co-efficients γ_1, γ_2, ... γ_n in effect, captures the effect of IC on TFP rather than labour productivity. Including real wage (w) in the equation 36, made the production function to be more general. Descriptive analysis of TFP revealed that there was a positive relationship between a market friendly IC and TFP. The regression analysis revealed that IC matter for TFP. Dummies for the best and good IC states showed a positive co-efficient with statistical significance, after taking poor IC states as the base for comparison. The results also revealed that the value of the co-efficient was high for the best IC states than the good IC states. The average number of days required to get a new power connection in the state as a proxy for IC and the number of days required to get a new telephone connection in the state had a negative co-efficient.

The results of the study also revealed that the percentage of the managementôs time spent with government officials about regulatory and administration issues had a negative impact on TFP. Mandays lost in industrial disputes also had a negative impact on TFP. The variables that had a positive impact on TFP were availability of power for industrial use and disbursement of credit in various state industries.

… investment climate and technical inefficiency: evidence … g. The study identified the constraints of investment climate on Vietnamese manufacturing technical efficiency. Pham (2011) used panel data to measure technical inefficiency. The author used time-varying inefficiency panel data models:

$$\square_{\square\square\square\square} = \square\square\square_{\square\square\square\square}, \square_{\square\square\square\square}, \square_{\square}, \square_{\square}, \square_{\square}, \square\ \square\square\ \square\square_{\square\square\square\square}, \square\square \exp(\square_{\square\square\square\square}) \qquad (37)$$

Where: □ □□$_{□□□□}$, □□= degree of efficiency for firm □and in the interval (0,1).

□$_{□□□□}$ = factors explaining technical inefficiency such as investment climate (IC) and Firm-specific characteristics (C).

Taking natural log of equation 37, the technical inefficiency and stochastic frontier model were both estimated as follows:

$$\square\square\square_{\square\square\square\square} = \square\square\square\square_{\square\square\square\square}, \square_{\square\square\square\square}, \square\ \square + \square_{\square} + \square_{\square} + \square_{\square} + \square_{\square\square\square\square} - \square_{\square\square\square\square} \qquad (38)$$

Where $\square_{\square\square\square\square} = -\square\square\square(\square_{\square\square\square\square}, \square)$

Specifically

$$\square\square\square_{\square\square\square\square} = \square_{\square}\square\square\square_{\square\square\square\square} + \square_{\square}\ \square\square\square_{\square\square\square\square} + \square_{\square} + \square_{\square} + \square_{\square} + \square_{\square\square}\square\square\square + \square_{\square}\square\square\square_{\square\square\square\square} + \square_{\square} + \square_{\square\square\square\square} + \square_{\square\square\square\square} \qquad (39)$$

Where: □$_{□□□□}$ = value added to the firm □in region □ and sector □ during year □

□, □ = parameters for the equation 39.

□$_{□□□□}$, □$_{□□□□}$ = production factors, labour and capital.

□$_{□}$, □$_{□}$, □$_{□}$ = dummies for region, sector and year.

□$_{□□□□}$ = external shocks and assumed to be independently □ □0, □$_{□}^{□}$□distributed.

□$_{□□□□}$ = error term defined by the truncation of normal distribution with zero mean and □$^{□}$ variance.

□$_{□□□□}$ = technical inefficiency assumed to be independently exponentially distributed with variance □$_{□}^{□}$ or independently half- normally □$^{□}$ □0, □$_{□}^{□}$□or truncated-normal distribution □$^{□}$(□, □$^{□}$).

ntier analysis revealed that eight out of thirteen industries ndustries were Apparel and leather, Paper, Food, Textiles, Plastics and Rubber, Non Metallic Products, Machinery and Equipment and Construction Materials. Findings of the study revealed that the following firmøs characteristics positively affected the firmøs technical efficiency: export activities, training employee, getting ISO certificates and managerøs experience. Also the results revealed that deficiencies in investment climate affected the performance of firms. Most industries in Vietnamese faced obstacles like security cost, crime problem, duration of power outages and quality of infrastructure.

Kinda et al. (2008) investigated on the productivity and technical efficiency in MENA manufacturing industry: the role of the business environment. Objective of the study was to examine the relationship between business environment and firm level productivity for a large number of countries (23) and manufacturing industries (8). The authors used three measures of firmøs productive performance, Labour Productivity (LP), Total Factor Productivity (TFP) and Technical Efficiency (TE) using a production frontier approach. Data that was used in the study was pooled across the 23 countries.

Firm level Labour Productivity (LP) was calculated as the ratio of output to labour. The firmsô Value Added (Y) was represented by the output, calculated by subtracting Intermediate Consumptions (IC) from ñTotal Salesò (S). To calculate intermediate consumption (IC), ñTotal Purchase of Raw Materialsò was chosen in the absence of information on ñDirect Raw Material Costs (fuel was excluded from both variables)ò. Labour was calculated by the ñNumber of Permanent Workersò.

The model for the firm level labour productivity:

$$LP_{ij} = \frac{Y_{ij}}{L_{ij}} \qquad (40)$$

Where: LP = labour productivity.

Y = value added.

L = number of permanent employees.

i/j= enterprise and country index respectively.

luctivity (TFP) was calculated from a non-parametric

vs:

$$□□□_{□□} = □□□\ □□_{□□}□ - □□□□□□_{□□}□ - □□□□(□_{□□}) \qquad (41)$$

Where: □□□ = Total Factor Productivity at firm level.

□ = value added.

□ = number of permanent employees.

□ = Gross Value (Capital).

□ = ratio of ñTotal Wagesò (W) to ñTotal Production Costò (Y).

□ = 1 − □.

□/□= enterprise and country index respectively.

To measure the firm level Technical Efficiency, likelihood estimation method was used. The method allowed the error term to be divided into two independent factors: the error term (□) which follows a normal distribution and the Technical Efficiency (□) which follows a truncated normal distribution. Model that was used was as follows:

$$□□□\ □□_{□□}□ = □□□□□□_{□□}□ + □□□□□□_{□□}□ + □_{□} - □_{□□} + □_{□□} \qquad (42)$$

Where: □ = value added.

□ = the number of permanent workers.

□ = gross value (capital).

□ = country- dummy variables.

□ = error term.

□ = technical efficiency.

□/□= enterprise and country index respectively.

...vestment climate on the performance of the industries, ...pirical models. The first model was based on individual ...ent. The model was as follows:

$$
\begin{aligned}
\text{Ln}\square_{\square\square}\square = {} & \square_{\square} + \square_{\square}\ln\square_{\square\square}\square + \square_{\square}\ln\square_{\square\square}\square + \square\square\square\square_{\square\square} + \square\square\square\square\square\square\square_{\square\square} + \\
& \square\square\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square\ \square\square_{\square\square} + \square_{\square}\square\square\square\square_{\square\square} + \\
& \square_{\square}\square\square\square\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square\square\square\square_{\square\square} + \\
& \square_{\square}\square\square\square\square\square\square\square\square_{\square\square} + \square_{\square}\square\square\square\square\square\square\square\square_{\square\square} + \square + \square_{\square\square} \qquad (43)
\end{aligned}
$$

Where: □ = value added.

□ = number of permanent workers.

□ = gross value of property, plant and equipment.

□□□□ = size of the firm.

□□□□□□□ = foreign capital (% of firmôs capital).

□□□□□□ = export (% of firm sales).

□□□□□□□□ = electricity delivery (obstacle for the enterprise, regional average).

□□□□ □□ = utilization of internet (regional average).

□□□□ = overdraft facility or credit line.

□□□□□□□ = access to financing (obstacle for the enterprise, regional average).

□□□□ = level of education of the top manager (number of years).

□□□□ = experience of the top manager (number of years).

□□□□□□□ = training of workers.

□□□□□□□ = labour regulation (obstacle for the enterprise, regional average).

□□□□□□□□□ = corruption (obstacle for the enterprise, regional average).

$\square_{\square}$ = country-dummy variables.

□ = intercept.

$\square_{\square\square}$ = error term.

□/□ = enterprise and country indices respectively.

the composite indicators of business environment. Model

ln□□□□□ = □□ + □□ ln□□□□□ + □□ ln□□□□□ + □□□□□□□ + □□□□□□□□□□ + □□□□□□□□□ +
□□□ □□□□□□□□□ + □□□□□□□□□ + □□□□□ + □□□□□□ + □ + □□□ (44)

Where: □ = value added.

□= number of permanent employees.

□ = gross value of property, plant and equipment.

□□□□ = size of the firm.

□□□□□□□ = foreign capital (% of firmôs capital).

□□□□□□= export (% of firmôs sales).

□□□□□□□□ = quality infrastructure.

□□□□□□□ = business-government relations.

□ = Human Capacity.

□□□ = financing.

□□ = country- dummy variables.

□ = intercept.

□□□ = error term.

□/□ = enterprise and country indices respectively.

The results of the study revealed that there are differences in performance across industries. Impact of the shortage of infrastructure and human capacity was stronger in Textiles and Metal & Machinery Products than in other sectors. Financing was in shortage in the textile industry. The results also showed that the impact of business environment varies for relatively small domestic firms. Whereas, big and foreign firms had the possibility to influence their business environment positively. Business environment played a major role for firmsô productive performances as shown by the results.

Based on the various measures of firm level productivity: Labour Productivity (LP), Total Factor Productivity (TFP) and Technical Efficiency (TE), enterprises in MENA performed poorly as compared with other countries which were used in the study. This showed that the MENA investment climate was in shortage. Most of the enterprises in MENA faced more constraints than in most countries used in the study.

…2) investigated on the effects of investment climate on … Uganda using panel data. The main objective of the study was to identify the investment climate factors that determine manufacturing firmsô growth in Uganda. Law of Proportionate of effect (LPE) by Gibrat (1931) and learning model due to Jovannovic (1982) were used to analyse the data of the study. Gibratôs LPE states that firm growth rates and variance of firm growth rates were independent of firm size. Younger firms learn over time, which helps them to improve their performance as they accumulate market knowledge as stated by the learning model due to Jovannovic. This model states that, young firms grow faster than old ones. The model in LPE was as follows:

□□□ □$_{□}$□$_{□}$ □□ □$_{□}$□ / □ = □ □□$_{□}$, □$_{□}$□+ □$_{□}$ (45)

Where: □$_{□}$ = size at time t.

□$_{□}$ = age at time t.

□ = □$^{□}$− □(time difference).

□$_{□}$ = normally distributed with mean zero and possible a non-zero constant variance and was independent of size and age.

Aggrey et al. (2012) extended the above equation by adding other explanatory variables which were investment climate variables, firm level variables and growth strategy variables. Thus equation (45) was model as follows:

(□$_{□□□□}$ □$_{□}$) / □$_{□}$ = □ □□□$_{□}$, □$_{□}$, □$_{□}$, □$_{□}$□+ □ + □$_{□□}$ + □ (46)

Where: □□$_{□}$ = investment climate variables.

□$_{□}$ = firm-level variables.

□$_{□}$= growth strategy variables.

□$_{□}$ = other control variables.

□ = firm fixed effects.

□$_{□□}$ = set of time dummies defined separately.

□ = random disturbance.

estimated: a basic age-size-growth model (equation 45) th model (equation 46) using stepwise regression procedure.

The variables that were used in the study: dependent variable which was firm growth, was defined as the relative change in a firmôs number of permanent employees over a period of time. This measure was preferred to other proxies such as sales because it is less prone to measurement errors and it does not need to be deflated. The firm growth is a measure of economic growth for the entrepreneur and also serves as an indicator of the entrepreneurôs success and the success of the company as a whole.

The independent variables used in the study were investment climate variables, firm level variables, growth strategy variables and control variables. Investment climate variables were divided into subjective and objective measures. The subjective measure captured the firm managersô perceptions. In the study, the managers were asked about the hard infrastructure (telecom, electricity, transportation) and soft infrastructure (problems in tax administration, customs clearance, business regulations, corruption). Rating index from 0 (no problem) to 4 (severe problem) was used to create a dummy variable of one for each problem by looking at whether the firm rates are given problems as serious and zero otherwise. For the value of 1 was given to firms which answered that there were serious problems (3 to 4 in the rating scale) or 0 otherwise.

The objective measures of the investment climate variables which were used in the study were: borrowing interest rates, days to clear customs for exports and imports, number of days of power outages per year, days to get power connection and days to get telephone connection once all the application procedures were completed by the firm.
The firm level variables that were used by Aggrey et al. (2012) were: physical capital, human capital, managerial capital, research and development capital and profit. Physical capital was calculated as the ratio of value added to net book value in dollars of machinery and equipment, which is also the accumulated stock of net fixed investment. Human capital was calculated in terms of both generic and specific human capital. Generic human capital was calculated as the average educational attainment of workers. Specific human capital was calculated as a dummy indicating whether workers in a firm have received on-job-training or not. Managerial capital was calculated as a dummy

had tertiary education or not. Research and Development vhether a firm had capacity to develop the products with its own plans by conducting in-house R&D (a dummy variable was used for firms introducing a new production process or a new product). Profit was calculated as value-added less wages and interest payments. A FINGOOD, dummy variable was added to see if firms with good and intermediate access to financial resources had a differential growth performance with respect to firms that had a poor access to financial resources. Unionization dummy was used to capture firms that had workers that belong to a trade union.

The growth strategy variables that were used in the study were export orientation, invite foreigners and foreign technology. Control variables that were used in the study were age, initial size of the firm, firm size and dummies for sectors and countries. Two alternative proxies were used for firm age, first a variable showing the years that each firm was under operation. Second, a dummy variable that took a value of 1 for firms with less than 5 years in operation, 2 for firms with more than 5 but less than 10 years in operation and 3 for firms with more than 10 years in operation.

The results of the study revealed that firm size, firm age and average education were the main drivers of firm growth in Ugandan manufacturing firms. Access to credit, value added capital ratio and unionization negatively affected firm growth.

Goedhuys, Janz and Mohnen (2006) investigated on what drives productivity in Tanzanian manufacturing firms: technology or institutions?. The study examined the determinants of productivity among manufacturing firms in Tanzania. Importance of technological variables such as R&D, education and training, innovation, foreign ownership, licensing and ISO certification and institutional variables like access to credit, health of the workforce, regulation and business support services were evaluated in the study. In the conduct of the research Goedhuys et al.(2006) used rich mirco data set of the World Bank Investment Climate Survey.

To study the effects of technological and institutional variables on firm level productivity, a straightforward production function approach was used. In which a firmsô value added □□ was a function of physical capital □□ and labour □□ as well as other factors like institutional variables I_{ij}. In the study it was assumed that

ariables T_{ij}, I_{ij} affect only total factor productivity not the marginal productivity of capital and labour. The following specification was obtained which allow for non-constant returns to scale:

$$Y_i = A(T_{ij}, I_{ij})\, K_i^{\alpha} L_i^{\beta} e^{u_i} \qquad (47)$$

Where Ŭ and б stands for marginal productivity of physical capital and labour respectively. The error term u_i stands for other unobservable factors affecting firms output. Taking logarithms of equation 47, equation 48 is obtained:

$$\ln Y_i = \ln A(T_{ij}, I_{ij}) + \alpha \ln K_i + \beta \ln L_i + u_i \qquad (48)$$

Equation 48 was then rewritten in terms of labour productivity:

$$\ln\left(\frac{Y_i}{L_i}\right) = \ln A(T_{ij}, I_{ij}) + \alpha \ln\left(\frac{K_i}{L_i}\right) + (\alpha + \beta - 1)\ln L_i + u_i \qquad (49)$$

The error term u_i was assumed to be normal distributed. Total factor productivity was also assumed as a linear function of technological and institutional variables. Firms operating at higher capacity, they produce more with the less amount of inputs thus part of the total factor productivity was attributed to capacity utilization. Thus the variable C_i was introduced to measure capacity utilization:

$$\ln\left(\frac{Y_i}{L_i}\right) = \ln A(T_{ij}, I_{ij}) + \alpha \ln\left(\frac{K_i}{L_i}\right) + (\alpha + \beta - 1)\ln L_i + \gamma C_i + u_i \qquad (50)$$

Two different estimation techniques were applied to estimate equation 50: Ordinary Least Squares (OLS) regression and quantile regression. The Ordinary Least Squares regression was as follows:

$$\sum_{i=1}^{n} \left(\ln(Y_i/L_i) - x_i'\beta\right)^2 \qquad (51)$$

ated coefficients and y_i was value added per employee.

was also applied:

$$\sum_{i=1}^{n} \theta \left| \ln(Y_i/L_i) - x_i\beta \right| I\left(\ln \frac{Y_i}{L_i} \le x_i\beta\right) + \sum_{i=1}^{n} (1-\theta) \left| \ln(Y_i/L_i) - x_i\beta \right| I\left(\ln \frac{Y_i}{L_i} > x_i\beta\right) \qquad (52)$$

Where I was an indicator function taking the value of 1 if the condition in bracket is met and 0 otherwise. θ was a weighting factor ranging from 0 to 1.

The results of the study revealed that foreign ownership, ISO certification and high education of management affected productivity positively. On the other hand, the results revealed that formal credit constraints, administrative burdens related to regulations and lack of business support services affected productivity negatively. Membership of a business association had a positive impact on production. The results of the quantile regression showed that educational level of managers and access to formal credit were important for the less productive firms only. While for more productive firms, having ISO certification or being a member of a business association were the important determinants.

Nguyen and Taise (2017) investigated on investment climate and firm productivity: an application to Vietnamese manufacturing firms. The objective of the study was to examine the effect of investment climate and corruption on firm efficiency. Data that was used in the study was from 1800 Vietnamese manufacturing firms from 2004 and 2005 obtained from the Investment Climate Assessment (ICA) survey of the World Bank. The model that was used in the study was as follows:

$$\ln Productivity_i = \beta_0 + \sum_{j=1}^{k} \beta_j X_j + \varepsilon_i \qquad (53)$$

Where: Productivity = dependent variable measured as the firm-level LP and TFP

X_j = matrix of the appropriate explanatory variables of the investment climate and other variables of interest

ε_i = error term

discrepancies, a single stage procedure was used:

□□ = □(□□,□) □ … (54)

□□ = □□□ + □□ (55)

Where: Y = value added of the firm

X = matrix of the inputs (Labour(L) and Capital (K)

Equation 54 specifies the stochastic frontier production function in terms of the original inputs. Equation 54 and 55 were simultaneously estimated based on maximum likelihood estimation.

The results of the study revealed that deficiencies in the investment climate were prejudicial to firm productivity and competition. Also the results showed that corruption acts as óspeed moneyô to improve the efficacy of public service provision. This is harmful in the economy in the long run because it distorts the market and destroys the incentives for productive investments. Thus developing countries need to put more effort in fighting corruption and efficiency in the provision of public goods and services.

Ajetomobi, Ajagbe and Dlamini (2017) investigated on investment climate and relative technical efficiency of food Industries in Nigeria. The objectives of the study were to estimate the technical efficiencies of industries in Nigeria and to compare the effects of investment climate on the technical efficiency of food industries with those of those. In the conduct of the study Ajetomobi et al. (2017) used two phases which were: (i) an estimation of the technical efficiency (TE) and (ii) differences in TE across firms were statistically related to investment climate variables and characteristics of firm level. The data that was used for the study was from 2009 World Bank Enterprise survey data on Nigeria. Cobb-Douglas production frontier was used to estimate firm- level technical efficiency:

□□□□□□□□ = □□□□□□□□ + □□□□□□□□ + □□ − □□□ + □□□ (56)

Where: □□□ = Value added (Total sales less total purchased material).

□□□ = Capital.

of permanent workers in 2008)

bles.

□□□ = Error term.

□□□ = Technical efficiency.

□/□ = Industries and cities.

The model used to estimate the effects of investment climate on firm level productivity was:

□□□□□□□□ = □□□□□□□□□□ + □□□□□□□□□ + □□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□ + □□□□□□□□□□ + □ □□□□□ + □□ + □□□ (57)

Where: □□□ = Value added (Total sales less total purchased material).

□□□ = Capital.

□□□ = Labour (Number of permanent workers in 2008).

□□ = city dummy variables.

□□□□ = average number of days to claim goods from custom.

□□□□ = total losses for the year as a % of annual sales.

□□□ = Value of domestic shipment lost in transit due to breakage and spoilage.

□□□□ = informal payment/gifts given to public officials as a % of total sales.

□□□□ = Number of days to obtain telephone lines.

□□□□ = Operating license dummy (Yes = 1, No = 0).

□□□ = Number of times establishment is visited by, inspected by, or required to meet with tax officials?

□□ □□□= Power interruption: Total duration of power outages suffered by plant in hours equal average duration times the total number of power outages.

□□□□ = Ranking: Small = 1, Medium = 2 and Large = 3.

□□□□□□= Percentage of establishmentô s sales scheduled for direct export.

□ □ □□□□□□□ = Percentage of this firm owned by largest shareholder(s).

[illegible] dustry was more labour intensive and less efficient than [illegible] geria can improve their productivity by learning from [illegible] ational competition since the importance of scale, export and firm ownership were significant in all the industries. Difficulties of investment climate had less effect on food industry than other industries.

Bakare (2013) conducted a study on investment climate and performance of industrial sector in Nigeria. The author used data from publications of the central bank of Nigeria, African Development Indicators, website, Journals and Newspapers. Data collected was on: industrial sector value added, infrastructure, fiscal policy proxied by company income tax, macroeconomic instability proxied by Nominal Exchange Rate, Political Instability (POLI), legal system (LES), corruption (COR) and financial policy proxied by lending rate. The study covered the years 1979 ï 2009. Model used in the study was:

[illegible] = [illegible]([illegible], [illegible], [illegible], [illegible], [illegible], [illegible], [illegible]) (58)

Where: [illegible] = Industrial output.

[illegible] = Infrastructure.

[illegible] = Fiscal Policy proxied by Company Income Tax.

[illegible] = Political Instability.

[illegible] = Macroeconomic Instability proxied Nominal Exchange Rate.

[illegible] = Legal System.

[illegible] = Corruption.

[illegible] = Financial policy proxied by lending rate.

Equation 58 in linear form was:

[illegible] = [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] + [illegible] (59)

Where: [illegible] = error term.

The results revealed a negative relationship between investment climate and performance of industrial sector in Nigeria. Corruption and political instability are the major constraints to the performance of industrial sector in Nigeria. Poor infrastructure and macroeconomic instability have played a significant role in the performance of industrial sector in Nigeria.

l on the impact of the investment climate on total factor ector in Hanoi, Vietnam. The analysis of the study was done in two steps: (i) an econometric production function was estimated to produce a measure of TFP at the firm level and (ii) variation in TFP across firms was statistically related to indicators of the investment climate as well as firm characteristics. Cross-sectional data was used in the study. To measure TFP at firm level the authors used the Cobb-Douglas production function:

$$□□□_□ = □□□ + □_□□□□_□ + □_□□□□_□ + □_□□□□_□ + □_□ \qquad (60)$$

Where: □ = value added.

□ = capital services.

□ = Labour inputs.

□ = intermediate materials.

□ = error term.

To measure the impact of investment climate on total factor productivity the following model was used:

$$□_□ = \sum_□ □_□ □□□_{□□} + \sum_□ □_□ □□□_{□□} + □_□ \qquad (61)$$

Where: □ = characteristics of firm.

□ = investment climate variables.

□ □□□ □ = statistical parameters

□ = stochastic term.

The investment climate variables used in the study were: educated labour, time of land rent, administrative clearance time, infrastructure and utility services, market competition, certification of clean production and age of firm.

Administrative clearance time was significant but negative on total factor productivity of agricultural sector in Hanoi, Vietnam. The results show that time of land rent, certification of clean production, market competition and educated labour had positive effect on TFP of agricultural sector in Hanoi, Vietnam. Older firms had higher productivity than younger firms.

mework relevant to the study was presented, which is the Neoclassical theory. Also measuring of total factor productivity and relationship between investment climate and productivity were outlined under the theoretical framework. The conceptual framework relevant to the study was presented. Under the conceptual framework, factors of productivity, importance and measurement of investment climate were presented. Lastly empirical studies relevant to the study were reviewed.

CHAPTER 3

METHODOLOGY

3.1 Research Design

The study used Cobb-Douglas production function to estimate a measure of TFP for each industry. An extended Cobb-Douglas production function was estimated with investment climate variables to investigate the effects of investment climate on productivity of industries. Descriptive statistics was also used in the study to examine the characteristics of industries and obstacles faced by industries in Swaziland.

3.2 Target Population

The targeted population of the study are the industries of Swaziland. Following the ISIC (revision 3.1) classification, the following industries in Table 3.1 were covered by the 2006 World Bank Investment Climate in Swaziland, namely, food and beverages, garments, textiles, machinery and equipment, chemical, wood, wood product and furniture, metal and metal products and other manufacturing.

Table 3.1

Types of Industries

Industry	Frequency	Percentage	Cumulative Frequency
Food and beverages	14	20	20
Garments	15	21.4	41.4
Textiles	5	7.1	48.5
Machinery & equipment	3	4.3	52.8
Chemical	4	5.7	58.5
Wood, wood product & furniture	3	4.3	62.8
Metal & metal products	2	2.9	65.7
Other manufacturing	24	34.3	100
Total	70	100	

on three factors: gross output, value added and 3.2. Food and beverages sector as a whole is the second largest industry in terms of gross output. In terms of number of employees the food and beverages industries employ a large number of people as compared to other industries. In terms of value added, food and beverages sector is the forth in the order of importance after garment, machinery and equipment and textiles industries.

Table 3.2

Importance of Industries

Industry	Gross Output	Value added	Employee
Chemical	2.56	4.13	2.10
Food and beverages	26.12	9.58	27.02
Garment	26.97	35.88	20.49
Machinery & Equipment	16.82	22.71	20.14
Metal	10.39	7.71	12.03
other manufacturing	5.54	3.43	6.88
Textile	10.81	15.56	10.61
Wood	0.77	0.99	0.72
Total	100.00	100.00	100.00

3.3 Output, Labour, Capital and Materials

The measures of output for the production function estimation in this study, is sales measured in Emalangeni for all the industries. It can be seen from Table 3.3 that, the total sales vary from 850 thousand Emalangeni to 32 million Emalangeni. On average food and beverages industries record the highest sales followed by garment industry. Labour was measured as the number of employee in 2006. Garments industry had the highest employer of labour on average followed by machinery and equipment industry, textile industry and then food and beverages industries. The total cost of production (labour, materials and capital) is higher in textile industry followed by food and beverages industries.

Descriptive Statistics: Production Data

Industry	Sales	Labour cost	Employees	Material cost	Capital
Chemical (Mean)	2,465,376	145,297.200	56.75	497,250	708,609.200
(S.D)	1,869,185.000	187,785.800	95.598	648,488.200	1,003,857.000
Food (Mean)	31,750,708	139,924.400	131.714	11,639,137.000	2,980,046.000
(S.D)	51,836,574.000	151,165.000	111.547	18,171,936.000	5,962,362.000
Garment (Mean)	24,078,280	90,628.060	493.4	3,312,800	4,479,240.000
(S.D)	28,174,701.000	133,733.400	752.82	5,331,577.000	8,334,986.000
Machinery & Equipment (Mean)	23,666,667.000	90,457.880	312.333	10,716,667.000	965,644.700
(S.D)	20,256,686.000	58,914.840	426.786	9,928,033.000	899,154.100
Metal (Mean)	14,135,000	79,291.670	106	6,133,500	2,375,500
(S.D)	16,779,644.000	6,069.333	132.936	6,882,270.000	3,004,497.000
other manufacturing (Mean)	8,084,759.000	109,568.600	47.167	3,816,458.000	1,794,968.000
(S.D)	13,433,885.000	168,650.000	46.086	8,678,298.000	2,701,244.000
Textile (Mean)	12,472,000	41,788.210	214	4,146,333.000	19,148,000
(S.D)	21,049,796.000	43,566.020	141.662	8,862,944.000	42,402,790.000
Wood (Mean)	851,333.300	45,872.220	13.667	259,333.300	337,233.300
(S.D)	624,584.100	21,137.620	9.074	340,031.400	321,289.500

rom the 2006 World Bank Enterprise survey for
was used in the study.

3.5 Data analysis

Data was pooled across three cities covered by the 2006 World Bank Enterprise survey for Swaziland. The three cities were Manzini, Matsapha and Mbabane. R-package was used for data analysis.

3.5.1 Descriptive statistics

Specific descriptive statistics used to achieve objective 1 and 2 of the study are presented in Table 3.4:

Table 3.4

Descriptive statistics

Objectives	Descriptive statistic
1. Examine the characteristics of food and beverages industries in Swaziland.	Percentages, frequencies and bar charts
2. Investigate the most serious obstacles facing industries in Swaziland.	Pareto chart

3.5.2 Empirical Model Specification and Estimation Technique

The computational models used to achieve objective 3 and 5 of the study are shown in the next sections.

3.5.2.1 Firm-level Total Factor Production

A Cobb-Douglas production frontier is estimated for food and beverages, garments, textiles, chemical and other manufacturing industries. The estimation of the firm-level total factor production is derived from the production frontier. The model is adopted from Kinda et al. (2008).

...es the relationship between the Value added (Y) as the ...K) and labour (L) as the independent variables.

$$\ln(Y_{ij}) = \beta_1 \ln(K_{ij}) + \beta_2 \ln(L_{ij}) + D_c + \varepsilon_{ij} \qquad (62)$$

Where:

Y_{ij} = Value added (Total sales less purchased total material)

K_{ij} = Capital (Net book value)

L_{ij} = Labour (Total number of employees)

D_c = city dummy variables

ε_{ij} = error term

i/j = industries and cities

3.5.2.2 Assessment of the effect of investment climate on firm-level productivity

To assess the effect of investment climate variables on the productivity of industries, Cobb-Douglas production frontier with investment climate variables and firm characteristics were estimated for food and beverages and garments industries. The World Bank Investment Climate (IC) surveys made available information on a large number of investment climate (IC) variables as well as general information on firmsô status, productivity, sales and supplies. In the questionnaire, the IC variables are classified into 6 broad categories: (a) Infrastructures and Services, (b) Finance, (c) Business-Government Relations, (d) Conflict Resolution/Legal Environment, (e) Crime, and (f) Capacity, Innovation, Learning. The survey contains multiple indicators for different categories. Within the same category, the correlation between indicators is high. One solution applied in some studies has been to restrict the analysis to a limited number of indicators and accept the omitted variable bias. This was also adopted in this study. Based on availability of data, the IC indicators used in the analysis were limited to the following: Average number of days to claim goods from customs (X_1), Total losses for the year as the % of annual sales (X_2), informal payments/gifts given to public officials as a % of total sales (X_3), number of days to obtain telephone lines (X_4), obtain a loan from a financial institution dummy (Yes =1, No = 0) (X_5), number of unskilled production workers (X_6), influences of the pressure from domestic competitors on production (X_7).

elow:

□□□□□□□□□ = □□□□□□□□□+ □□□□□□□□□+ □□□□□+ □□□□□+ □□□□□+ □□□□□+

□□□□□+ □□□□□+ □□□□□+ □ □□□□□+ □□□□□□□□+ □ □□□ □□+ □□+ □□□ (63)

Where:

□□□ = Value added (Total sales less purchased total material)

□□□ = Capital (Net book value)

□□□ = Labour (Total number of employees)

□□ = Average number of days to claim goods from custom

□□ = Total losses for the year as the % of annual sales

□□ = Informal payment/gifts given to public officials as a % of total sales

□□ = Number of days to obtain telephone lines

□□ = obtain a loan from a financial institution dummy (Yes =1, No = 0)

□□ = number of unskilled production workers

□□ = influences of the pressure from domestic competitors on production

□□□□ = size of firms ranking: Small= 1, Medium = 2 and Large = 3

□□□□□□ = percentage of establishmentôs sales scheduled for direct exports

□ □ □□□□□□□ = percentage of firm owned by largest shareholder(s)

□□ = city dummy variables

□□□ = error term

□/□ = industries and cities

Other individual variables that have been included in the model are: size of firm (Size), percentage of establishmentôs sales scheduled for direct exports (Export) and percentage of firm owned by largest shareholder(s) (Ownership).

Following Kinda et al. (2011) one step procedure was used to estimate all the coefficients. That is the production frontiers and the factors contributing to the firmsô productivity were estimated at the same time. This is to solve the problem of possible correlation between the production function inputs and the firm level productivity.

odology carried out the investigation. Also target population, importance of the data and data collection procedures were discussed. Descriptive statistics used were outlined in the chapter. Lastly the models used in the study were discussed.

CHAPTER 4

FINDINGS AND DISCUSSION

4.1 Description of data sample

A cross-sectional data from 2006 World Bank Enterprise survey for Swaziland was used in the study. The data was collected across three cities of Swaziland namely: Manzini, Matsapha and Mbabane.

4.2 Characteristics of industries in Swaziland

The section discusses the characteristics of industries in Swaziland. Table 4.1 shows, data for 70 industries in Swaziland distributed across three cities: Manzini, Mbabane and Matsapha.

Table 4.1

Industries by city

	FREQUENCY			PERCENTAGE		
City / Industry	Manzini	Matsapha	Mbabane	Manzini	Matsapha	Mbabane
Food & beverages	2	11	1	40	22	6.67
Garments	0	12	3	0	24	20
Textiles	1	4	0	20	8	0
Machinery & equipment	0	2	1	0	4	6.67
Chemical	1	2	1	20	4	6.67
Wood, wood product & furniture	0	1	2	0	2	13.33
Metal & metal product	0	2	0	0	4	0
Other manufacturing	1	16	7	20	32	46.67
Total	5	50	15	100	100	100

14 of the total industries found in the three cities are food and beverages industries, which 11 of the industries are found in Matsapha, two in Manzini and one in Mbabane. There are 12 firms under the garments industry found in Matsapha while three of the firms are found

anzini. Five of the firms under textiles industry of which in Manzini and none in Mbabane. There are three firms under the machinery and equipment industry, two of the firms are found in Matsapha and one in Mbabane and none in Manzini. Four of the firms are under chemical industry of which two are found in Matsapha, one in Manzini and one in Mbabane. Two of the three firms under wood, wood product and furniture industry are found in Mbabane and the other one in Matsapha. The two firms under metal and metal industry are found only in Matsapha. There are 16 firms found in Matsapha under other manufacturings of which seven are found in Mbabane and one in Manzini. The results reveal that there are more firms in Matsapha than the other two industrial cities of Swaziland.

Ownership of industries was also analysed, the results are presented in Table 4.2. The results reveal that most of the industries in Swaziland are domestic owned as compared to foreign owned (see appendix A).

Table 4.2

Ownership of industries

Industry	Percentage of domestic owned	Percentage of Private owned	Percentage of co-owned	Total
Food & beverages	35.7	28.6	35.7	100
Garments	40	53.3	6.7	100
Textiles	60	40	0	100
Machinery & equipment	100	0	0	100
Chemical	50	50	0	100
Wood, wood product & furniture	66.7	33.3	0	100
Metal & metal products	100	0	0	100
Other manufacturing	79.2	16.7	4.1	100

According to World Bank (2007), domestic owned are industries which are completely owned or controlled by individuals who are citizens of Swaziland or their headquarters are in the country. Foreign owned are industries which are completely owned or controlled by individuals who are not citizens of Swaziland or their headquarters are not in the country.

achinery and equipment industries are 100% owned by ustry is mostly owned by foreign owners as compared to domestic owners. Only 6.7% of the garment industry is co-owned. Most of textiles, wood, wood product and furniture and other manufacturing industries are domestic owned. Half of chemical industry is owned by domestic owners while the other half is owned by foreign owners. In food and beverages industries, 35.7% are owned by domestic owners while 28.6% are owned by foreign owners. About 35.7% of food and beverages industries are co-owned.

The results show ownership by gender which is represented in figure 4.1 and indicates that industries in Swaziland are mostly owned by males as compared to females.

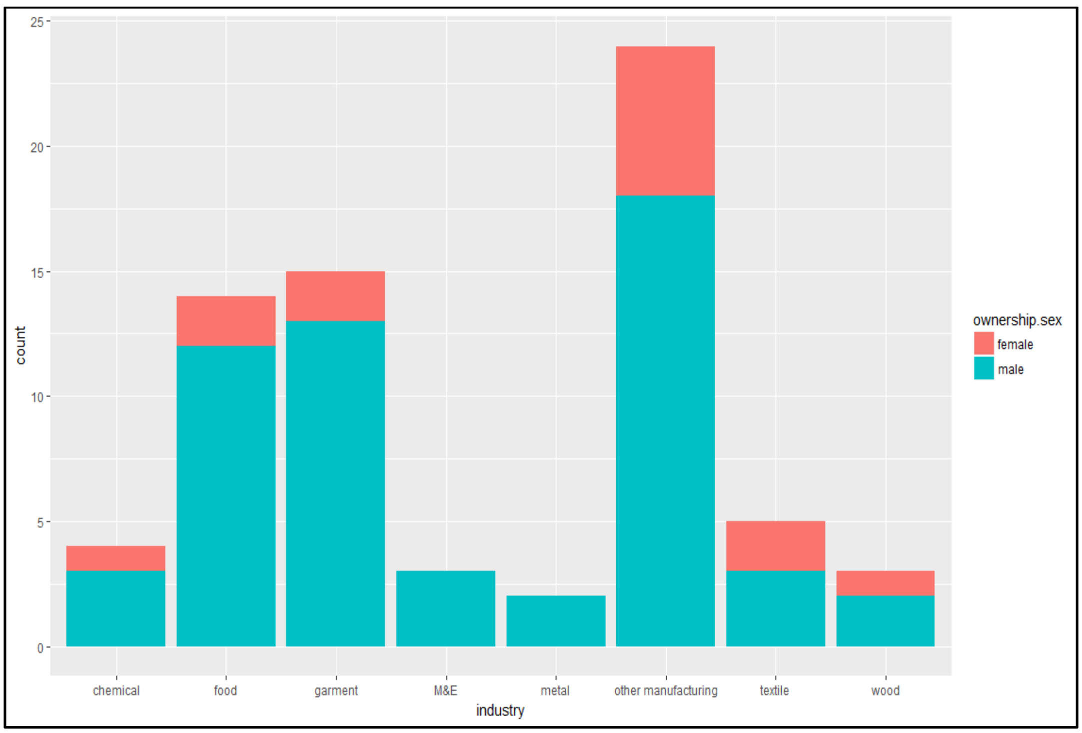

Figure 4.1. Ownership by gender

The food and beverages industries are also following the same trend. However, the metal and metal products and machinery and equipment industries are only owned by males. Figure B.1 to B.6 in the appendices B show the ownership of industries in Swaziland by race. The results reveal that most industries in Swaziland are owned by Africans as compared to Non Africans. Food and beverages industries are following the same trend. However, wood, wood product and furniture and metal and metal products industries are

B.2 shows that industries in Swaziland are mostly owned and beverages, chemical and garment industries are owned by Indians but in small percentage. Most industries in Swaziland are not owned by Lebanese or Middle East nations. However, textile industry only a small percentage of the industry is owned by Lebanese or Middle East nations. From figure B.4, it shows that industries in Swaziland are mostly owned by Non other Asians nations. Food and beverages, garments, textile and other manufacturing industries only a percentage of the industries are owned by other Asians nations. Results from Figure B.5 show that industries in Swaziland are mostly owned by Non Europeans nations as compared to European nations. However, metal and metal products and wood, wood products and furniture industries are completely owned by Non Europeans nations. Many of the industries in Swaziland are owned by either Africans or Indians or Lebanese or Middle East Nations or other Asians or Europeans. However, other manufacturing industries are owned by other origins neither than Africans, Indians, Lebanese or Middle East nations, other Asians and Europeans.

4.3 Obstacles faced by industries in Swaziland

The section discusses the obstacles faced by industries in Swaziland. The results are presented in the figure 4.2. Competition from informal sectors is the main problem faced by industries. One may say that competition is good in industries because it can encourage industries to provide quality goods and services to their customers. On the other hand, competition from informal sectors can reduce profits of industries. Most informal sectors do not pay rents where they are operating so they sell their goods and services at a low price. The low prices of informal sectors attract more customers. Also informal sectors do not have trading licenses, thus they do not pay tax. This can affect the country as a whole because tax cannot be collected from the informal sectors. Also informal sectors are not regulated.

The second obstacles faced by industries are access to finance and electricity. This means that industries in Swaziland cannot access capital from money institutions to start their businesses or to expand their businesses. The World Bank in 2007 also found that banks in Swaziland provide less finance to businesses. Power outages in Swaziland affects production of industries thus affecting their profits.

ries in Swaziland is crime, theft and disorder. e, access to land and corruption are the forth obstacles faced by industries in country. Other serious problems facing industries in Swaziland are tax rates, labour regulations, business licensing and permits, telecommunication, customs and trade regulation, functioning of courts and tax administration.

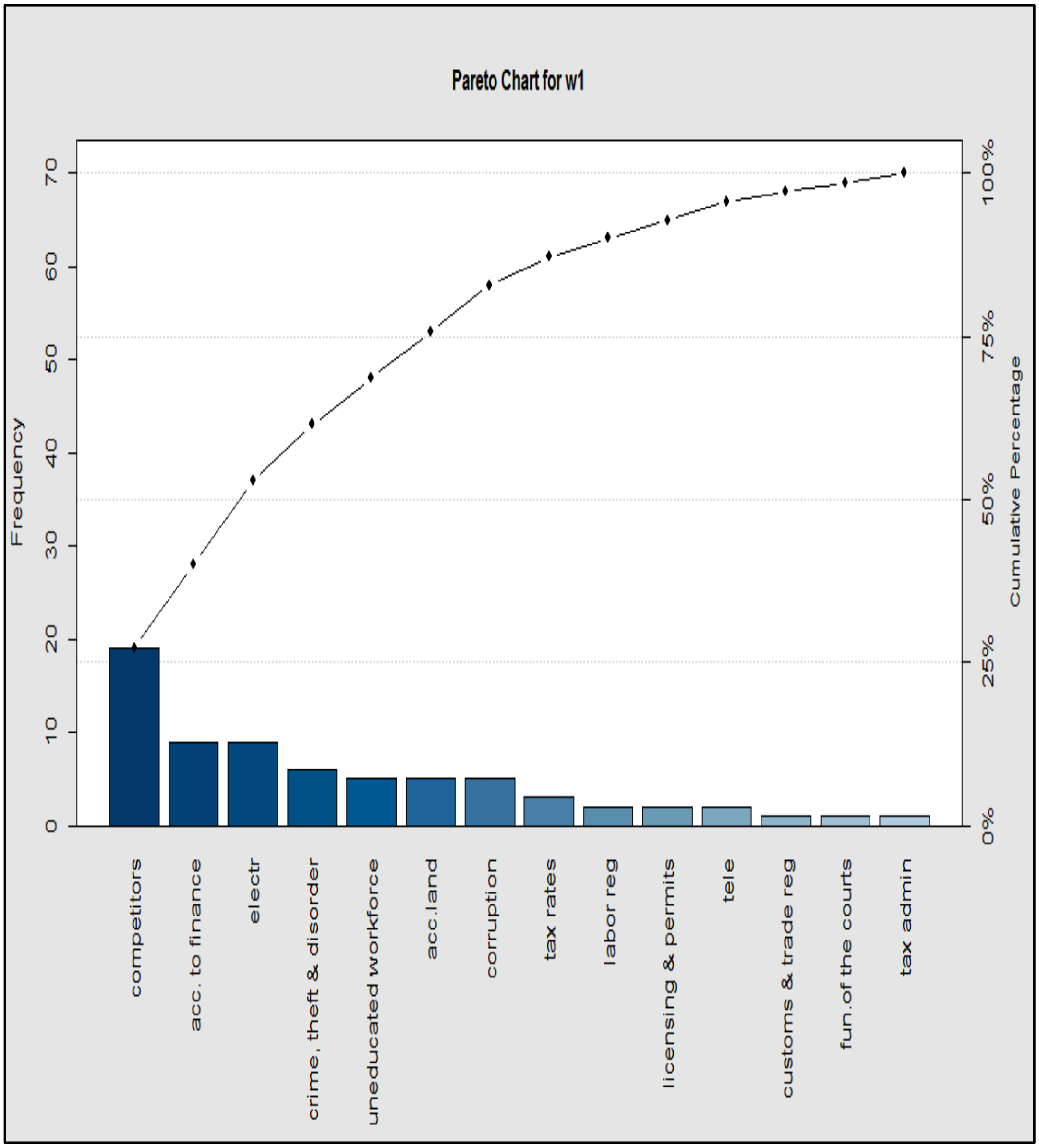

Figure 4.2. Obstacles faced by industries

...roductivity

...otal factor productivity using the stochastic production frontier for five industries is discussed in this section.

Table 4.3 includes the coefficients and significance levels of labour and capital. R^2 and number of observations are also presented in Table 4.3 together with F-statistic. The R^2 give some information about the goodness of fit of a model. R^2 ranges between 0 and 1, 0 indicates that the model explains none of the variability of the response data around its mean. While 1 indicates that the model explains all the variability of the response data around its mean. R^2 in all the industries is above 0.5 that indicate a good fit of the model.

Table 4.3

Estimates of the Stochastic Production Frontier

	Food	Garment	Textile	Chemical	Other manufacturing	Total
Log (Capital)	0.221 (0.176)	0.332 (0.294)	0.218 (0.149)	0.142 (0.089)	0.335** (0.052)	0.228*** (0.052)
Log (labour)	0.935** (0.350)	0.318 (0.346)	0.738*** (0.205)	0.806*** (0.174)	0.488** (0.098)	0.749*** (0.077)
Constant	8.793*** (1.421)	8.786 (3.868)	9.152*** (1.875)	9.913*** (1.172)	8.337*** (0.607)	9.036*** (0.673)
Observations	14	15	5	4	24	70
R^2	0.799	0.730	0.654	0.592	0.985	0.727
F Statistic	21.816*** (df = 2; 11)	1.349 (df = 2; 1)	11.338*** (df = 2; 12)	15.215*** (df = 2; 21)	67.450** (df = 2; 2)	89.185*** (df = 2; 67)

Note: *p **p ***p<0.01

In all the industries except food and beverages industries, the sum of the coefficients relative to labour and capital is less than one. Which means that all the industries except food and beverages industries are probably mostly exposed to competition in the developing country like Swaziland.

of capital are insignificant in all the industries except in where it is significant at 5%. It means that 1 unit increase in capital will increase total output by 0.34 units.

While the coefficients of labour are significant in all the industries except in garment industry where it is insignificant. Coefficients of labour in food and beverages and other manufacturing industries are significant at 5%. While in textile and chemical industries, the coefficients of labour are significant at 1%. A 1 unit increase in labour (number of employees), total output will increase by 0.94 units, 0.76 units, 0.81 units and 0.49 units in food and beverages, textile, chemical and other manufacturing industries respectively.

4.5 Stochastic Frontier Model with Investment Climate variables

Table 4.4 shows the results of the stochastic production frontier with IC variables, the model is estimated at the sector level and the sample size varies from 14 observations in food and beverages industries, 15 in garments industry and 70 in total of the industries. The Cobb-Douglas production function was estimated with the production frontier. According to Ajetomobi et al. (2017) the merit of the model is that the coefficient of labour and capital expressed in logarithmic form can be treated as the variableôs direct elasticity.

The results reveal that the elasticities of labour and capital are different in food and beverages, garments and total industries. The coefficients of labour and capital are strongly significant in the total industries. In food and beverages industries, the coefficients of labour and capital are significant at 5% and 10% respectively. The coefficient of labour is higher than that of capital in food and beverages, garments and total industries. This shows that all industries in Swaziland are labour intensive. The results are in line with what Ajetomobi et al. (2017) found in Nigerian industries. Thus there is a need to improve capital technologies in all sectors in Swaziland just like in Nigeria.

The coefficient of labour for the food and beverages industries is higher than the garments industry and the total industries in Swaziland. This means that food and beverages industries in Swaziland are more labour intensive than other industries.

with Individual IC Variables

Variable	Food & beverages	Garments	Total Industries
log(capital)	0.546*	0.289	0.221***
	(0.062)	(0.140)	(0.058)
log(labour)	2.506**	1.877	0.738***
	(0.155)	(0.762)	(0.245)
X_1	-0.405*	0.171	0.082
	(0.042)	(0.159)	(0.088)
X_2	0.046	0.066	0.050
	(0.024)	(0.111)	(0.047)
X_3	-0.959*	0.297	0.087*
	(0.095)	(0.112)	(0.049)
X_4	0.269*	-0.176	-0.013
	(0.025)	(0.062)	(0.009)
X_5	0.767	0.431	-0.168
	(0.186)	(0.634)	(0.222)
X_6	-0.022*	-0.001	-0.0002
	(0.002)	(0.0005)	(0.001)
X_7	1.008**	0.058	0.232**
	(0.061)	(0.281)	(0.113)
Size	-2.991**	-2.132	0.089
	(0.188)	(1.182)	(0.392)
Export	0.010	-0.017	0.001
	(0.002)	(0.015)	(0.004)
Ownership	0.004	0.012	-0.005
	(0.002)	(0.017)	(0.004)
Constant	1.322	6.827*	8.835***
	(0.690)	(1.680)	(1.032)
Adjusted R^2	0.996	0.921	0.732
F statistic	291.451**(df=12; 1)	14.635*(df= 12; 2)	16.668***(df=12;57)
Observations	14	15	70

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Regarding the effects of investment climates, the results clearly reveal that differences in firm level efficiencies across industries in Swaziland can be pointed to discrepancies in show that most of the investment climate variables are s industries.

An interesting aspect of the results is that corruption and unskilled workforce negatively and significant influences productivity of food and beverages industries. It is in line with what Ajagbe and Ajetomobi (2017) found in Nigeria in terms of corruption. Nguyen and Taisen (2017) also found that corruption in Vietnamese destroys markets and incentives for productive investments.

Access to finances is insignificant in food and beverages, garments and the total industries. This might be a good reason for relatively low performance of industries in Swaziland because they are not able to obtain capital to expand their businesses.

Poor finance, asymmetric information, inadequate modern technologies, power interruption, government bureaucratic bottleneck and corruption need to be given enough attention in order to address the challenges of poor returns and high production costs in food industries (Clement and Reiner, 2009 in Ajetomobi et al., 2017).

Number of days to claim goods from customs is significant and negatively affect productivity of food and beverages industries. The results correspond with what Subramanian et al., (2005) found in their study in China and Brazil.

The importance of export and firm ownership is not significant in Swaziland in all the industries. This shows that industries in Swaziland are not willing to improve their productivity by learning from customers and by facing international competition. In addition industries in Swaziland are not willing to improve their productivity by allowing foreign investors to bring new technologies and management techniques.

Size of firms in food and beverages industries are significant but negative. According to kinda et al. (2011) the expected sign of size of firms is negative due to the fact that the one step procedure explains firm level inefficiency. The size of firms in food and beverages industries are significant and negative which means that small firms are more efficient than large firms. Small firms are able to manage their inputs in order to produce outputs. Large firms require large inputs which they cannot manage.

The results of the study reveal that industries in Swaziland are labour intensive, thus there is a need to improve capital technologies in all sectors. Equally the results reveal that poor finance of industries in Swaziland need to be addressed in order to increase productivity of industries. The main obstacles facing industries in Swaziland are competition from informal sectors, access to finance and electricity. Most industries in Swaziland are owned by males as compared to females.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Purpose and Objectives of the Study

Main objective of the study was to examine the influence of investment climate on productivity of food and beverages industries in Swaziland. Specific objectives of the study were to: examine the characteristics of food and beverages industries in Swaziland, investigate the most serious obstacles facing industries in Swaziland, estimate total factor productivity of food and beverages industries in Swaziland and examine the effect of investment climate on productivity of food and beverages industries.

5.2 Methodology

The study used 2006 World Bank Enterprise data for Swaziland. R-package was used to analyse the data. Two phases were conducted in the study namely: (i) an estimation of the firm-level productivity was carried out using Cobb-Douglas production function and (ii) differences in TFP across firms were statistically related to indicators of investment climate, taking into consideration firms characteristics. Firm characteristics used in the study were: size of firms, export and ownership. The investment climate variables used were: average number of days to claim goods from customs, total losses for the year as the percentage of annual sales, informal payment/gifts given to public officials as a percentage of total sales, number of days to obtain telephone lines, a dummy whether a firm received loan from a financial institution, number of unskilled production workers and influence of the pressure from domestic competitors on production.

5.3 Summary of findings

The results show that most industries in Swaziland are owned by males as compared to females. Main obstacle faced by industries is competition from informal sectors. Informal sectors are not regulated while formal sectors are regulated. Following the informal sectors are lack of access to finance and electricity. Industries in Swaziland cannot access loans from financial institutions in order to expand their business. Crime, thief and disorder, access to land, uneducated workforce and corruption are among other obstacles faced by industries in Swaziland. Industries in Swaziland are labour intensive as shown by to improve the capital technologies in all sectors in

Further, the results indicate that competition from domestic pressure, average number of days to claim goods from custom and number of days to obtain telephone lines are important to productive performance of food and beverages industries. Corruption is important to all industries in Swaziland. Average number of days to claim goods from custom, corruption and uneducated workforce negatively and significantly affect production of food and beverages industries while number of days to obtain telephone lines and pressure from domestic competition are positive and significant.

5.4 Conclusions

The food and beverages industries are mainly owned by males as compared to females. This trend is the same to other industries in Swaziland. It shows that males dominate the ownership of industries in the country. Competition from informal sectors is a problem in all the industries in the country not sparing food and beverages industries. Access to finance and electricity are other obstacles facing industries in Swaziland. Electricity and access to finance discourages inputs and outputs manufacturing in industries. Crime, thief and disorder is another problem facing industries in Swaziland. Crime, thief and disorder can discourage both domestic and foreign investors wanting to open more firms in the country. Other obstacles facing industries in Swaziland are access to land and corruption. Most industries cannot obtain spaces to operate in, thus affect job opportunities for the people of Swaziland. These obstacles faced by the industries are the reasons behind Swaziland importing about 90% of food.

All industries besides the food and beverages industries are exposed to competition since the sum of the coefficients relative to labour and capital is less than one. Industries in Swaziland are labour intensive so there is a need to improve capital technologies in all industries including food and beverages industries. The following investment climate indicators are important for food and beverages industries: competition from domestic pressure, average number of days to claim goods from custom, corruption, uneducated workforce and number of days to obtain telephone lines.

s to existing literature

l that industries in Swaziland are labour intensive. This is what Ajetomobi et al. (2017) found in Nigeriaøs industries. Industries in Swaziland need to improve capital technologies just like in Nigeria. Corruption and unskilled workforce negatively and significant influences productivity of food and beverages industries in Swaziland. It is inline with what Ajagbe and Ajetomobi (2017) found in Nigeria in terms of corruption. Also Nguyen and Taisen (2017) found that corruption destroys markets in Vietnamese. Number of days to claim goods from customs is significant and negatively affect productivity of food and beverages industries in Swaziland. Subramanian et al. (2005) also found that number of days to claim goods from customs negatively and significantly affect productivity of industries in China and Brazil.

5.6 Recommendations

In order to improve the performance of food and beverages industries relative to non food and beverages industries much effort from policy makers may be needed to build up a conducive investment climate. A friendly investment climate in Swaziland can help in attracting Foreign direct investment and encourage local investment in food and beverages industries. This can help in reducing the amount of food being imported into the country and increase job opportunities. The foreign investors can bring their advance technologies into the country, thus increase production of food and beverages.

Despite the hard work done by government in attracting foreign investors, more work need to be done in order to achieve its priorities which are job creation and food security. Government can achieve this through import substitution by strengthening agro processing. The import substitution can be achieved by making the investment climate friendly for domestic and foreign investors to be able to operate in the country.
The results reveal that there are scopes for initiating policy measures to improve the dimensions of the relevant investment climate variables. Hence, the following policies are suggested to help in the competitiveness of Swazilandøs industries:

i. Appropriate measures should be put in place to reduce opening of informal sectors in the country. This can be controlled by an assigned government agency.

s should be put in place to decrease the rate of unofficial
try. The country can invest much more effort in institutional reforms especially to fight against corruption and efficacy in the provision of public goods and services.

iii. Especial vehicle should be put in place to provide easy access to finance to favour food and beverages industries and other industries.

iv. Initiate a roadmap for power reforms to ensure a stable and sufficient electricity for industrial use. For example, the frequency and duration of power outage could be reduced by generating our own electricity as a country. Also provide renewable energy to complement the electricity.

v. Put educational programmes to empower the workforce of the country.

5.7 Recommendation for further study

The study focused on three cities of Swaziland which are: Manzini, Matsapha and Mbababe. Another study can be expanded to other cities of the country especial in the lowveld where there is high level of drought.

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APPENDIX A

Private domestic owned industries

Private domestic owned industries (100%)	Frequency
Industry	
Food and beverages	5
Garments	6
Textiles	3
Machinery & equipment	3
Chemicals	2
Wood, wood products & furniture	2
Metal& metal products	2
Other manufacturing	19
Total	42

Table A.2

Private-foreign owned industries

Private Foreign owned industries (100%)	Frequency
Industry	
Food and beverages	4
Garment	8
Textile	2
Machinery & equipment	0
Chemicals	2
Wood, wood product & furniture	1
Metal & metal products	0
Other manufacturing	4
Total	21

APPENDIX B

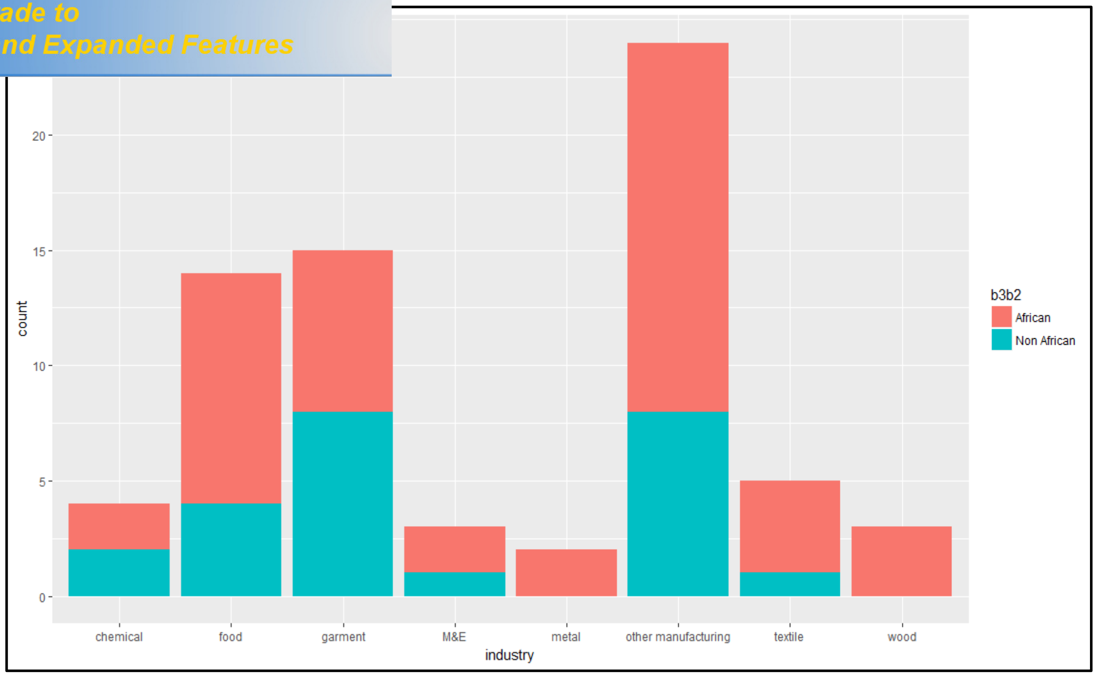

Figure B.1. Ownership by Africans

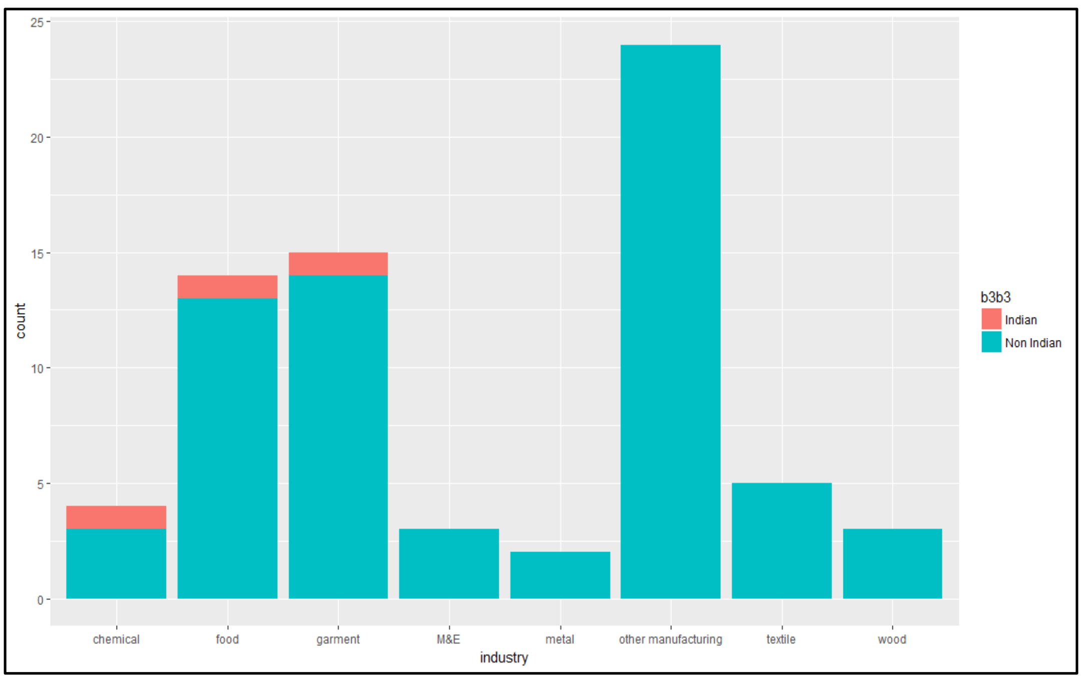

Figure B.2. Ownership by Indians

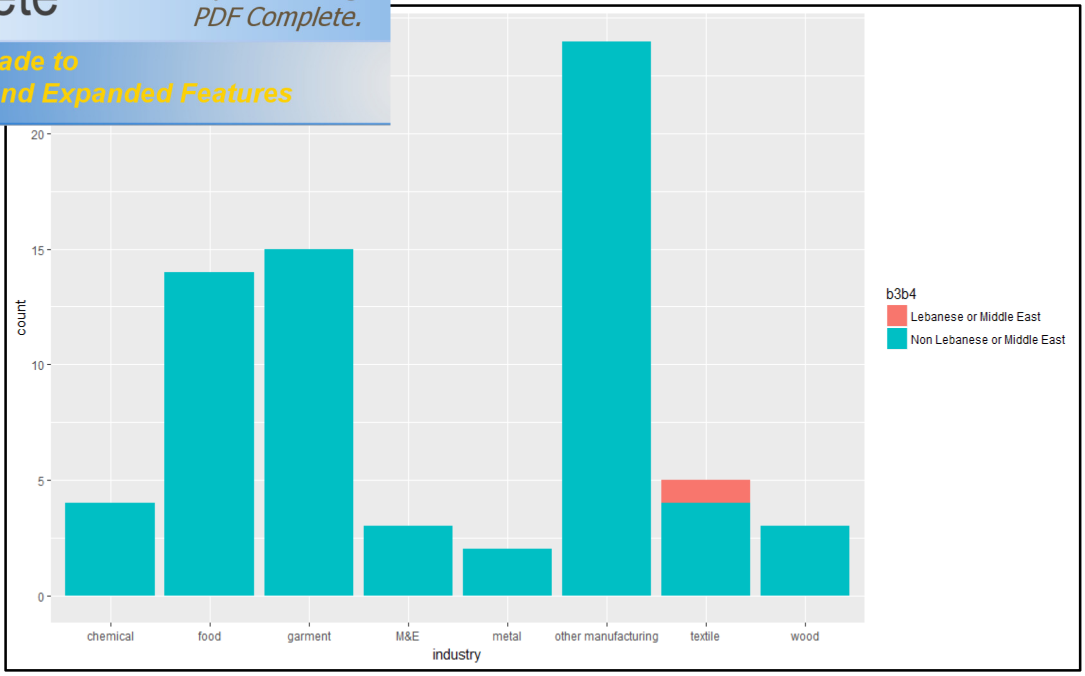

Figure B.3. Ownership by Lebanese or Middle East

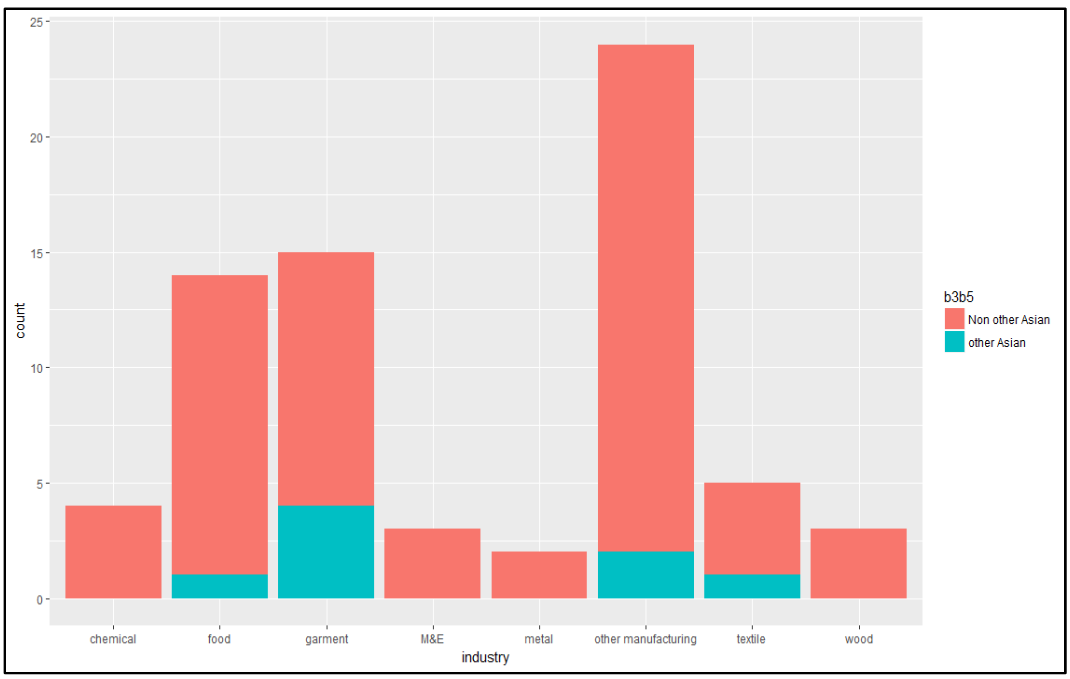

Figure B.4. Ownership by Other Asian

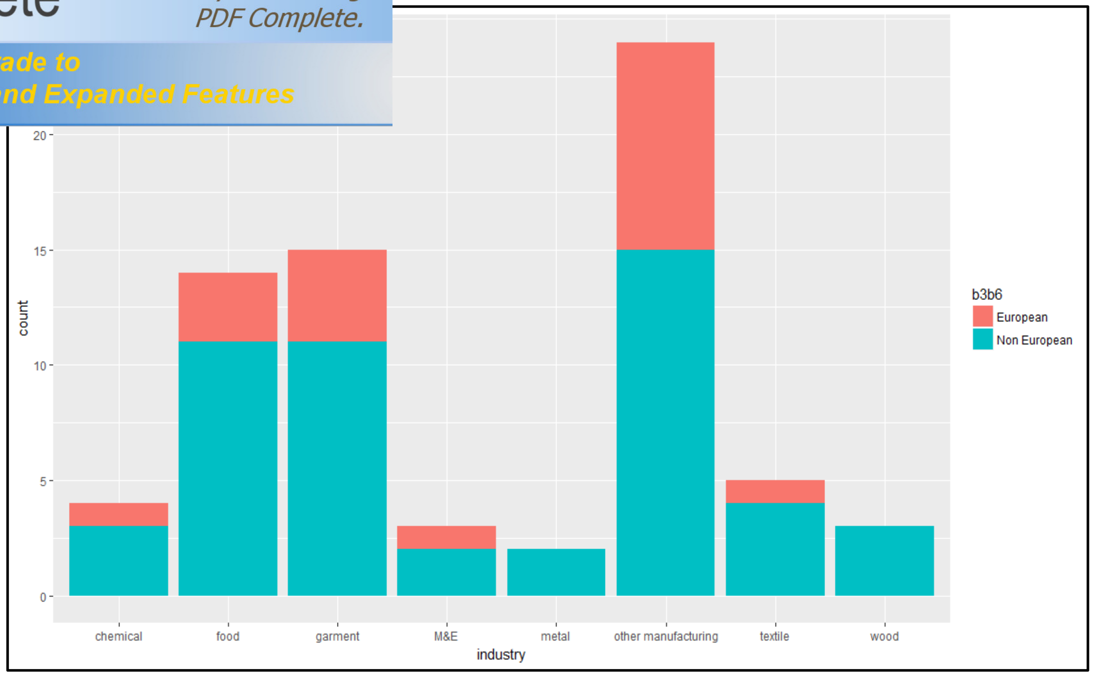

Figure B.5. Ownership by European

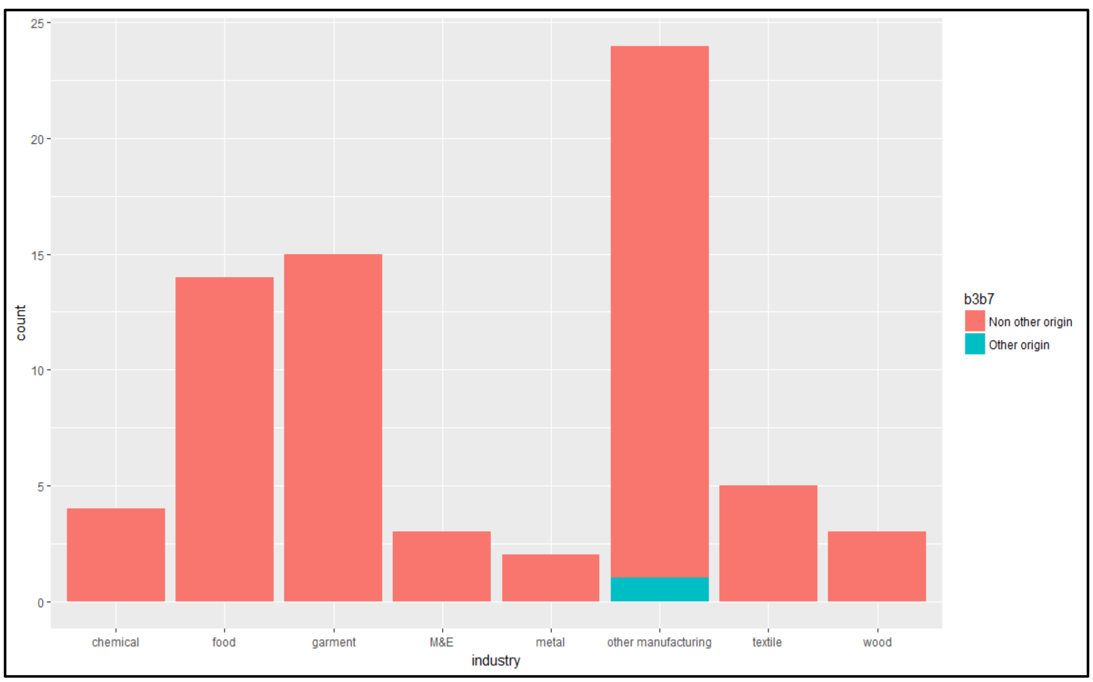

Figure B.6. Ownership by other origin

APPENDIX C

	Count			Column %		
city	Manzini	Matsapha	Mbabane	Manzini	Matsapha	Mbabane
industry						
1	2.00	11.00	1.00	40.00	22.00	6.67
2	0.00	12.00	3.00	0.00	24.00	20.00
3	1.00	4.00	0.00	20.00	8.00	0.00
4	0.00	2.00	1.00	0.00	4.00	6.67
5	1.00	2.00	1.00	20.00	4.00	6.67
8	0.00	1.00	2.00	0.00	2.00	13.33
9	0.00	2.00	0.00	0.00	4.00	0.00
10	1.00	16.00	7.00	20.00	32.00	46.67

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Table C.2

Output of Importance of industries

	industry	vad	j2a	l1b
1	chemical	1968126	56.75000	2465376.0
2	food	20111571	131.71429	31750708.0
3	garment	20765480	493.40000	24078280.0
4	M&E	12950000	312.33333	23666666.7
5	metal	8001500	106.00000	14135000.0
6	other manufacturing	4268301	47.16667	8084759.2
7	textile	8325667	214.00000	12472000.0
8	wood	592000	13.66667	851333.3

Table C.3

Output of shares of domestic owned industries

b2a	0	1	5	30	40	50	60	100
industry								
1	4.00	0.00	1.00	1.00	1.00	1.00	1.00	5.00
2	8.00	1.00	0.00	0.00	0.00	0.00	0.00	6.00
3	2.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
5	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
8	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
10	4.00	0.00	0.00	0.00	1.00	0.00	0.00	19.00

Table C.4

Output of shares of private owned industries

b2b	0	25	60	70	95	99	100
industry							
1	6.00	1.00	1.00	1.00	1.00	0.00	4.00
2	6.00	0.00	0.00	0.00	0.00	1.00	8.00
3	3.00	0.00	0.00	0.00	0.00	0.00	2.00
4	3.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.00	0.00	0.00	0.00	0.00	0.00	2.00
8	2.00	0.00	0.00	0.00	0.00	0.00	1.00
9	2.00	0.00	0.00	0.00	0.00	0.00	0.00
10	19.00	0.00	1.00	0.00	0.00	0.00	4.00

hastic Production Frontier

	Dependent variable:						
	log(vad)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(capital)	0.221	0.332	0.218	0.937	0.142	0.335^{**}	0.228^{***}
	(0.176)	(0.294)	(0.149)		(0.089)	(0.052)	(0.055)
log(labor)	0.935^{**}	0.318	0.738^{***}		0.806^{***}	0.488^{**}	0.749^{***}
	(0.350)	(0.346)	(0.205)		(0.174)	(0.098)	(0.077)
Constant	8.793^{***}	8.786	9.152^{***}	2.166	9.913^{***}	8.337^{***}	9.036^{***}
	(1.421)	(3.868)	(1.875)		(1.172)	(0.607)	(0.673)
Observations	14	15	5	2	4	24	70
R^2	0.799	0.730	0.654	1.000	0.592	0.985	0.727
Adjusted R^2	0.762	0.689	0.596		0.553	0.971	0.719
Residual Std. Error	0.891 (df = 11)	0.978 (df = 1)	1.183 (df = 12)		0.840 (df = 21)	0.285 (df = 2)	0.887 (df = 67)
F Statistic	21.816^{***} (df = 2; 11)	1.349 (df = 2; 1)	11.338^{***} (df = 2; 12)		15.215^{***} (df = 2; 21)	67.450^{**} (df = 2; 2)	89.185^{***} (df = 2; 67)

Note: *p **p ***p<0.01

Frontier with Individual IC Variables

	Dependent variable:		
	log(vad)		
	(1)	(2)	(3)
log(capital)	0.546*	0.289	0.221***
	(0.062)	(0.140)	(0.058)
log(labor)	2.506**	1.877	0.738***
	(0.155)	(0.762)	(0.245)
d1b2	-0.405*	0.171	0.082
	(0.042)	(0.159)	(0.088)
g1a4	0.046	0.066	0.050
	(0.024)	(0.111)	(0.047)
i1c1	-0.959*	0.297	0.087*
	(0.095)	(0.112)	(0.049)
i2a2	0.269*	-0.176	-0.013
	(0.025)	(0.062)	(0.009)
k4a	0.767	0.431	-0.168
	(0.186)	(0.634)	(0.222)
j2b1b	-0.022*	-0.001	-0.0002
	(0.002)	(0.0005)	(0.001)
e3a1	1.008**	0.058	0.232**
	(0.061)	(0.281)	(0.113)
sampsize	-2.991**	-2.132	0.089
	(0.188)	(1.182)	(0.392)
c6b	0.010	-0.017	0.001
	(0.002)	(0.015)	(0.004)
b3a	0.004	0.012	-0.005
	(0.002)	(0.017)	(0.004)
Constant	1.322	6.827*	8.835***

		(1.680)	(1.032)
		15	70
R^2	0.999	0.989	0.778
Adjusted R^2	0.996	0.921	0.732
Residual Std. Error	0.111 (df = 1)	0.523 (df = 2)	0.867 (df = 57)
F Statistic	291.451** (df = 12; 1)	14.635* (df = 12; 2)	16.668*** (df = 12; 57)
Note:	*p**p***p<0.01		