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Econometric Analysis of Foreign Direct Investment in the Zimbabwean Mining Sector 2005-2014

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Abstract

The paper analyses the determinants and the effects of foreign direct investment inflows (FDI) in the Zimbabwe Mining Sector (ZMS) in a specific study for 14 minerals from 2005-14 estimating a random effect model. Mineral specific variables examined include capacity utilisation, volume of manufacturing index, labour cost, sectorial contribution to Gross Domestic Product (GDP), political instability, mineral price and mineral output. FDI inflow in the ZMS can be explained by capacity utilisation, volume of manufacturing index, labour, sectorial contribution to GDP and political instability. No statistical evidence could be established to support mineral price and output as major determinants of FDI in the mining sector. All these variables confirmed with literature except for volume of manufacturing index. As a result, the government is recommended to put in place supportive policies that encourage investments and recapitalization in the mining sector so that local firms can effectively compete at both domestic and international investment markets.

Keywords

Foreign Direct Investment Inflow, Zimbabwean Mining Sector

1. Introduction

Access to foreign capital and investment enables a country to invest in human and physical capital as well as to make full use of opportunities otherwise not available. Acquisition of capital and making profitable investments is important in the economic improvement of a country. Foreign direct investment is therefore a vital component of development and operation at an international scale.

Unfortunately, its empirical determinants and effects are not very well understood. Foreign direct investment (FDI) is crucial for developing countries because of the long-term finance, technology, technical knowhow, managerial expertise and marketing experience that if offers. It brings to the host country economic development, and leads to increased employment (Kukaj and Ahmet [1]). Chimuka [2], argued that FDI is crucial in the mining sector for carrying out mineral exploration, extraction, processing and marketing because Zimbabwe lacks enough capital and technological resources to finance such capital intensive large-scale projects. However, negative effects may also flow from FDI; these include increased financial risks, foreign exchange rates crises, transfers of obsolete and dirt technologies. As a consequence one needs to understand not only determinants but also effects of FDI.

A panel data analysis for 14 minerals across a 10-year period (2005-2014) is estimated in a bid to provide answers to the raised questions. Section 2 provides review of the theoretical and empirical literature of this topic. Section 3 shows methodological estimation procedures. Section 4 presents empirical results, discussion and their economic interpretation. Lastly Section 5 gives some possible policy recommendation, as well as suggested areas for future research.

2. Literature Review

Various theories have been put forward on the motivations and determinants of FDI. These theories can be divided into macro level theories and micro level theories. However, there is no established theory on the interrelationship between FDI and the mining sector hence it is necessary to consider FDI theories that try to provide an insight into what causes FDI to flow into various investment destination and not just FDI development theories. The eclectic paradigm that is also known as the OLI-Model which is an extension of internalization theory by Dunning [3] will be considered in the theoretical section of the paper because it is more acceptable than the heavily criticised neoclassical condition of perfect competition. The theory argues that the structure of an organisation is not the only significant factor in inviting FDI, but rather three additional elements were added to the theory, and these are Ownership, Location and Internalization advantages. It is a combination of three approaches to FDI, (O-L-I), "O" Ownership advantages, "L" Location and "I" for Internalisation, Denisia [3].

Macroeconomic environment, political stability, FDI incentives, cost of labour, legal framework, availability of resources, level of infrastructural development are some of the factors considered before decisions are made by multinational companies(henceforth MNCs) as far as FDI location is concerned.

The eclectic theory takes into account the significance of three variables namely, country-specific, company-specific and internalisation relating to trade and FDI. The country-specific variables are geographical environment, the political environment, the government's regulatory framework, taxation and fiscal policy, production costs and transportation costs and the cultural environment

[3]. The specific advantages of each country can be divided into three categories, economic, political and social. The economic benefits consist of quantitative and qualitative factors of production, costs of transport, telecommunications, market size and infrastructure of the host economy, Zimbabwe has a wide range of these services however not much FDI has been attracted yet.

Internalisation, being another characteristic of the eclectic paradigm offers a framework for assessing different ways in which the company will exploit its powers from the sale of goods and services to various agreements that might be signed between the companies. The higher the cross-border market internalisation benefits the more the firm will want to engage in foreign production rather than offering this right under license, franchise. Eclectic paradigm OLI shows that OLI parameters are different from company to company and depend on context and reflects the economic, political, social characteristics of the host country. Therefore the objectives and strategies of the firms, the magnitude and pattern of production will depend on the challenges and opportunities offered by different types of countries. The main challenge in Zimbabwe can be argued to have been political and partly economical; this fact might have made the economy a less safe FDI destination although it provides all other advantages posed by the theory.

This scenario encourages the current study to assess the determinants of FDI, macroeconomic policy, political stability, and cost of labor, legal framework guiding FDI, availability of resources, FDI incentives and level of infrastructural developed to find out how they affect or influence the flow of FDI in the Zimbabwe mining sector. The study will test the theories of FDI effect on economic growth which have remained ambiguous in previous studies with the aim of shedding more light on this controversial topic. The study seeks to provide answers to the question of whether the mining sector should continue seeking or abandon the search for FDI. Economic development in the mining sector contributes to the economic development of the whole country and therefore the current research could help clear up the gray areas raised by previous researchers.

Empirical studies on both macro and/or micro data are yet to reach consensus on both the determinants and effects of FDI on the performances of either a particular sector or economy in general. Few studies on Africa have attempted either to establish determinants of FDI on a particular sector of the economy. Most of the available literature is on FDI and economic growth at large.

There are differing findings about the actual impact of political stability on FDI inflows. Demirhan and Masca [4], studied FDI inflows in developing countries between 2000 and 2004 they came up with the conclusion that political risk has an insignificant effect on FDI. The argument was that investors were concerned with returns rather than political risks. Opposite results are held by Luiz and Ruplal [5], who argued that security of tenure; political stability and the availability of infrastructure were the most important factors influencing the internationalisation of South African mining firms. It is apparent from these stu-

dies that political stability increases the probability of attracting more FDI inflows in a nation's particular sector thus political stability is expected to have a positive effect on FDI inflows. Contrary to recent studies Tsikata *et al.* [6], could not confirm that political instability was a significant determinant of FDI, Anyanwu [7] [8], Moyo [9], Kariuki [10], later confirmed it as a prime variable. Divergent results need to further study the Zimbabwean mining sector as the developing country argument is contrary to the single nation argument. The argument is not the effect but rather the significance of the factors in influencing FDI.

Severiano's [11], study, "The determinants of FDI in Portugal," concluded that most foreign investing firms do not choose to invest in Portugal to take advantage of a cheap labour force. According to Severiano [11], a raise in the real minimum wage was found to affect positively FDI inflows. This is very interesting because previous research by different scholars indicated that FDI favours countries with low labour costs, see for example, Mody and Srinivasan [12]. Recent research by Bayraktar-Saglam and Böke [13], however, examined the endogenous interaction between labour costs and Foreign Direct Investment (FDI) in the OECD countries via the Panel VAR approach under system GMM estimates for the period 1995-2009. The empirical findings revealed that sactorial composition of FDI and the decomposition of labour costs play a significant role in investigating the dynamic association between labour costs and FDI. It will be interesting to find out how labour cost determines FDI inflows to Zimbabwe.

Having discussed much about the determinants of FDI it becomes imperative to review the effect of FDI. Rate of growth can be explained by the state of technology used by a country [14]. However, on the state of technology it may be necessary to concentrate on sectorial level rather than at national level so as to have a clear understanding of its effects. Transfer of technology and knowledge by MNCs through FDI increases and improves productivity which leads to growth of Gross Domestic Product argue Varamini, and Vu [15]. Contrary to this view, MNCs could bring obsolete and dirty technology [16].

Aswal [17] argues that host countries are integrated into the global economy thanks to financial flows received from FDI and that there is a link between the increase of FDI and rapid integration into global trade. However, further integration into the global economy can bring negative effects. Since FDI has a greater impact on imports than on exports this influences negatively the balance of payment which might prompt capital flight and repel FDI in the long run. FDI is the easiest way of spreading economic problems in the world especially those that have occurred in the MNCs countries of origin; for example, -host countries are forced to open economies and are more subject to global changes than would be the case, Khurtishi-Kastrati [18].

Furthermore, FDI can be cardinal in producing a better economic environment resulting in economic growth: as Honsen and Rand [19], argued FDI is a source of change. FDI can create entry barriers and or it can eliminate or reduce monopolies in these sectors changing the structure of the local economy for the

best or worst. By takeovers and privatization MNCs force the adoption of their policies and procedures. These arguments have not only highlighted that the effects of FDI on the sector are inconclusive but even that the effects on the structure of the economy are not conclusive.

Using the OLS method of estimation Adewuni [20], Anyanwu [7], and Moyo, [9], studied the possible impact of FDI on economic growth. Of these studies, Moyo [9], made an attempt to establish the determinants of FDI in the post dollarization period of 2009 to 2012 in Zimbabwe using monthly data. The study established a positive relationship in respect to FDI. It should also be noted that Moyo [9], study was based only on macro data. That data was based on the whole nation and not on sectors, which is instead the scope of this study. Adewuni [20], employing a pooled OLS had a similar objective for nine African countries and concluded that economic growth was insignificant as a determinant of FDI. Anyanwu [7], focused on the Nigerian economy for a 27-year period [1980-2007], and share the same results with Adewuni [20], in the sense that economic growth was irrelevant in attracting FDI but rather he found natural resource endowment and exploitation especially for oil as the prime determinants of FDI. Since Nigeria is highly endowed with oil which was found to be a determinant for FDI, this study seeks to find out if such a conclusion could be reached on the diamond sector and FDI in Zimbabwe given the fact that the country is highly endowed with the germ.

Oluwatosin [21], examined the causal linkages between FDI and economic growth and financial development in 5 African nations that is Gambia, Ghana, Ivory Coast, Nigeria and Sierra Leone from 1970-2005. A Vector Error Correction Model (VECM) was employed in the trivariate framework and results showed FDI to have bi directional causality on both financial and economic growth while financial development had a causal relation on economic growth and not the other way. A similar estimation concept was employed by Javorvick [22], on firm-based panel of 9 MNCs. The focus was to test for productivity spillovers from FDI that would result from linkages between foreign and domestic suppliers and forward linkages (interactions between foreign suppliers of intermediate inputs and their domestic customers). This sort of methodology can also be employed to establish the relationship between mining sector performance and FDI. Given the size of the sector with 14 main minerals, a mineral based panel may also yield superior results to secondary macro data.

In a separate all Africa's FDI determinant study done by Anyanwu [8], for which data from 1996-2008 was studied for those nations in a pooled ordinary squares and Fixed General Least Square estimation technique was employed. Results showed market size and trade openness to be the most (positive) significant factor in attracting FDI. However financial market development was found to have a negative impact while economic growth had no share on attracting FDI.

In a study by Kariuki [10], an estimated Least Square Dummy Variable also known as the fixed effects model for a sample of 35 African countries including

Zimbabwe was used and produced similar results to those found by Anyanwu [8]. The only difference was that financial sector development this time around was found to have a positive effect on FDI attraction for the nation. One would wonder if the use of a different methodology would influence the results or if it is the sample size that affects variable significance. It is not only Anyanwu [8], who could not establish the significance of the economic growth similar results were obtained even by Adewuni [20].

In terms of determinants and effects of FDI on mining sector nothing much can be drawn from the reviewed literature as most studies focused on either or both determinants and effect of FDI on economic growth. Interestingly, of that existing literature contradictory views on the link between FDI and economic growth were found. Hence, this study does not only seek to contribute to that debate but to empirically establish determinants and effects of FDI in the Zimbabwean mining sector context.

3. Methodology

Theory and empirical studies carried out by previous scholars provide a foundation for model building. Approach and methods to be used in this research are explained in this section. The approach and methods of this study relates to studies by Javorvick [22] and Oluwatosin [21]. This study presents results from panel data regressions from 14 minerals for the period 2005 to 2014. The suitable model to study determinants and effects is the one expressed by an analytical approach similar to that used by Javorvick [22], Oluwatosin [21], with the needed ad hoc adjustments model is:

$$FDI_{i,t} = \alpha + \beta X_{i,t} + \varepsilon_t \tag{1}$$

$$\begin{aligned} X_{i,t} = \beta_0 + DPS_{i,t} + \beta_2 VMI_{i,t} + \beta_3 COST_{i,t} + \beta_4 PRICE_{i,t} + \beta_5 CU_{i,t} \\ + \beta_6 CONTR_{i,t} + \beta_7 OUT_{i,t} + \beta_7 LABR + \mu_{i,t} \end{aligned} \tag{2}$$

$$D = \begin{cases} 1 & \text{2005-8, 2013} \\ 0 & \text{otherwise} \end{cases}$$

where *FDI* is the foreign direct investment inflow in a particular mineral, *X* is a set of all possible factors that determine *FDI* inflow into a firm and *t* is annual time period from 2005 to 2014 for 14 minerals. While α and β are related coefficients and ε_t is a vector of white noise disturbance.

The study wants to establish through estimation the determinants and effects of FDI on the mining sector performance of the Zimbabwean economy.

3.1. Panel Data Analysis

Panel data analysis is a frequently used approach in FDI and growth research since it enables the researcher to study the dynamics of the change of economic growth per capita for a short time series [2005-2014]. Since panel data combines both cross-sections and time series it can enhance the quality of data and sort out economic effects that cannot be distinct with only cross-sections or time se-

ries data. Panel data also has more numbers of data points that generate additional degrees of freedom which improve the efficiency of the econometric estimates. Moreover, using information of both temporal (time) and minerals (cross-section) effects one can substantially overcome omitted or missing variables problem [23]. Some models that can be used for panel data analysis are described below.

3.2. Constant Coefficient Model

$$FDI_{j,t} = a + \beta_i X_{j,t} + \varepsilon_{j,t},$$

$j = 1,\cdots 14$, j is for minerals; $t = 1\cdots 10$, for 2005 = 1.

The constant intercept assumption means that all minerals are considered to be the same and there are no significant cross sectional and time specific effects. The first step here is simply combining both the time-series and cross-section data, also known as pooling, and then estimating parameters with ordinary least squares (OLS). This simple use of pooled data enables the testing of theories and assumptions with relative ease. The estimated parameters of this model will be used as a benchmark against other estimates from the more sophisticated models.

By ignoring the cross section and time specific effects that possibly exist, the parameters estimated will be meaningless and inconsistent. To account for possible heterogeneity among minerals, fixed effects models and random effects models are considered to be more appropriate for handling panel data.

Hsiao [23] argued that it makes no difference whether fixed or random effect models are used when T (time series) is large, but if T is finite and N is large it could make a surprisingly difference in the estimates. Since the data set of this study only consist of 10 years for each of the 14 minerals, it is essential to choose the correct model to make the best use of this small amount of information. Hsiao [23] argued that one way to decide to use fixed effects or random effects model is to test for misspecification of the random effects model, where a is assumed to be random and uncorrelated with the independent variables.

To test the significant hypothesis, this study will perform a Hausman-test which tests for correlated random effects. If a is uncorrelated with the independent variables and thus the null hypothesis holds then a random effects model should be applied. Contrary, if the alternative hypothesis holds, a fixed effect model should be applied. The Hausman-test suggests the null hypothesis may not be rejected if, P-value > critical value mostly 0.05 thus it will be possible to use cross-section random effects estimators.

3.3. Definition and Justification of Variables

The determinant variables of FDI inflows include macroeconomic policy, political stability, mineral price, cost of labour, mineral output, volume of manufacturing index and sectorial contribution to economic growth. These variables are interrelated and are derived from the eclectic theory by Dunning [3].

Foreign direct investment inflow (FDI) constitutes a direct capital investment for the purpose of development and enterprising in a foreign country by TNCS. Such investment is very useful in developing countries especially when channeled to a nation's industries such as mining. For enterprises on Zimbabwe Stock Exchange such activities are not considered FDI but rather transfer payment. FDI in the mining sector like Output in the very sector will be considered on annual bases and the variable is also considered to be a dependent variable-hence no prior exception to talk about, Henry [24], Javorvick [22] and Oluwatosin [21].

Political stability (PS) is cardinal for normal macroeconomic and business environment in a nation [5] [25]. Political risk refers to activities that interrupt business or harm staff and property for example property take over by government and violent demonstrations. These factors influence the decision to invest or not to invest in a certain location Dunning [25]. All the above will be considered as proxy for political stability. Political stability increases the probability of attracting more FDI inflows into nation.

Cost of labour (*COST*) is the total amount of expenditures on labour force, cost of labour is considered as a percentage of income in that particular year. Henry [24], Javorvick [22], and Oluwatosin [21] argued that cost of labor theories are important f**o**r FDI as investors look for countries with lower labor costs so as to maximize profits. Thus we would expect cost of labour to negatively influence FDI inflows in a firm.

Output (*OUT*) is the real output of each mineral produced annually and this would be introduced to capture the total output of economic activities in the firm, This variable is also used as the income level, which is considered as the main resource of technological development and human capital improvement. Investors would also consider this variable especially as percentage of total sector output so as to measure the potential market size when deciding FDI location, especially those who target to enhance their market share in the host country. All the extracting mining firms in the economy are viewed to constitute Zimbabwe Mining Sector (ZMS).

Price-*PRICE* is the closing year International price of the mineral understudy. This variable is used to test the impact of mineral prices in a small economy such as Zimbabwe and it would be expected that this variable would influence the attraction of FDI. Adewuni [20], and Anyanwu, [7], have all included the mineral price in their study of determinants of FDI in a particular sector or for that particular resource.

Capacity utilisation-*CU* is the measure of operational capacity for minerals by the mining firms and it would be expected to impact positively on direction of foreign direct investment inflows. However, there might be a possibility of reserve effect which is beyond the scope of the study. The variable was once used by Ramirez [26], Anyanwu [8], and Fasanya [27].

Volume of the Manufacturing Index-(*VMI*) is considered the proxy for rate of growth of mining sector as the index measure for mineral and quarry activities

only. This variable provides an indication on the possible effect of the sectorial activities on its ability to influence the direction of flow of FDI in that particular sector. Hermes and Lensink [28], Varamini, and Vu [15], Volume of the Manufacturing Index-(*VMI*) is considered the proxy for rate of growth of mining sector as the index measure for mineral and quarry activities only. This variable provides an indication on the possible effect of the sectorial activities on its ability to influence the direction of flow of FDI in that particular sector. Hermes and Lensink [28], Buckley, *et al.* [29], Ikechi, *et al.* [30], Orji, *et al.* [31], are among those who have used this variable.

Contribution to GDP-(*CONTR*), Oladipo [32], Fasanya [27], and Anyanwu [8], Moyo [9] all argued that contribution of a particular sector has a role to play in influencing the direction of the flow of FDI in that particular sector. They all agreed that the variable positively help to attract FDI hence; a positive coefficient on the variable is expected. This will be measured as the percentage contribution of the mining sector to the country's GDP.

4. Estimated Results

4.1. F-Test (Pool Ability Test)

In a bid to find the most suitable model between the fixed effects model and the pooled OLS model pool ability tests were carried out. The hypothesis to be tested is that there is no mineral specific heterogeneity *i.e.* the pooled OLS model is the most suitable against the alternative that the fixed effect is the proper model. The F-test results[1] reject the null hypothesis, implying that there is mineral specific heterogeneity, thus the pooled OLS model is not the appropriate model of the two.

4.2. Breusch and Pagan Lagrange Multiplier Test for Random Effects (LM)

To determine the most suitable model between the random effects and the pooled OLS model a LM test was carried out. Results[2] failed to accept the null hypothesis and it can be concluded that there are panel effects. Thus the pooled OLS model is not to be preferred over the random effects model.

4.3. Hausman Test

The Hausman test[3] was carried out to determine the best model between the fixed effects model and the random effects model. It was necessary to test hypothesis that there is no relationship between mineral specific heterogeneity and the explanatory variables *i.e.* the random effects model is the appropriate model against the alternative hypothesis that the fixed effects is the appropriate model. The null hypothesis could not be rejected and therefore the conclusion is that the random effects is the best model.

[1]Annual bases for each firm in the firm panel model and FDI is a depended variable.
[2]See appendix for the Breusch and Pagan Lagrange multiplier test for random effect results.
[3]See appendix for the Hausman test results.

4.4. Heteroskedasticity Test

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity[4] was conducted to verify the nature of the variances of the error terms, that is, are they homoscedastic or not? It was decided to reject the null hypothesis and conclude that there is statistical evidence of heteroskedasticity. However, as noted in Mulenga [33], this problem can be easily dealt with by estimating a feasible generalized least square (FGLS) in the random effects model.

4.5. Estimation of the Model

4.5.1. The Unrestricted Random Effects Model (REM)

The various econometric tests conducted concluded that the REM is the most appropriate model for estimating the mineral specific determinants of FDI in the mining sector. A Generalized Least Squares (GLS) regression of the unrestricted REM was run. The results found all other variables significant at the conventional levels of significance (1%, 5% and 10%) except for price and costs. It was therefore decided to drop these variables one by one, starting with price as it was the variable that was highly insignificant. Subsequently cost was dropped and another regression was run.

4.5.2. Presentation of the Restricted REM Results

Tables 1-3 are a summary of the REM results after elimination of insignificant variables of the unrestricted model. The explanatory variable of the restricted model are all significant at either the 1%, 5% or 10% level of significance.

Random-effects (GLS), using 140 observations;

Included 14 cross-sectional units;

Time-series length = 10;

Dependent variable: L_FDI;

"These cross-sectional units were the results of REM using Stata. There were 140 observations for the 14 minerals. The regression covered 10 years."

There were 140 observations obtained from pooling time series data from 14 minerals each contributing 10 observations as reported in the table above. The regression results report a Wald chi 2(5) statistic of 21.03, with a p-value of 0.008. This implies that there is statistical evidence that at least one of the regression coefficients is statistically different from zero. The reported Hausman test further supports the argument early raised that random effect model is the best one and its estimates are consistent.

4.6. Capacity Utilisation (*CU*)

The variable *CU* is found to be significant at 5% level with the expected positive sign. The results confirm the findings of many other studies done on the country specific determinants of foreign direct investment inflows. For instance, Ramirez [26], Anyanwu [8] and Fasanya [27] all found a positive value for the CU variable with respect to FDI. A positive coefficient of 0.0224 implies that a 1%

[4]See appendix.

Table 1. REM results.

	Coefficient	Std. Error	t-ratio	p-value	
CONST	8.59821	1.44097	5.9670	<0.0001	***
PS	−1.02268	0.185225	−5.5213	<0.0001	***
L_LABR	0.463614	0.207414	2.2352	0.0271	**
VMI	−0.0407823	0.00778521	−5.2384	<0.0001	***
CU	0.0224109	0.00939814	2.3846	0.0185	**
CONTR	0.347487	0.0217281	15.9925	<0.0001	***

***Significant at 1% level of significance. **Significant at 5% level of significance. *Significant at 10% level of significance. Source: Created by author.

Table 2. Breusch-Pagan test.

Null hypothesis: Variance of the unit-specific error = 0
Asymptotic test statistic: Chi-square (1) = 392.6 with p-value = 2.2478e−087

Source: Created by author.

Table 3. Hausman test.

Null hypothesis: GLS estimates are consistent
Asymptotic test statistic: Chi-square (5) = 0.71204 with p-value = 0.982301

Source: Created by author.

increase in the capacity utilisation in the mining sector will result in an increase in FDI inflows share by approximately 2.24% holding everything else constant. The results confirm that the economic size of the mining sector is very important for the attraction of FDI inflow in that particular sector. The larger the sector the bigger the markets power, this fosters innovativeness amongst investors as they try to secure more of the input so as to differentiate their final products from their competitors. According to Krugman [34], through product differentiation, firms can concentrate on a limited set of products, this result in lower per unit cost as firms exploit economies of scale. Hence increase in capacity utilisation has positive effect in attracting FDI inflows in the Zimbabwe's mining sector.

4.7. Contribution of the Mining Sector (*CONTR*)

The variable is highly significant at 1% level with the expected positive sign. The coefficient of 0.347 implies that for a 1% increase in the contribution of the mining sector to the economies GDP leads to 34.47 percentage increase in FDI inflows in the mining sector. The results confirm economic theory, as it is expected that the more the sector grows the more it can attract investments. Anyanwu [8], Fasanya [27] and Oladipo [32] all get of similar results for different nations and sectors while they agree that contribution of sector influence FDI inflows in that particular sector.

4.8. Volume of Manufacturing Index (*VMI*)

The variable *VMI* is found to be highly significant at 1% with an unexpected negative sign. The negative coefficient of 0.04078 implies that a 1% increase in the *VMI* will result in a decrease in FDI in the mining sector share by approximately 4.08%, holding everything else constant. Orji, *et al.* [31], results were that FDI has a negative correlation with manufacturing output. Ikechi, *et al.* [30], study established that Nigerian industrial productivity is not dependent on FDI, however, when individual component sectors were examined the findings were that FDI has a positive and significant relationship with mining sector productivity in Nigeria at 5% level in the short term. The results, though not conforming to economic theory, could be justified on the grounds that Zimbabwe for the large part of the period understudy experienced economic decline. Thus it can be concluded that economic decline negatively affects FDI inflow in the ZMS.

4.9. Labour (*LABR*)

The variable was found to have the expected positive sign and statistically significant at 5% level. The coefficient of 0.4636 implies FDI inflows in the mining sector are relatively elastic to changes in labour level available to the sector and mineral specific. Thus a unit percentage increase in Labour will result in 46.36 percentage increase in FDI inflows in the ZMS. Thus a unit percentage increase in Labour will result in 46.36 percentage increase in FDI inflows in the ZMS. The findings are similar to those held by Henry [24], Demirhan and Masca [4], Hussain and Kimuli [35]. These findings lead to the conclusion that Labour levels availability has been positively affecting and influencing FDI inflow in the Zimbabwe Mining Sector for the period under study.

4.10. Political Stability (*PS*)

Dummy variable for political instability is highly significant at 1% level of significance. The variable has the expected negative sign and the coefficient of 1.02268 implies that political instability negatively affects the FDI inflows in the Zimbabwe's mining sector by 63.037 percentage. Similar results are held by Demirhan and Masca [4], and Luiz and Ruplal [5] for the different nations they studied.

5. Conclusions

Comparative results of the three models: the pooled OLS (POLS), random effects model (REM) and the fixed effects model (FEM), show that the REM and POLS report results which are comparably similar in terms of the coefficients and expected signs. However, CU was also significant but the coefficient of this variable for the FEM differs significantly from those of the POLS and the REM. Legislators have well vested interest in implementing policies aimed at stabilisation and efficiency in the Mining sector. For one to formulate an effective policy that

strikes a balance between the two, one needs to understand the determinants of FDI so as to adopt policies that promote a sustainable and stable Mining sector for economic growth.

The study finds that mining firms can increase FDI inflows by a small percentage increase in capacity utilisation. Hence there is a call for mining firm managers to be innovative and incorporate information and communications technology when dealing with mineral products.

It is thus recommended that government should put in place supportive policies that encourage investments and recapitalization of the mining sector so that local commodity can effectively compete both on the domestic and international markets. This could involve provision of a relative stable political environment which boosts investor confidence and thus helps attract foreign direct investments. Furthermore, government should put in place an enabling environment with enough incentives to spur innovativeness amongst local mineral mining firms, so that different varieties of products appealing to different sections of consumers both domestically and internationally are readily available.

As is noted in the Chamber of Mines annual reports [36], most companies are operating below full capacity owing to challenges related to working capital, inadequate provision of supportive infrastructure (energy, water), obsolete equipment and low consumer demand. The Zimtrade export capacity mining survey of 2011 noted a decline in companies exporting; thus there is need for government to pursue a rigorous export led industrialization strategy following in the footsteps of the Asian tigers. However, it is imperative to put place an enabling policy environment which recognizes need to tap in foreign direct investments, protect property rights and uproot corruption.

From the results, labour was found to be a significant explanatory variable for FDI inflow in the ZMS. It is thus recommended that government should undertake policies which nurture and support growth of labour to the sector. This would require the government to establish a menu of policies that reinforces confidence amongst domestic and foreign investors, spruces the image of Zimbabwe as a prudent borrower and above all, fosters the development and retention of human capital. Due to data limitations, the study concentrated on 14 out of 66 minerals to draw conclusions on the mineral specific determinants of FDI in the country's mining sector. A richer data set would broaden this study to include other important minerals in the sector, such as diamond. Furthermore, the scope of the study was limited to investigating the sector mineral specific determinants of FDI and this could be extended to incorporate company specific determinants of FDI; for instance the analysis could be enriched adding the capital to labour ratios and proxies for productivity.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendix 1

The Sample

The sample was made up of the following minerals, asbestos, chrome, coal, cobalt, copper, gold, graphite, iridium, nickel, palladium, phosphate, platinum, rhodium, and rhithium. The original mineral data obtained from Zimbabwe National Statistical Agency, (ZIMSTAT) is attached.

Table A1. Raw data.

	FDI	OUT	PRICE	vmi	cu	contr	labr	PS	CRS ID	TIMEID
ASB 1	133,823.748	6554.601	542.647692	56.7266	56	4	2154.993956	0	1	2005
ASB 2	1,581,273.712	6665.27	197.681078	49.176	54	6	1841.0648	0	1	2006
ASB 3	615,281.6	4629.03	4.729899261	46.1896	40	8	1815.0138	0	1	2007
ASB 4	1,059,822.556	3571.84	173.69	34.0332	34	6	1845.8448	0	1	2008
ASB 5	793,713.264	4970.81	315.3003112	31.9186	41	8	1973.4708	1	1	2009
ASB 6	1,615,114.2	2030.97	644.416855	41.2271	51	12	2246.1698	1	1	2010
ASB 7	2,551,880.436	0	366.846	65.3027	55	13	2649.4584	1	1	2011
ASB 8	5,952,849.48	0	798.3050847	53.1	60	15	2421.309	1	1	2012
ASB 9	6,145,124.98	377	834.3928827	62.8539	58	15.7	2450.228	1	1	2013
ASB 10	6,152,816	0	2.17554E−09	63.2565	60	16.9	2152.3862	1	1	2014
CHR 1	273,246.816	544.3882	142.0722286	56.7266	56	4	4400.155022	0	2	2005
CHR 2	3,228,709.504	519.604	87.25352983	49.176	54	6	3759.1616	0	2	2006
CHR 3	1,256,307.2	398.3646084	786.768321	46.1896	40	8	3705.9696	0	2	2007
CHR 4	2,163,989.152	253.99	197	34.0332	34	6	3768.9216	0	2	2008
CHR 5	1,620,636.288	193,673.74	94.87971142	31.9186	41	8	4029.5136	1	2	2009
CHR 6	3,297,806.4	516,776.08	110.0619262	41.2271	51	12	4586.3216	1	2	2010
CHR 7	5,210,534.112	599,079.38	250.99	65.3027	55	13	5409.7728	1	2	2011
CHR 8	12,154,772.16	408,475.81	119.8797011	53.1	60	15	4943.928	1	2	2012
CHR 9	12,547,368.16	355,142	102.5436924	62.8539	58	15.7	5002.976	1	2	2013
CHR 10	12,563,072	408,422	4.7778E−11	63.2565	60	16.9	4394.8304	1	2	2014
COAL 1	8398.98	8638.65	25.35583755	56.7266	56	4	135.2506667	0	3	2005
COAL 2	99,243.12	10,826.55914	22.33271315	49.176	54	6	115.548	0	3	2006
COAL 3	38,616	10,524.345	48.4041197	46.1896	40	8	113.913	0	3	2007
COAL 4	66,516.06	13,065.5	8374.268814	34.0332	34	6	115.848	0	3	2008
COAL 5	49,814.64	12,482.7341	34.77017608	31.9186	41	8	123.858	1	3	2009
COAL 6	101,367	2500.169	36.35576945	41.2271	51	12	140.973	1	3	2010
COAL 7	160,159.86	2562.054	173.0073569	65.3027	55	13	166.284	1	3	2011
COAL 8	373,609.8	1593.613	47.0007861	53.1	60	15	151.965	1	3	2012
COAL 9	385,677.3	2976.138	34.43243626	62.8539	58	15.7	153.78	1	3	2013
COAL 10	386,160	6353.802	0.271669292	63.2565	60	16.9	135.087	1	3	2014

Continued

Cobalt 1	127,104.564	398.3646084	10,327.11593	56.7266	56	4	2046.793422	0	4	2005
Cobalt 2	1,501,879.216	307.99	9290.76148	49.176	54	6	1748.6264	0	4	2006
Cobalt 3	584,388.8	208.9	14,639.83018	46.1896	40	8	1723.8834	0	4	2007
Cobalt 4	1,006,609.708	253.99	14009	34.0332	34	6	1753.1664	0	4	2008
Cobalt 5	753,861.552	39.001	12,145.61165	31.9186	41	8	1874.3844	1	4	2009
Cobalt 6	1,534,020.6	57.619	11,888.56388	41.2271	51	12	2133.3914	1	4	2010
Cobalt 7	2,423,752.548	173.976	9569.47364	65.3027	55	13	2516.4312	1	4	2011
Cobalt 8	5,653,961.64	194.517	14.535.61711	53.1	60	15	2299.737	1	4	2012
Cobalt 9	5,836,583.14	318.924	10,910.43911	62.8539	58	15.7	2327.204	1	4	2013
Cobalt 10	5,843,888	357.808	1.51899E−06	63.2565	60	16.9	2044.3166	1	4	2014
Copper 1	59,632.758	12,949.27753	8226.788825	56.7266	56	4	960.2797333	0	5	2005
Copper 2	704,626.152	9619.8371	4006.955799	49.176	54	6	820.3908	0	5	2006
Copper 3	274,173.6	10,137.4813	3893.484296	46.1896	40	8	808.7823	0	5	2007
Copper 4	472,264.026	1011.653	2366.4	34.0332	34	6	822.5208	0	5	2008
Copper 5	353,683.944	3571.84	4314.997592	31.9186	41	8	879.3918	1	5	2009
Copper 6	719,705.7	4629.03	6159.438586	41.2271	51	12	1000.9083	1	5	2010
Copper 7	1,137,135.006	6554.601	6079.88436	65.3027	55	13	1180.6164	1	5	2011
Copper 8	2,652,629.58	6665.27	5880.228834	53.1	60	15	1078.9515	1	5	2012
Copper 9	2,738,308.83	8284.557	5344.367934	62.8539	58	15.7	1091.838	1	5	2013
Copper 10	2,741,736	8261.419	9.67245E−07	63.2565	60	16.9	959.1177	1	5	2014
Gold 1	563,683.5444	14,203	35,480.78955	56.7266	56	4	9077.123076	0	6	2005
Gold 2	6,660,536.594	11,354	18,934.37719	49.176	54	6	7754.81144	0	6	2006
Gold 3	2,591,648.48	7018	72,636.91313	46.1896	40	8	7645.08114	0	6	2007
Gold 4	4,464,114.507	3579	9233.39877	34.0332	34	6	7774.94544	0	6	2008
Gold 5	3,343,226.539	4965.7449	31,652.9657	31.9186	41	8	8312.52324	1	6	2009
Gold 6	6,803,077.26	9619.8371	39,547.23107	41.2271	51	12	9461.16794	1	6	2010
Gold 7	10,748,862.07	12,949.27753	26,051.51405	65.3027	55	13	11,159.8735	1	6	2011
Gold 8	25,074,199.04	0	53,093.13125	53.1	60	15	10,198.8777	1	6	2012
Gold 9	25,884,089.19	14,001.3241	44515.10292	62.8539	58	15.7	10,320.6884	1	6	2013
Gold 10	25,916,484.8	15,385.7389	2.038005589	63.2565	60	16.9	9066.13886	1	6	2014
GRAPH 1	89,869.086	3456	275.8747397	56.7266	56	4	1447.182133	0	7	2005
GRAPH 2	1,061,901.384	3567	114.032357	49.176	54	6	1236.3636	0	7	2006
GRAPH 3	413,191.2	3907	162.8050178	46.1896	40	8	1218.8691	0	7	2007
GRAPH 4	711,721.842	1976	2149.42	34.0332	34	6	1239.5736	0	7	2008
GRAPH 5	533,016.648	2463	291.7966995	31.9186	41	8	1325.2806	1	7	2009
GRAPH 6	1,084,626.9	741	366.9271255	41.2271	51	12	1508.4111	1	7	2010
GRAPH 7	1,713,710.502	7252	494.9819	65.3027	55	13	1779.2388	1	7	2011

Continued

GRAPH 8	3,997,624.86	7022	576.5069781	53.1	60	15	1626.0255	1	7	2012
GRAPH 9	4,126,747.11	6934	537.5506201	62.8539	58	15.7	1645.446	1	7	2013
GRAPH 10	4,131,912	6853	4.37076E−08	63.2565	60	16.9	1445.4309	1	7	2014
IRID 1	34,435.818	657.678	7858.224499	56.7266	56	4	554.5277333	0	8	2005
IRID 2	406,896.792	687.906	4229.461417	49.176	54	6	473.7468	0	8	2006
IRID 3	158,325.6	456.8705	4130.281552	46.1896	40	8	467.0433	0	8	2007
IRID 4	272,715.846	198.9782	4790.1	34.0332	34	6	474.9768	0	8	2008
IRID 5	204,240.024	208.9	6999.147918	31.9186	41	8	507.8178	1	8	2009
IRID 6	415,604.7	253.99	10,406.06323	41.2271	51	12	577.9893	1	8	2010
IRID 7	656,655.426	398.3646084	11,597.8474	65.3027	55	13	681.7644	1	8	2011
IRID 8	1,531,800.18	412.014	21,823.51593	53.1	60	15	623.0565	1	8	2012
IRID 9	1,581,276.93	519.604	15,721.36884	62.8539	58	15.7	630.498	1	8	2013
IRID 10	1,583,256	544.3882	1.88177E−06	63.2565	60	16.9	553.8567	1	8	2014
NICK 1	59,632.758	20,789.809	28,258.23462	56.7266	56	4	960.2797333	0	9	2005
NICK 2	704,626.152	21,677.097	16,234.58643	49.176	54	6	820.3908	0	9	2006
NICK 3	274,173.6	13,456.5047	19,105.24519	46.1896	40	8	808.7823	0	9	2007
NICK 4	472,264.026	3056.308	15239.7	34.0332	34	6	822.5208	0	9	2008
NICK 5	353,683.944	4857.528	12,805.68738	31.9186	41	8	879.3918	1	9	2009
NICK 6	719,705.7	6133.483	18,132.66296	41.2271	51	12	1000.9083	1	9	2010
NICK 7	1,137,135.006	7992.188	24,748.64246	65.3027	55	13	1180.6164	1	9	2011
NICK 8	2,652,629.58	7898.719	14,225.21917	53.1	60	15	1078.9515	1	9	2012
NICK 9	2,738,308.83	12,961.947	11,243.47113	62.8539	58	15.7	1091.838	1	9	2013
NICK 10	2,741,736	16,632.728	5.74789E−06	63.2565	60	16.9	959.1177	1	9	2014
PALA 1	95,468.406	11,344.89	15,030.36097	56.7266	56	4	1537.349244	0	10	2005
PALA 2	1,128,063.464	9876.078	6227.088127	49.176	54	6	1313.3956	0	10	2006
PALA 3	438,935.2	7789.305	5982.152927	46.1896	40	8	1294.8111	0	10	2007
PALA 4	756,065.882	4678.7098	3585.4	34.0332	34	6	1316.8056	0	10	2008
PALA 5	566,226.408	5354.449	7692.078867	31.9186	41	8	1407.8526	1	10	2009
PALA 6	1,152,204.9	6916.102	14,553.65305	41.2271	51	12	1602.3931	1	10	2010
PALA 7	1,820,483.742	8421.674655	15,993.65023	65.3027	55	13	1890.0948	1	10	2011
PALA 8	4,246,698.06	8136.213	18,266.87147	53.1	60	15	1727.3355	1	10	2012
PALA 9	4,383,865.31	9642.575	20,269.37736	62.8539	58	15.7	1747.966	1	10	2013
PALA 10	4,389,352	10,137.4813	3.0478E−06	63.2565	60	16.9	1535.4889	1	10	2014
PHOS 1	504,294.3568	194.517	102.7599696	56.7266	56	4	94.67546667	0	11	2005
PHOS 2	5,958,788.492	173.976	44.63377392	49.176	54	6	80.8836	0	11	2006
PHOS 3	2,318,594.744	39.001	47.92290091	46.1896	40	8	79.7391	0	11	2007
PHOS 4	3,993,779.447	0	48,679.6824	34.0332	34	6	81.0936	0	11	2008

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PHOS 5	2,990,987.22	0	0	31.9186	41	8	86.7006	1	11	2009
PHOS 6	6,086,311.203	56.656	104.7510265	41.2271	51	12	98.6811	1	11	2010
PHOS 7	9,616,371.701	46.047	1015.791646	65.3027	55	13	116.3988	1	11	2011
PHOS 8	22,432,404.15	16.79	101.4549796	53.1	60	15	106.3755	1	11	2012
PHOS 9	23,156,965.01	0	61.36901639	62.8539	58	15.7	107.646	1	11	2013
PHOS 10	23,185,947.44	0	0.099877746	63.2565	60	16.9	94.5609	1	11	2014
PLATI 1	504,294.3568	599,079.38	68,017.15464	56.7266	56	4	8120.765612	0	12	2005
PLATI 2	5,958,788.492	408,475.81	22,659.70376	49.176	54	6	6937.771532	0	12	2006
PLATI 3	2,318,594.744	355142	23,390.33738	46.1896	40	8	6839.602317	0	12	2007
PLATI 4	3,993,779.447	408,422	19,273	34.0332	34	6	6955.78423	0	12	2008
PLATI 5	2,990,987.22	6848.899	34,909.14657	31.9186	41	8	7436.72332	1	12	2009
PLATI 6	6,086,311.203	8638.65	47,352.96395	41.2271	51	12	8464.34786	1	12	2010
PLATI 7	9,616,371.701	10,826.55914	39,646.1825	65.3027	55	13	9984.07936	1	12	2011
PLATI 8	22,432,404.15	10,524.345	44,137.99721	53.1	60	15	9124.33319	1	12	2012
PLATI 9	23,156,965.01	13,065.5	42401.77305	62.8539	58	15.7	9233.31002	1	12	2013
PLATI 10	23,185,947.44	12,482.7341	1.1133E−06	63.2565	60	16.9	8110.93868	1	12	2014
RHOD 1	78,026.5242	1319.9	140,644.356	56.7266	56	4	1256.478693	0	13	2005
RHOD 2	921,968.5848	1416.1	86,500.98391	49.176	54	6	1073.44092	0	13	2006
RHOD 3	358,742.64	1256.8	101,595.3962	46.1896	40	8	1058.25177	0	13	2007
RHOD 4	617,934.1974	509.7	285936	34.0332	34	6	1076.22792	0	13	2008
RHOD 5	462,778.0056	568.132	42,339.41232	31.9186	41	8	1150.64082	1	13	2009
RHOD 6	941,699.43	726.904	69,156.03023	41.2271	51	12	1309.63917	1	13	2010
RHOD 7	1,487,885.099	940.3199851	28,147.77106	65.3027	55	13	1544.77836	1	13	2011
RHOD 8	3,470,835.042	890.676	35,053.14655	53.1	60	15	1411.75485	1	13	2012
RHOD 9	3,582,942.117	1146.089	28,697.87756	62.8539	58	15.7	1428.6162	1	13	2013
RHOD 10	3,587,426.4	1139.9235	1.24546E−05	63.2565	60	16.9	1254.95823	1	13	2014
RHUT 1	27,324.6816	1345.089	3839.079037	56.7266	56	4	440.0155022	0	14	2005
RHUT 2	322,870.9504	1045.983	2624.86715	49.176	54	6	375.91616	0	14	2006
RHUT 3	125,630.72	967.5804	5131.06564	46.1896	40	8	370.59696	0	14	2007
RHUT 4	216,398.9152	300.987	1639.8	34.0332	34	6	376.89216	0	14	2008
RHUT 5	162,063.6288	412.777	1723.90419	31.9186	41	8	402.95136	1	14	2009
RHUT 6	329,780.64	555.021	3637.410116	41.2271	51	12	458.63216	1	14	2010
RHUT 7	521,053.4112	823.0314914	3194.90559	65.3027	55	13	540.97728	1	14	2011
RHUT 8	1,215,477.216	787.169	2225.389544	53.1	60	15	494.3928	1	14	2012
RHUT 9	1,254,736.816	1011.653	1509.744593	62.8539	58	15.7	500.2976	1	14	2013
RHUT 10	1,256,307.2	982.5804	6.96598E−07	63.2565	60	16.9	439.48304	1	14	2014

Appendix 2: Summary Statistics

Table A2. Summary statistics.

Variable	Mean	Median	Minimum	Maximum
fdi	3.6338e+006	1.2555e+006	8399.0	2.5916e+007
out	34637.	3511.5	0.00000	5.9908e+005
price	14964.	4179.9	0.00000	2.8594e+005
vmi	50.380	51.150	31.900	65.300
cu	50.900	54.500	34.000	60.000
contr	10.460	10.000	4.0000	16.900
labr	2370.4	1302.5	80.000	11160.
ps	0.60000	1.0000	0.00000	1.0000
Variable	**Std. Dev.**	**C.V.**	**Skewness**	**Ex. kurtosis**
fdi	5.9342e+006	1.6331	2.6143	6.1548
out	1.1316e+005	3.2671	3.7207	12.776
price	31417.	2.0995	5.4647	39.860
vmi	11.472	0.22770	−0.25720	−1.2446
cu	8.8116	0.17312	−0.73808	−0.93698
contr	4.3973	0.42039	0.056813	−1.4936
labr	2803.9	1.1829	1.6481	1.4880
ps	0.49166	0.81943	−0.40825	−1.8333
Variable	**5% Perc.**	**95% Perc.**	**IQ range**	**Missing obs.**
fdi	59977.	2.3121e+007	3.5829e + 006	0
out	0.00000	4.0576e+005	9149.7	0
price	0.00000	67271.	16049.	0
vmi	31.900	65.300	21.700	0
cu	34.000	60.000	17.000	0
contr	4.0000	16.900	9.0000	0
labr	99.350	9121.6	1766.0	0
ps	0.00000	1.0000	1.0000	0

Appendix 3: Correlation Matrix

Table A3. Correlation coefficients, using the observations 1:01 - 14:10. 5% critical value (two-tailed) = 0.1660 for n = 140.

out	price	vmi	cu	contr	labr
1.0000	0.0059	0.0437	0.0357	−0.0027	0.3477
	1.0000	−0.1119	−0.1358	−0.1561	0.2088
		1.0000	0.8224	0.5554	0.0728
			1.0000	0.5913	0.0730
				1.0000	0.0736
					1.0000

Appendix 4

Table A4. Model 1: Random-effects (GLS), using 140 observations; Included 14 cross-sectional units; Time-series length = 10; Dependent variable: l_fdi.

(a)

	Coefficient	*Std. Error*	*z*	*p-value*	
const	8.25078	0.746805	11.05	<0.0001	***
ps	−1.03696	0.395350	−2.623	0.0087	***
l_labr	0.510446	0.0717979	7.109	<0.0001	***
vmi	−0.0393250	0.0166948	−2.356	0.0185	**
cu	0.0207884	0.0205690	1.011	0.3122	
contr	0.352366	0.0483561	7.287	<0.0001	***

(b)

Mean dependent var	14.00240	S.D. dependent var	1.643830
Sum squared resid	159.6645	S.E. of regression	1.087520
Log-likelihood	−207.8516	Akaike criterion	427.7033
Schwarz criterion	445.3531	Hannan-Quinn	434.8756

'Between' variance = 0
'Within' variance = 1.25397
theta used for quasi-demeaning = 0
Joint test on named regressors-
Asymptotic test statistic: Chi-square(5) = 181.228
with p-value = 2.92486e−037
Breusch-Pagan test-
ull hypothesis: Variance of the unit-specific error = 0
symptotic test statistic: Chi-square(1) = 3.70976
ith p-value = 0.0540952
Hausman test-
Null hypothesis: GLS estimates are consistent
Asymptotic test statistic: Chi-square(5) = 4.24038
with p-value = 0.515352