
A statistical analysis of value of imports in Nigeria

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Abstract: The value of products imported into a country each year goes a long way to tell us how much the product is appreciated in the country. Some products form the major imports of some countries yearly. Previous studies have focused on the major determinants of imports in some countries, including Nigeria. In the present study, we used a regression approach to identify the major significant imports in Nigeria. This will help in the effective distribution of human resources and services and improve balance of payments. In using the above approach, the method of stepwise regression and transformation of the data via first-order differencing were employed to remove multicollinearity from the data. A predictive model was then specified for the prediction of future imports in the country. Our results show that the major significant imports in Nigeria during the period under study are miscellaneous manufactured goods, machinery and transport equipment, food and live animal, beverages and tobacco.

Keywords: Value of Imports, Statistical Analysis, Significant Factors, Regression, Predictive Model

1. Introduction

The value of products imported into a country plays a significant role in the international trade. Imports are key part of international trade and the import of capital goods in particular is vital to stimulating economic growth of a country. This is more often experienced in countries with limited productive capacity. In a country like, Nigeria where the Federal Government is trying to grow the economy by improving local capacity in the agricultural, manufacturing and other key sectors of the economy, analysis of value of imports into the country is highly essential. Knowing the value of the imports into the country will enable the Government to understand which areas of the economy need more attention to boost indigenous production. For example, according to the National Mirror of March 13, 2013, Nigeria witnessed a 43.1% decline in the import trade value from 2011 to 2012. It was also reported that at the end of 2012, the structure of import trade was dominated by the imports of mineral products, machinery and transport equipment, boilers and vegetable products. This decline, no doubt shows that the efforts by the Federal Government to grow the economy by improving local capacity in the agricultural, manufacturing and other key sectors of the economy are yielding desired results. Therefore, the present paper will no doubt through

appropriate statistical methods compare the present result with the past and recommend to the Government which areas still require more efforts.

Effective balance of payments and better projection of foreign reserves are anchored in understanding the major significant imports in a country. Many authors have concentrated on the determinants of imports; for examples, Egwaikhide (2000) using a dynamic specification approach studied the determinants of imports in Nigeria. He observed that trade policies have been substantially influenced by the periodic balance of payments difficulties and the need to generate revenue. According to him, there have been frequent changes in import control measures in Nigeria, probably because of the conflict between raising revenue and maintaining a favourable balance of payments, on one hand and the need to protect import substituting industries on the other hand. Rogers (2000) concentrated on the determinants of Fiji's imports. According to his paper, to forecast the level of foreign reserves requires substantive analysis of the components of the balance of payments. He stated that, improvements in the balance of payments can eventuate through changes in the current account or the capital account. Balance of payments accounts are accounting record of all monetary transactions between a country and the rest of the world, Sloman (2004).

The value of imports also has great bearing in the value

of a country's currency. For example, the Chinese government contributed to growth in U.S. imports by maintaining an undervalued currency between 1997 and 2007, Orang (2008). An undervalued Chinese currency would cause the dollar prices of U.S. imports from China to be lower than they would be in a competitive market. This development, however posed a challenge for competing U.S. manufacturers whose products must compete with the imports.

At this juncture, it has become obvious that the continuous analysis of the value of imports in a country is highly imperative. Though, the Nigerian Bureau of Statistics has the mandate to advice the Federal Government of Nigeria on the yearly significant imports in the country. The task should not be left alone for the Bureau as various and appropriate methods must be employed to identify these significant imports. The power of good predictive models cannot be underestimated in a nation that plans the future of her economy. In this study we have used both the method of transforming the data via first – order differencing and stepwise regression to ensure that the presence of multicollinearity in the data which could give false significant results does not jeopardise with the results of this study. A linear predictive model which could serve as a useful guide in predicting future imports into the country was provided and recommendations were given.

1.1. Multicollinearity

Multicollinear data are often undetected companion to econometric data and their presence, whether exposed or not renders ordinary least-squares estimates less precise and less useful than would otherwise be the case, Belsley (1976). Multicollinearity is problem that you can run into when you are fitting a regression model or other linear models. It refers to predictors that are correlated with other predictors in the model. Severe multicollinearity can increase the variance of the coefficient estimates and make the estimates very sensitive to minor changes in the model. The result is that the coefficient estimates are unstable and difficult to interpret. Multicollinearity causes the coefficients to change signs and make it more difficult to specify the correct model. According to Belsley et al (1980), multicollinearity also yields high R^2 . Tull and Hawkins (1990) and Lehmann et al (1998) respectively suggest 0.35 and 0.7 as a threshold of bivariate correlations for the harmful effect of multicollinearity. Regarding other multicollinearity diagnostics, Belsley et al (1980) and Johnston (1984) suggested condition indices (CI) less than 20 are not problematic. Hair et al (1995) suggested variance inflation factors (VIF) less than 10 are indicative of inconsequential multicollinearity. Stepwise regression can be used to determine superfluous variables when the data are multicollinear. Multicollinearity may be reduced by applying first difference method, removal of some of the variables that are correlated and increase in the number of observations used for the model.

2. Specification of the Model

The model that we intend to fit into the data is the multiple linear regression model. The usual form of the model is

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + X_p \beta_p \quad (2.1)$$

where Y is the dependent variable, X_1, X_2, \dots, X_p are the independent variables, otherwise, called the predictors, $\beta_0, \beta_1, \dots, \beta_p$ are the parameters of the model indicating the number of units increase in Y caused by one unit increase in the independent variables and p is the number of independent variables in the model. Equation 2.1 is called the intercept model with β_0 as the intercept. When the intercept is not significant, it is often better to remove it from the model and specify the model as,

$$Y = \beta_1 X_1 + \beta_2 X_2 + \dots + X_p \beta_p \quad (2.2).$$

Although, there are other forms of regression model, such as log linear regression, non-linear regression among others but a simple linear regression or multiple linear regression as the case may be often forms the starting model for investigation of better models.

3. Analysis of Data and Discussion of Results

In this section, we present the results of data analysed in this study and discuss the results of the analysis. The data used for this study were extracted from the Central Bank of Nigeria (CBN) Bulletin (2008), pp. 210-211. The following notations were used to represent the variables in the data:

X_1 =Value of Food and Live Animal, X_2 = Value of Beverages and Tobacco, X_3 =Value of crude minerals inedible, X_4 =Value of Mineral Fuels, X_5 =Value of Animal and Vegetable Oils and Fats, X_6 =Value of Chemicals, X_7 =Value of Manufactured Goods, X_8 =Value of Machinery and Transport Equipment, X_9 =Value of Miscellaneous Manufactured Goods, X_{10} = Value of Miscellaneous Transactions, Y = Total Value of imports.

In order to determine the significant major imports in Nigeria from 1960-2008, we first employed the Ordinary Least Square Regression (OLS) to estimate the parameters of the model and identify the significant major imports in the country for the period under study. The total import for each year was used as the dependent variable.

The Statistical Package for Social Sciences (SPSS) was used to facilitate the calculations. Table 1 shows the model summary of the OLS. The results in Table 1 and Table 2 give a general indication that the independent variables used in the data are significant major imports in the country for the period under study at 0.05 level of significance. This is because, the P-value (0.000) is less than 0.05. However, Table 1 shows that the R^2 is very high indicating

that the presence of multicollinearity might have affected the significance of the regressors. Further, when a T-test was conducted, It was found that only food and live animal, beverages and tobacco, machinery and transport equipment and miscellaneous manufactured goods were significant. This was because only these variables had $P < 0.05$. The variance inflation factors were all very high except for the variables, chemicals (see Table 3). All these indicate the presence of multicollinearity in the data whose effect, we have earlier enumerated. Table 4 gives the bivariate correlations between each pair of the independent variables. The results in Table 4 show that some of the independent variables are highly related; for example, the value of food and live animal imported into the country have high positive relationship with the value of beverages and tobacco (correlation coefficient of 0.802). Some of the condition indices as could be seen in Table 6 are as high as 40. This further shows the presence of multicollinearity.

Following the presence of multicollinearity in the data, we transformed the data using the First Difference Method. The results of the Ordinary Least Square Regression after transformation show that multicollinearity was still highly present in the data (see tables 6- 10). Therefore, we had to run a stepwise regression in order to remove the superfluous variables. Our results show that the most essential variables needed in the regression model are food and live animal, beverages and tobacco, machinery and transport equipment and miscellaneous manufactured goods (see Table 11). Following this result, we removed other independent variables and regressed these selected variables on the total value of imports for each year. The results show that the multicollinearity was highly reduced. This could be attested by the moderate values of VIF and CI (see Table 15 and Table 16). When a T-test was performed, all the independent variables included in the regression were significant. However, the results also show that the constant term was not significant (see Table 12). Therefore, we re-ran the regression without the constant term. All the independent variables included were still significant (see Table 13, Table 14 and Table 15). Therefore, the appropriate regression model for the total value of imports from 1960 to 2008 is

Total import for the year = $2.358 \text{ food and live animal} + 41.871 \text{ beverages and tobacco} + 2.453 \text{ machine and transport equipment} - 3.745 \text{ miscellaneous manufactured goods}$

This show that 1 million Naira increase each in the values of food and live animal, beverages and tobacco, machinery and transport equipment would cause the total

import to increase by 2.358, 41.871, 2.453 and decrease by -3.745 million Naira respectively.

Comparing this result with the result of the present time shows that importation of machinery and transport equipment still contributes significantly to the value of imports in Nigeria.

4. Conclusion

In this study, we have used different methods such as R^2 , bivariate correlation, VIF and CI to identify multicollinearity in data on the values of imports in Nigeria from 1960-2008. The method of first-order differencing was used to transform the data in order to remove the multicollinearity. It was found out that multicollinearity was still high in the data after the first –order differencing. Some of the predictors were still not significant when the T-test was performed. A stepwise regression was then performed to identify the superfluous variables and remove them from the regression. The stepwise regression identified machinery and transport equipment (X_8), food and live animals (X_1), beverages and tobacco (X_2) and miscellaneous manufactured goods (X_9) as the only significant variables most useful in the presence of the multicollinearity. The ordinary least square regression was then re-run with only these four predictors and both the F-test and the T-values for all the predictors were significant with highly reduced VIF, CI and bivariate correlation coefficients but the constant term was not significant. The constant term was removed and the ordinary least-square regression was again re-run in order to specify the appropriate model. We observed that the appropriate model for predicting the value of imports in Nigeria is given by $Y = 2.358X_1 + 41.871X_2 + 2.453X_8 - 3.745X_9$, where Y is the total import for the year. When these results were compared with the current report of the Nigerian Bureau of Statistics, it was found out that machinery and transport equipment still contributes significantly to the Value of Nigerian imports. We therefore recommend that if Nigeria wishes to further reduce her value of imports, more effort should be made to establish industries in the country for local production of machinery and transport equipment. We caution that while Nigeria currently encourages the production and patronage of indigenous products efforts should be made to strike a balance so that the value of her currency is not further devalued due to insufficiency of the indigenous products in the country.

Table I. Model summary of the OLS without Transformation of data

model	R	R Square	Adjusted R square	Std. Error of the Estimate	Change Statistics				
					R square change	F change	df1	df2	Sig. F change
1	1.000 ^a	.999	.999	25831.43992	.999	6578.779	.10	37	.000

a. Predictors: (constant), X10, X6,X9, X1, X3, X8, X5, X2, X7, X4

Table 2. ANOVA table of the OLS without Transformation of Data

Model	Sum of squares	df	Mean square	F	Sig.
Regression	4.390E13	10	4.390E12		
Residual	2.469E10	37	6.673E8	6578.779	.000 ^a
Total	4.392E13	47			

a. Predictors: (constant), X10, X6,X9, X1, X3, X8, X5, X2, X7, X4
 b. Dependent Variable: Total

Table 3. Parameters and the VIF of the OLS without Transformation of Data

Coefficients^a

Model	Unstandardized Coefficients		Standardized coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
1 (Contant)	-293.046	4731.194			-.062	.951		
X1	2.329	.770	.178		3.024	.005	.004	228.975
X2	28.990	15.256	.286		1.900	0.65	.001	1493.486
X3	4.044	4.193	.233		.964	.341	.000	3838.254
X4	-1.964	12.495	-.035		.157	.876	.000	3232.842
X5	-2.812	5.443	-.063		-.517	.608	.001	967.907
X6	.001	.009	.001		.163	.871	.194	5.151
X7	0.27	.436	.009		0.062	.951	.001	1287.647
X8	1.821	.344	.412		5.300	.000	.003	398.190
X9	-1.951	1.396	0.71		-1.398	.171	.006	172.003
X10	13.607	10.32 9	0.57		1.317	.196	.008	123.906

a. Dependent Variable: Total

Table 4. Correlation Coefficients of the OLS without Transformation of Data

Coefficient Correlations

Model	X10	X6	X9	X1	X3	X8	X5	X2	X7	X4
Correlations X10	1.000	.159	.462	-.416	.316	-.100	-.220	-.305	.157	-.273
X6	.159	1.000	.183	-.333	.651	-.098	.471	-.522	.313	-.787
X9	.462	.183	1.000	-.853	.458	-.136	.302	-.808	.254	-.322
X1	-.416	-.333	-.853	1.000	-.392	-.187	-.422	.822	-.431	.456
X3	.316	.651	.458	-.392	1.000	-.255	.439	-.717	-.042	-.805
X8	-.100	-.098	-.136	-.187	-.255	1.000	.073	.090	-.324	.132
X5	-.220	.471	.302	-.422	.439	.073	1.000	-.698	.358	-.731
X2	-.305	-.522	-.808	.822	-.717	.090	-.698	1.000	-.391	.739
X7	.157	.313	.254	-.431	-.042	-.324	.358	-.391	1.000	-.386
X4	-.273	-.787	-.322	.456	-.805	.132	-.731	.739	-.386	1.000
CovarianceX10	106.691	.014	6.666	3.308	13.686	-.355	12.389	48.125	.709	35.180
X6	.014	7.503E-5	.002	-.002	.024	.000	.022	-.069	.001	-.085
X9	6.666	.002	1.948	-.917	2.681	-.065	2.297	17.213	.155	5.623
X1	-.3.308	-.002	-.917	.593	-1.265	-.049	-1.769	9.657	-.145	4.393
X3	13.686	.024	2.681	1.265	17.583	-.368	10.024	45.884	-.077	42.182
X8	-.355	.000	-.065	-.049	-.368	.118	.137	.473	-.049	.565
X5	.12.389	.022	2.297	1.769	10.024	.137	29.621	57.954	.850	49.691
X2	-48.125	-.069	-17.213	9.657	-45.884	.473	57.654	232.752	2.606	140.85
X7	.709	.001	.155	-.145	-.077	-.049	.850	-2.606	.190	-2.106
X4	-35.180	-.085	-5.623	4.393	-42.182	.565	49.691	140.856	2.106	156.123

a. Dependent Variable: Total

Table 5. Condition Index of the OLS without Transformation of Data

Collinearity Diagnostics

Model dimension	Eigen value	Condition index	Variance Proportions										
			(constant)	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
1	9.316	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.837	3.337	.62	.00	.00	.00	.00	.00	.02	.00	.00	.00	.00
3	.624	3.833	.11	.00	.00	.00	.00	.00	.23	.00	.00	.00	.00
4	.173	7.335	.10	.00	.00	.00	.00	.00	.05	.00	.00	.01	.01
5	0.32	17.028	.06	.04	.00	.00	.00	.00	.00	.00	.00	.03	.01
6	.012	27.401	.00	.00	.00	.00	.00	.00	.04	.01	.02	.04	.26
7	.003	60.455	.06	.09	.00	.00	.01	.10	.03	.00	.28	.00	.39
8	.001	90.716	.02	.43	.20	.00	.06	.00	.07	.00	.05	.59	.04
9	.001	91.831	.02	.00	.00	.01	.01	.27	.00	.10	.61	.05	.20
10	.000	146.504	.02	.11	.04	.14	.02	.15	.01	.80	.00	.01	.00
11	.000	299.385	.00	.32	.75	.84	.91	.48	.54	.08	.04	.27	.09

a. Dependent Variable

Table 6. Model Summary of the Transformed Data Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	Df1	Df2	Sig.F Change
1	.993	.986	.983	41450.61666	.986	269.442	10	37	.000

a. Predictors: (constant), DX10, DX6, DX9, DX4, DX1, DX2, DX7, DX8, DX5, DX3

Table 7. ANOVA table for the Transformed Data

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.629E12	10	4.629E11		
Residual	6.357E10	37	1.718E9	269.442	.000 ^a
Total	4.693E12	47			

a. Predictors: (constant), DX10, DX6,DX9,DX4,DX1,DX2,DX7,DX8,DX5,DX3

b. Dependent Variable: DTotal

Table 8. Parameters and VIF of the Transformed Data

Coefficients^a

Model	Unstandardized coefficients		Beta	T	Sig.	Collinearity Statistics	
	B	Std. Error				Tolerance	VIF
1 (constant)	-3419.375	6838.068		-.500	.620		
DX1	2.936	1.004	.194	2.925	.006	.083	12.004
DX2	42.380	16.500	.400	2.568	.014	.015	66.366
DX3	-2.582	5.650	-.137	-.457	.650	.004	244.234
DX4	-2.417	8.863	.039	.273	.787	.018	56.851
DX5	.276	5.868	.008	.047	.963	.013	76.519
DX6	.004	.007	.017	.596	.555	.452	2.211
DX7	.796	.451	.266	1.766	.086	.016	62.002
DX8	1.481	.598	.329	2.478	.018	.021	48.183
DX9	-2.336	1.755	-.092	-1.331	.191	.077	13.032
DX10	1.436	15.919	.010	.090	.929	.032	31.712

a. Dependent Variable: DTotal

Table 9. Correlation Coefficients of the Transformed Data

Coefficient Correlations

Model	DX10	DX6	DX9	DX4	DX1	DX2	DX7	DX8	DX5	DX3
CorrelationDX10	1.000	-.033	.385	.369	-.138	.077	-.052	.479	-.849	-.241
DX6	-.033	1.000	.088	-.400	.180	-.073	-.156	-.240	.003	.334
DX9	.385	.088	1.000	.120	-.577	-.555	-.214	.060	-.088	.219
DX4	.369	-.400	.120	1.000	.098	.575	.423	.292	-.543	-.895
DX1	-.138	.180	-.577	.098	1.000	.653	.176	-.475	-.176	-.227
DX2	.077	-.073	-.555	.575	.653	1.000	.358	-.037	-.475	-.724
DX7	-.052	-.156	-.214	.423	.176	.358	1.000	-.173	-.303	-.614
DX8	.479	-.240	.060	.292	-.475	-.037	-.173	1.000	-.319	-.338
DX5	-.849	.003	-.088	-.543	-.176	-.475	-.303	-.319	1.000	.521
DX3	-.241	.334	.219	-.895	-.227	-.724	-.614	-.338	.521	1.000
CovarianceDX10	253.423	-.004	10.745	51.991	-2.202	20.112	-374	4.562	-79.334	-21.670
DX6	-.004	5.015E-5	.001	-.025	.001	-.009	.000	-.001	.000	.013
DX9	10.745	.001	3.079	1.866	-1.017	-16.077	-.169	.063	-.907	2.167
DX4	51.991	-.025	1.866	78.546	.874	84.053	1.691	1.548	-28.244	-44.825
DX1	-2.202	.001	-1.017	.874	1.008	10.812	.080	-.285	-1.034	-1.288
DX2	20.112	-.009	-16.077	84.053	10.812	272.265	2.663	-.366	-45.952	-67.471
DX7	-374	.000	-.169	1.691	.080	2.663	.203	-.047	-.802	-1.563
DX8	4.562	-.001	.063	1.548	-.285	-.366	-.047	.357	-1.118	-1.143
DX5	-79.334	.000	-.907	-28.244	-1.034	-45.952	-.802	-1.118	34.439	17.271
DX3	-21.670	.013	2.167	-44.825	-1.288	-67.471	-1.563	-1.143	17.271	31.919

a. Dependent Variable : DTotal

Table 10. Condition Index of the Transformed Data

Model Dimension	Eigen value	Condition index	Variance Proportions										
			(constant)	DX1	DX2	DX3	DX4	DX5	DX6	DX7	DX8	DX9	DX10
1.	7.415	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2.	1.618	2.141	.00	.00	.00	.00	.00	.00	.14	.00	.00	.01	.00
3.	.840	2.970	.87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4.	.480	3.932	.02	.01	.00	.00	.00	.00	.04	.00	.00	.00	.03
5.	.351	4.596	.00	.00	.00	.00	.01	.00	.58	.00	.00	.06	.00
6.	.211	5.927	.00	.21	.01	.00	.00	.00	.00	.00	.00	.02	.01
7.	.038	14.000	.03	.00	.00	.00	.15	.00	.01	.04	.13	.41	.00
8.	.020	19.455	.01	.14	.20	.00	.00	.02	.00	.38	.03	.19	.02
9.	.016	21.773	.03	.35	.13	.02	.02	.26	.13	.01	.27	.02	.10
10.	.010	27.766	.00	.21	.07	.01	.01	.30	.00	.18	.47	.25	.72
11.	.002	57.692	.03	.07	.58	.97	.80	.42	.09	.38	.10	.04	.12

a. Dependent Variable: DTotal

Table 11. Results of the Stepwise Regression

Coefficient

Model	Unstandardized coefficients		Standard Coefficients	t	Sig	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1. (constant)	14722.433	8669.475	.998	1.698	.096	1.000	
X7	3.115	.025		122.466	.000		
2. (constant)	-4033.056	6148.525		-.856	.515		
X7	1.716	.178	.550	9.652	.000	.009	114.138
X8	1.990	.252	.450	7.903	.000	.009	114.138
3. (constant)	-3865.218	5412.439		-.714	.479		
X7	.741	.303	.238	2.445	.019	.002	428.623
X8	2.735	.298	.619	9.192	.000	.005	205.657
X5	6.577	1.753	.147	3.752	.001	.014	69.192
4. (constant)	-4074.023	5171.433		-.788	.435		
X7	.836	.293	.268	2.856	.007	.002	437.371
X8	2.205	.367	.499	6.008	.000	.003	342.821
X5	7.997	1.786	.178	4.476	.000	.013	76.740
X1	.793	.347	.061	2.283	.027	.028	35.136
5. (constant)	-1617.574	4890.972		-.331	.742		
X7	.713	.276	.229	2.585	.013	.002	448.947
X8	1.961	.353	.444	5.562	.000	.003	365.605
X5	6.015	1.809	.134	3.325	.002	.011	93.292
X1	1.113	.343	.085	3.246	.002	.025	39.631
X2	11.707	4.219	.116	2.775	.008	.010	99.660
6. (constant)	-427.860	4546.131		-.094	.925		
X7	.289	.296	.093	.977	.335	.002	603.209
X8	1.959	.326	.443	6.006	.000	.003	365.606
X5	1.007	2.434	.022	.414	.681	.005	197.236
X1	2.682	.638	.205	4.203	.000	.006	160.195
X2	36.289	9.512	.358	3.815	.000	.002	591.507
X9	-3.185	1.1214	-.117	-2.834	.007	.009	113.638
7. (constant)	-211.565	4471.186		-.047	.962		
X7	.288	.293	.092	.985	.330	.002	603.201
X8	1.928	.314	.436	6.134	.000	.003	346.198
X1	2.834	.518	.217	5.468	.000	.009	107.737
X2	39.333	5.969	.388	6.589	.000	.004	237.634
X9	-3.522	.765	-.129	-4.603	.000	.019	53.750
8. (constant)	-514.852	4459.003		-.115	.909		
X8	2.133	.236	.483	9.037	.000	.005	195.256
X1	3.085	.451	.236	6.839	.000	.012	81.659
X2	44.112	3.476	.436	12.692	.000	.012	80.609
X9	-4.074	.522	-.149	-7.811	.000	.040	24.986

a. Dependent Variable: Total

Table 12. Parameters of the OLS with the identified significant Independent Variables and non-signature Intercept Term

Coefficients

Model	Unstandardized Coefficients		Standardized coefficient	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(constant)	-2334.732	5237.269		-.446	.658		
X1	2.346	.491	.163	4.772	.000	.010	95.578
X2	41.378	4.031	.413	10.266	.000	.008	131.975
X8	2.478	.262	.553	9.471	.000	.004	278.442
X9	-3.724	.608	-.126	-6.127	.000	.029	34.587

a. Dependent Variable: Total

Table 13. Model Summary of the Final OLS Regression Containing the Major Significant Variable

Model Summary

Model	R	R Square ^b	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F. Change
1	1.000 ^a	1.000	1.000	29620.13828	1.000	25625.768	4	45	.000

a. Predictors: X9, X2, X1, X8

b. For regression through the origin (the no-intercept model), R square measures the proportion of the variability in the dependent variable about the origin explained by regression. This cannot be compared to R square for models which include an intercept.

Table 14. ANOVA Tables of the final OLS Regression containing the major Significant variableANOVA^{c,d}

Model	Sum of squares	Df	Mean square	F	Sig.
Regression	8.993E13	4	2.248E13		
Residual	3.948E10	45	8.774E8	25625.768	.000 ^a
Total	8.997E13	49			

a. Predictors: X9, X2, X1, X8

b. This total sum of squares is not corrected for the constant because the constant is zero for regression through the origin.

c. Dependent Variable: Total

d. Linear Regression through the Origin

Table 15. Parameters and VIF of the OLS Regression Model with the major significant variablesCoefficient^{a,b}

Model	Unstandardized Coefficients		Standardized Coefficient		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
X1	2.358	.486	.170		4.850	.000	.008	126.722
X2	41.871	3.842	.409		10.898	.000	.007	144.695
X8	2.453	.253	.553		9.691	.000	.003	333.671
X9	-3.745	.600	-.129		-6.238	.000	.023	44.179

a. Dependent Variable: Total

b. Linear Regression through the Origin

Table 16. Condition Index of the final OLS regression containing the major significant VariablesCollinearity Diagnostics^{a,b}

Model Dimension	Eigen value	Condition Index	Variable Proportions			
			X1	X2	X8	X9
1	3.911	1.000	.00	.00	.00	.00
2	.068	7.579	.03	.05	.00	.06
3	.019	14.185	.13	.01	.02	.62
4	.002	47.744	.84	.94	.98	.31

a. Dependent Variable: Total

b. Linear Regression through the Origin

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