POSSIBLE REASONS FOR SPURIOUS REGRESSION IN THE ECONOMETRIC MODEL (CASE STUDY OF IMPORTS IN THE UNITED STATES OF AMÉRICA)

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ARTICLE INFO	ABSTRACT
	Purpose: The research aims to identify statistical, econometric, and economic indicators to infer the problem of spurious regression. **Theoretical framework:** The research used a descriptive and econometric approach to identify the dimensions of this problem and the most likely causes of its emergence. **Design/Methodology/Approach:** The research estimated four equations, the first two are simple linear regressions (y, x1) and (y, x2), the third is a multiple linear regression equation (y, x1, x2), and the fourth is a double logarithmic regression equation for multiple linear regression. The results of the four equations were compared to assess the standard methods and explore spurious regression. **Findings:** The research concluded with several findings, one of which is that a high value of the coefficient of determination (R^2) in the absence of significance of the parameters is an indication of the problem of multicollinearity, and hence the possibility of spurious regression. **Research, Practical & Social implications:** Spurious regression can lead to misleading conclusions about the relationships between economic variables, this can have negative consequences for economic policymaking and other decision-making processes. The research on spurious regression can help to improve the accuracy and reliability of economic analysis, which can benefit society as a whole. **Originality/Value:** The paper could provide recommendations for how to avoid spurious regression in econometric models of imports. This could include recommendations for data collection, data preparation, and model specification. Doi: https://doi.org/10.26668/businessreview/2023.v8i12.3717

POSSÍVEIS RAZÕES PARA REGRESSÃO ESPÚRIA NO MODELO ECONOMÉTRICO (ESTUDO DE CASO DAS IMPORTAÇÕES NOS ESTADOS UNIDOS DA AMÉRICA)

RESUMO

Objetivo: A pesquisa visa identificar indicadores estatísticos, econométricos e econômicos para inferir o problema da regressão espúria.

Referencial teórico: A pesquisa utilizou uma abordagem descritiva e econométrica para identificar as dimensões deste problema e as causas mais prováveis do seu surgimento.

Desenho/Metodologia/Abordagem: A pesquisa estimou quatro equações, as duas primeiras são regressões lineares simples (y, x1) e (y, x2), a terceira é uma equação de regressão linear múltipla (y, x1, x2), e a quarta é uma equação de regressão logarítmica dupla para regressão linear múltipla. Os resultados das quatro equações foram comparados para avaliar os métodos padrão e explorar a regressão espúria.

Constatações: A pesquisa concluiu com diversas constatações, uma das quais é que um valor elevado do coeficiente de determinação (R^2) na ausência de significância dos parâmetros é uma indicação do problema de multicolinearidade e, portanto, da possibilidade de regressão espúria.

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Implicações de investigação, práticas e sociais: A regressão espúria pode levar a conclusões enganosas sobre as relações entre variáveis económicas, o que pode ter consequências negativas para a elaboração de políticas económicas e outros processos de tomada de decisão. A investigação sobre regressões espúrias pode ajudar a melhorar a precisão e a fiabilidade da análise económica, o que pode beneficiar a sociedade como um todo.

Originalidade/Valor: O documento poderia fornecer recomendações sobre como evitar regressões espúrias em modelos econométricos de importações. Isto poderia incluir recomendações para coleta de dados, preparação de dados e especificação de modelo.

Palavras-chave: Regressão Espúria, OLS, ARDL.

POSIBLES RAZONES DE LA REGRESIÓN ESPURIA EN EL MODELO ECONOMÉTRICO (ESTUDIO DE CASO DE LAS IMPORTACIONES EN LOS ESTADOS UNIDOS DE AMÉRICA)

RESUMEN

Propósito: La investigación tiene como objetivo identificar indicadores estadísticos, econométricos y económicos para inferir el problema de la regresión espuria.

Marco teórico: La investigación utilizó un enfoque descriptivo y econométrico para identificar las dimensiones de este problema y las causas más probables de su surgimiento.

Diseño/Metodología/Enfoque: La investigación estimó cuatro ecuaciones, las dos primeras son regresiones lineales simples (y, x1) y (y, x2), la tercera es una ecuación de regresión lineal múltiple (y, x1, x2) y la cuarta es una ecuación de regresión logarítmica doble para regresión lineal múltiple. Los resultados de las cuatro ecuaciones se compararon para evaluar los métodos estándar y explorar la regresión espuria.

Hallazgos: La investigación concluyó con varios hallazgos, uno de los cuales es que un valor alto del coeficiente de determinación (R2) en ausencia de significancia de los parámetros es una indicación del problema de multicolinealidad y, por lo tanto, de la posibilidad de regresión espuria.

Implicaciones prácticas, Sociales y de Investigación: la regresión espuria puede llevar a conclusiones engañosas sobre las relaciones entre las variables económicas, lo que puede tener consecuencias negativas para la formulación de políticas económicas y otros procesos de toma de decisiones. La investigación sobre regresión espuria puede ayudar a mejorar la precisión y confiabilidad del análisis económico, lo que puede beneficiar a la sociedad en su conjunto.

Originalidad/Valor: El documento podría proporcionar recomendaciones sobre cómo evitar regresiones espurias en modelos econométricos de importaciones. Esto podría incluir recomendaciones para la recopilación de datos, la preparación de datos y la especificación del modelo.

Palabras clave: Regresión Espuria, OLS, ARDL.

INTRODUCTION

The use of quantitative tools in economic analysis aims to simplify the complex economic reality intertwined with economic variables and crises, and to test economic theory to reveal new economic policies. The current study used this method to deduce a spurious regression. The research was divided into three sections.

First of all, the research problem: The widespread acceptance of economic, financial, and monetary models on a statistical and quantitative level in many current economic studies has increased the possibility of falling into the problem of spurious regression, and the fact that statistical tests themselves do not always lead to logical or causal relationships. As for spurious regression, the question remains:

- Do certain economic models suffer from the problem of spurious regression, and how can it be deduced?

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- What are the most important statistical, econometric, and economic indicators to deduce a spurious regression?

Secondly, the importance of research: This research aims to identify the main possible causes of the emergence of the problem of false regression in economic studies, as its widespread acceptance based on statistical and econometric tests can be suspicious for economic analysis, which requires the development of indicators to avoid the problem of spurious regression.

Thirdly, the Research Objectives: This research aims to study the dimensions of the spurious regression problem and its negative effects on econometric models, and to search for the most important indicators to deduce spurious regression in order to construct reliable econometric models when developing various economic policies.

Fourthly, the Research Hypothesis: The study starts with a main hypothesis that can be deduced from the problem of spurious regression by developing integrated standards for the most important statistical, econometric, and economic tests.

Fifthly, the Research Method: The research used the descriptive method based on deductive approach to identify the most important reasons leading to the emergence of the problem of spurious regression, as well as the use of econometric method in monitoring the most important indicators to deduce spurious regression.

Sixthly, the Research Structure: The research was structured around several themes: First theme The theoretical framework of spurious regression. Second theme: Possible causes of spurious regression. Third theme: Study of factors affecting imports (a case study).

THE THEORETICAL FRAMEWORK OF SPURIOUS REGRESSION

The Concept of Spurious Regression

First of all, it should be noted that a large number of scientific research studies, including academic research in the field of economics, use quantitative methodology through the use of econometric methodology to study economic phenomena. This trend is beneficial as it tests approved economic laws and theories and effectively contributes to the development of economic policies and making effective decisions to address economic crises and shocks. But the lack of attention to the content and steps of the econometric methodology represented in the model characterization process and the selection of the best econometric models can lead to negative results that do not reflect the true nature of the economic relationships between the variables studied, negatively affecting the analysis and prediction process of the behavior of

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variables and economic phenomena, which can lead to the emergence of the spurious regression problem.

The spurious regression notion

The word (spurious) in the dictionary of meanings indicates that it is invalid, inauthentic, or unreal (unreal relation) that has no meaningFranses, P. H., & Janssens, E. (2019). As for the term (regression), it refers to the anthropologist (Francis Galton), who concluded in a research paper that regression can mean (move) or (regress), and therefore regression analysis is concerned with studying and estimating the relationship between economic variables in a quantitative mannerHaig, B. D. (2003). In other words, false regression can take various forms, including the following:

• **Economically spurious regression:** this is the model that is not based on what economic theory and economic logic have proposed, and so the relationships are spurious, even if the statistical tests are acceptable, in other words, there are no causal relationships between the economic variables, which means that there are no direct or indirect relationships between the variables studied, in other words, the estimated econometric model may be contradictory to what is derived from economic theory and previous studies in the presence of acceptable statistical and econometric tests. This means that there are no real relationships between the economic variables, which means obtaining a regression with misleading results in the interpretation and analysis of economic relationships.

• **Spurious regression from a econometric statistical point of view:** regression analysis may show that there is a relationship between two or more variables in the time series data, but this relationship is unreliable (Unreliable Relationship) or uncertain (No exact), and is mainly due to the presence of a general trend (Trend) between the economic variables, in other words, if the econometric model suffers from econometric problems, this may lead to the emergence of the problem of spurious regression. Or a deficiency in the description of the econometric model, or a very high coefficient of determination (R2).

From the above, it is clear that the study of the problem of spurious regression requires a complete examination of the stages of econometric methodology and the statistical and econometric problems that accompany it, in order to determine the nature of this problem, its

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causes and justifications, and to know the most important statistical, econometric and economic tests for deducing its various dimensions.

The various regression models attempt to extract the best information by studying the sample regression function, which represents the variables of the phenomenon as it approximates the community regression function, and in order to reduce the effects of false regression, we look for the least deviations between the two functions to obtain the best estimates, in other words we look for the quality of fit. We need the quality of fit of the estimated regression line, which we obtain by knowing or measuring the fluctuations of the random variable, the coefficient of determination R2, the variance and the econometric deviation   Gonzalo, J., & Pitarakis, J. Y. (2021).

The development of econometric methods in recent years has contributed to the importance of studying the stability of (stationary) time series. Ghouse, G., Khan, S. A., Rehman, A. U., & Bhatti, M. I. (2021), which means you can suffer from spurious regression. Consequently, economic variables suffer from time-series instability, which means that most economic studies that have used the ordinary least squares (OLS) method are not considered the best method in the estimation process, and so this method becomes inappropriate in estimating economic relationships due to the lack of appropriate assumptions. In this case, the estimated model suffers from a number of econometric problems that impact negatively on the credibility of the estimated parameters, indicating the possibility of the emergence of this problem. Vinod, H. D. (2016).

Indeed, Gauss-Markov theory has provided many theoretical and mathematical justifications for the least squares method, and it provides the best linear unbiased estimates (BLUE) under a set of logical conditions and assumptions but violation of any of the assumptions The norm can affect the reliability of the estimated parameters and statistical tests. In other words, when the researcher performs an unstable time series regression on one or more of the unstable time series, he or she may obtain a spurious regression or an absurd regression Baumohl, E., & Lyocsa, S. (2009).

Interestingly, the wide acceptance of economic, financial and monetary models on a statistical and quantitative level in many current and past economic studies contributes to increasing the expected doubts about the emergence of the problem of spurious regression, despite the lack of conclusive evidence to determine the dimensions of this problem, but research aimed at determining its causes, the comparison of its indicators, the formulation of logical questions and the preparation of scenarios or experimental models using relatively

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modern econometric methods can contribute to a better understanding of the nature and dimensions of this problem, thereby improving the process of extracting evidence that may help to avoid the problem of spurious regression in the future Wong, W. K. (2020).

In order for the econometric model to be able to measure economic relations, it must be based on the premises of economic theory. Either the estimation of the econometric model's parameters corresponds to what the economic theory went to, taking into account statistical and econometric tests Ventosa-Santaulària, D., Vera-Valdés, J. E., Łasak, K., & Ramírez-Vargas, R. (2022). or the capabilities of the econometric model may not differ with the foundations and principles of economic theory and economic logic, and here comes the role of the researcher in re-analyzing and interpreting economic relations according to econometric models estimated according to economic analysis, as one of the most important goals of econometrics is to choose the economic theory.

need to take this into account when studying the problem of spurious regression, noting that the existence of acceptable or significant statistical and standard indicators and tests may not mean the existence of a real or logical relationship in economic terms between the variables under study, as there may be no logical or causal relationship between them, i.e. Unrelated to each other, as this may indicate the existence of a general tendency (trend) in the behavior of economic variables Leong, C. K., & Huang, W. (2006). We cannot fail to point out that the econometric model characterization stage is one of the fundamental steps in econometric model construction, and not paying attention to it is a weak point in applied econometric research. Indeed, if the description of the econometric model is incorrect, this will negatively affect statistical tests and econometric methods, and therefore On the strength and type of economic relationships raising doubts about the model's ability to explain and analyze the phenomenon Noriega, A. E., & Ventosa-Santaulària, D. (2006). Indeed, it is interesting to say that: The current study depends on the acceptance of the hypothesis of avoiding the problem of false regression by accepting the best results for the econometric models studied through the process of promoting the principle of integration between standards (economic, statistical and econometric), otherwise the econometric model becomes controversial due to contradictions in the results of statistical tests. and econometric, as shown in Figure 1.

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Figure 1 The relationship of the spurious-regression problem between previous studies and the current study
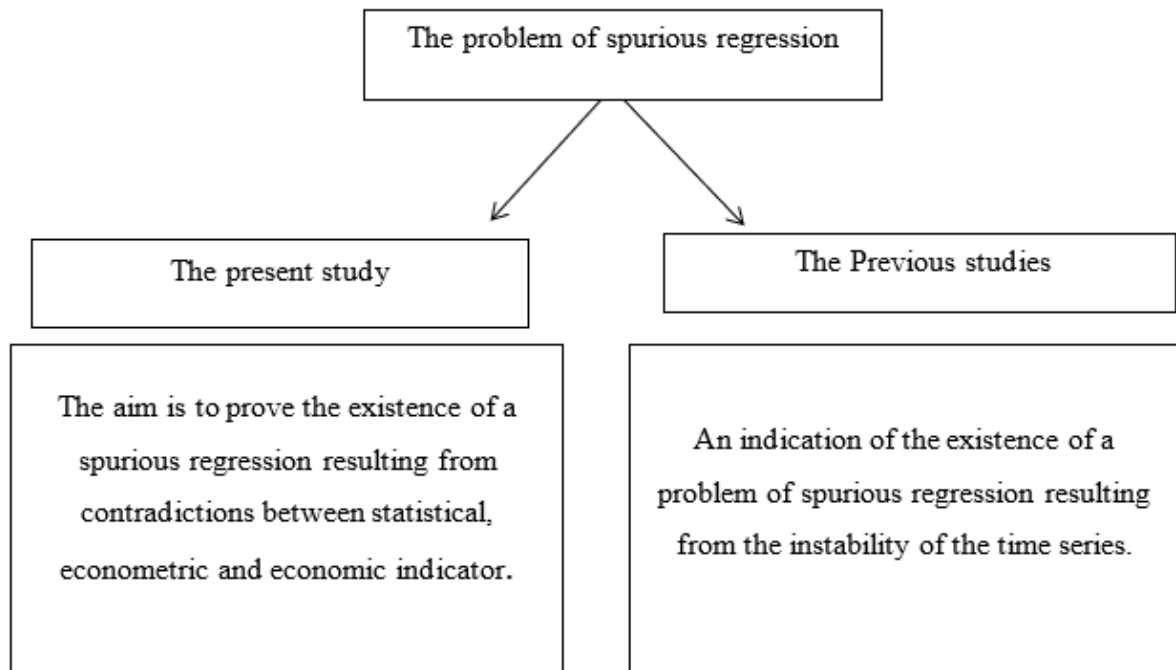
Source: Prepared by researchers

Characteristics of the spurious regression problem (Jabbar, 2011: 84) (Al-Alusi, 2013: 68)

It is important to emphasize that identifying the problem of spurious regression requires a process of control and comparison of statistical tests, as well as the search for modern econometric methods adapted to each economic phenomenon, and that the most important characteristics of this problem can therefore be identified through the following points:

- The instability of time series can lead to some classic problems.

- A significant increase in the coefficient of determination (R^2), given the insignificant parameters of the econometric model Chekenya, N. S. (2020).

- A high value of the coefficient of determination (R^2) with a very high sum of squared errors (SSR).

- The appearance of an explicit contradiction in the acceptance or non-acceptance of certain statistical and econometric tests.

- A significant increase in the overall significance of the test (F). Due to a strong increase in the value of (Fc).

- An increase in the value of the information standards (AIC, SC, HQ), as its value is expected to be the lowest Enns, P. K., Kelly, N. J., Masaki, T., & Wohlfarth, P. C. (2016).

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- The existence of causal relationships from a statistical point of view and the lack of clarity of this relationship from an economic point of view, which raises some doubts in the determination of the dependent variable.

- A significant increase in the values of the econometric model parameters (α, β), which contradicts economic theory, as most mathematical relationships are either slopes or elasticities.

- The indicator (R^2 > D-W) can be useful for deducing a false regression, in the case where there is an autocorrelation problem, and it is necessary to reconsider the other cases.

Possible Causes of Spurious Regression

Causes of spurious regression in econometric models

There is no doubt that some econometric models used in previous or current economic studies may suffer from the problem of false regression, particularly in developing countries, for the following reasons Olatayo, T. O., Adeogun, A. W., & Lawal, G. O. (2012).

- The imprecision of the available data, resulting from the fragility of the databases of public and private institutions, and this issue is related to the transparency of the databases.

- The lack of sufficient support for practical research, meaning the absence of necessary material and financial capabilities.

- The lack of comprehensive knowledge of modern econometric studies, resulting from the fact that academic institutions do not participate in global directories dealing with the austerity of scientific research.

- The error in the econometric model characterization process, which is reflected in the process of economic estimation and forecasting.

- The use of a relatively biased sample in terms of size and type of variables studied, which may not accurately represent the community of the economic phenomenon.

- The existence of intellectual perspectives dominated by the doctrine of the market, where the market is considered capable of achieving economic equilibrium and economic development, leading to biased assumptions in studies.

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- The lack of appropriate infrastructure, such as computers, electronic software, advisory offices, and specialized research team centers to prepare optimal econometric models.

These reasons may lead to the emergence of the spurious regression problem in econometric models in many countries, including developing ones. But the question is why does the problem of spurious regression appear in the econometric models of developed countries? Why do some Econometric Model estimates show irrational relationships (sign of estimate) that differ from what economic theories have proposed? In addition to the appearance of a contradiction in certain statistical tests, which may contribute to the possibility of obtaining results that may not be consistent with the assumptions of economic theory, and to answer this important question, we can say: When preparing a econometric model, whether simple or multiple linear regression, we sometimes obtain erroneous signals for the regression coefficients Thus, this is contrary to economic theories and the results of previous research and studies, making it difficult to interpret the results of the econometric model. The most important reasons can be summarized in the following points. Akpan, E. A., & Moffat, I. U. (2016).

- The narrowness of the interval (number) of values of the observations of the phenomenon: the convergence of the values of the independent variable is one of the most important reasons for obtaining a different or erroneous signal. The variance of the regression coefficient was significant, which can lead to the problem of multicollinearity, and increasing the size of the variance can change the sign of the regression coefficient, just as the small sample size contributes to the inflation of estimators or regression coefficients Cheng, Y., Hui, Y., McAleer, M., & Wong, W. K. (2021).

- Eliminating one of the independent variables: One of the most important conditions for linear regression models is that the model description is correct, so that the deletion of one or more variables sometimes leads to a false or erroneous indication of the regression coefficient, which results from the importance of the deleted variable.

- The presence of the multicollinearity problem between independent variables means that there is a linear relationship between the independent variables, and that the presence of such indicators can lead to the emergence of the spurious regression problem, which indicates their existence is that some or all of the regression coefficients are not statistically significant (non-significant) despite the high value of the R^2 coefficient of determination.

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• Existence of outliers: When studying regression analysis, outliers may appear in the dependent variable or independent variables for a number of reasons, including errors at the data collection stage or when processing data in the electronic calculator, or real data due to exceptional circumstances. Unnatural, such as wars and natural disasters Wong, W. K. (2020).

• Mischaracterization of the econometric model: Mischaracterization of the econometric model may be due to omitted variables or the use of an incorrect functional formula. Consequently, we note that the disturbance limit (random variable) does not contain the effect of the dependent variable's random limits alone, but will also include the effect of certain omitted variables, which reflects negatively on the econometric model's capabilities and its economic relationship McIntyre, S., & McKitrick, R. (2005).

• The multiplicity of statistical and econometric methods and tests, and the inability to choose the best among them to study economic phenomena, as each method has a set of assumptions defined by those assumptions that can contribute to the interpretation of the phenomenon, and among these methods: Phillips, P. C., Wang, X., & Zhang, Y. (2019)

- Weighted least squares (WLS).

- Vertical least squares (GLS) (Generalized-least-squares)

- Various autoregressive models: (ARDL), (NARDL) and (ARIAM).

• The emergence of econometric problems in the econometric model: As we know, econometric models can suffer from the emergence of certain standard problems represented by the autocorrelation problem, the multiple linear correlation problem and the variance heterogeneity problem. Saba affects the reliability of the econometric model.

• The reason for the emergence of the spurious regression problem is the presence of the general trend factor (Trend) in the time series, which causes the variables to move in the same direction (up and down). The absence of stability (Stationary None) in the time series.

The presence of one or more of these problems can render the econometric model's capabilities ineffective and bias its estimates, rendering the results unconvincing and dubious, and making them unreliable in the process of interpreting and analyzing economic relationships. All these factors and more adversely affect econometric models, leading to the emergence of

spurious relationships, which cause econometric studies and models to suffer from the problem of spurious regression. It should be noted that the optimal econometric model is the one characterized by impartiality, efficiency and consistency.

The Spurious Regression Relationship with Econometric Methodology

The econometric models can suffer from spurious deviations when errors are made following the econometric methodology, which is represented as follows Tu, Y., & Wang, Y. (2022).

- The specification stages
- The estimation stages
- The Testing stages
- The Forecasting stages

The success of regression analysis depends on the availability and reliability of the data, but also on the accuracy of the measurement in processing the data to avoid cases of measurement errors and omissions, source according to which data quality is important when preparing the model. It should be noted that the problem that researchers may face in practice is to determine or test the optimal econometric model to represent the economic phenomenon, and (Miller) believes that the best econometric model is the most consistent with the data.

 McCallum, B. T. (2010). and in the same context in order to correctly characterize the model, we can note the following Wong, W. K. (2020).

Determine the main and influential variables of the dependent variable.

- Choose the optimal form of the function from a mathematical point of view (linear or non-linear relationship).
- There are no errors in the measurement process of the dependent variable or in the independent variables.
- There are no abnormal or missing values.
- The data must have statistically acceptable characteristics.
- The probability distribution of the error limit is statistically acceptable.

In the event of errors in the observations, the (OLS) method can give biased and inconsistent estimates, while the econometric model suffers from the problem of variance heterogeneity. The estimates are unbiased, but the variance is large, reducing the ability of the (OLS) method to obtain reliable estimates Noriega, A. E., & Ventosa-Santaulària, D. (2006).

Proposed Methods for Dealing with the Problem of Spurious Regression

There are many studies that indicate some practical measures to avoid the problem of spurious regression, the most important of which can be summarized as follows:

- Optimally follow the steps of the econometric methodology to avoid possible errors in the process of characterizing the Econometric Model.

- The need for researchers to familiarize themselves with modern econometric tools, including statistical and econometric tests.

- Use an appropriate number of observations, preferably sample size ($30 < n$).

- The use of dummy variables or lagged variables when preparing the econometric model

- The use of modern econometric methods, including linear and non-linear functions, and their comparison.

A study of the Factors Affecting Imports into the United States of America

At the beginning of the econometric model (a2), this is an experimental model for studying the factors affecting imports into the United States of America for the period (1964-1979). The results for the econometric model parameters are not significant (0.79, 0.06), with a significant increase in the coefficient of determination ($R2 = 0.98$) (Salvatore,D 1982).

The question is whether it is possible to monitor certain statistical, economic, etc. data: Is it possible to control certain statistical, econometric and economic indicators in order to deduce a false regression? In order to answer this question, this study has simulated the data and estimated more than one econometric OLS model to determine the extent of the false regression problem.

Description of the Econometric Model of Factors Affecting Imports

The specification of the model stage is one of the most important stages of preparing and formulating the econometric model, in which the economic variables are identified as follows: Explanatory variables: Gross domestic production, symbolized by x1, and the consumer index, symbolized by x2. The dependent variable: represented by the size of Imports and symbolized by (y). Figure 2 shows the changes in the economic variables during the experimental study period.

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Figure 2: Changes in imports and influencing factors
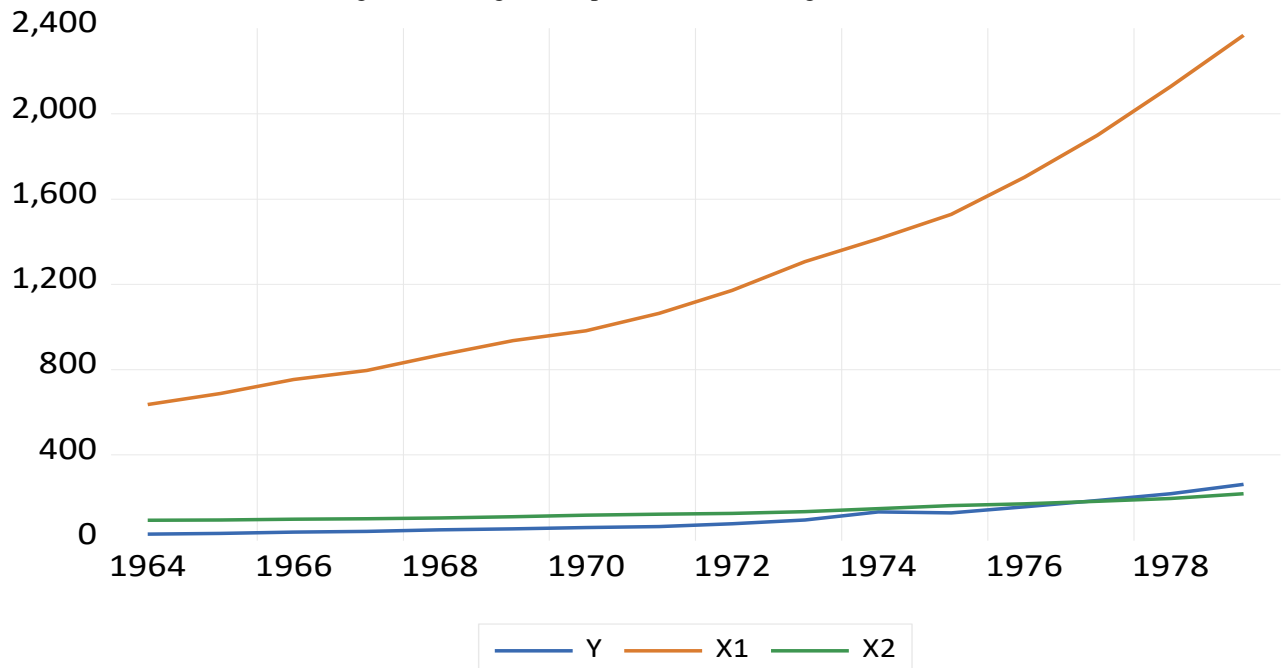
Source: Prepared by researchers, based on the Eviews 12 statistical program

A Study of the Statistical Characteristics of Economic Variables

- **The data are normally distributed:** initially, when analyzing the statistical characteristics of the data studied (y, x1, x2), we find that all the variables are normally distributed according to the Jarque-Bera test, the parameter of this test not being significant and amounting to (0.31, 0.43, 0.45) respectively.

- **The presence of the general trend:** From table 1, which studies the extent of the presence of the general trend (Trend) in the economic variables, it is clear from the estimation of the regression equation that the significance of the parameter (Trend) is accepted as it reached (0.0008), and this indicates the existence of a general trend among the economic variables.

Table 1 Equation of the general trend of economic variables

Dependent Variable: Y Method: Least Squares Date: 07/05/23				
Time: 10:54 Sample: 1964 1979				
Included observations: 16				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-112.6263	21.40792	-5.260965	0.0002
X1	0.135904	0.038238	3.554157	0.0040
X2	0.596394	0.490583	1.215684	0.2475
@TREND	-5.261258	1.192104	-4.413422	0.0008
R-squared	0.995184	Mean dependent var		100.6563
Adjusted R-squared	0.993980	S.D. dependent var		71.92798
S.E. of regression	5.580971	Akaike info criterion		6.488920
Sum squared resid	373.7668	Schwarz criterion		6.682068
Log likelihood	-47.91136	Hannan-Quinn criter.		6.498811

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F-statistic	826.5127	Durbin-Watson stat	2.662783
Prob(F-statistic)	0.000000		

Source: Prepared by researchers, based on the Eviews 12 statistical program

- **Tests of causal relationships (Granger):** Table 2 shows the existence of a causal relationship between (GDP), which represents variable x1, and import volume, since the value (F) is significant and amounts to (0.001), which means acceptance of the alternative hypothesis. As for the relationship between the variable (X2), which is represented by the consumer index, and the variable (Y), the value (F) is significant and amounts to (0.001), which means acceptance of the alternative hypothesis. The null hypothesis (0.37) can be accepted, confirming that there is no causal relationship between the two variables.

Table 2 The causal relationship between economic variables

Pairwise Granger Causality Tests Date: 07/05/23 Time: 10:47 Sample: 1964 1979 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
X1 does not Granger Cause Y Y does not Granger Cause X1	14	15.3697 1.09324	0.0013 0.3758
X2 does not Granger Cause Y Y does not Granger Cause X2	14	2.58153 2.86388	0.1300 0.1090
X2 does not Granger Cause X1 X1 does not Granger Cause X2	14	10.2850 32.1856	0.0047 8.E-05

Source: Prepared by researchers, based on the Eviews 12 statistical program

A comparative study of econometric estimated methods

Four equations were estimated, the first of which is the simple linear regression (y, x1) and (y, x2), the second is the estimation of the multiple linear regression equation (y, x1, x2), and the double log triple equation for multiple linear regression is estimated, the multiple linear regression equation was estimated by expanding the sample size, and finally the logarithmic equation (ARDL) was estimated. as shown in Table 3:

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Table 3 The results of the econometric models estimated by the method (OLS)

MODEL	Sig t	R^2	Sig F	ssr	AIC	SC
y= -69 + 0.13 x1	0.00 0.00	0.98	0.00	1055	7.27	7.37
y= -146.51 + 1.82 x2	0.00 0.00	0.98	0.00	1129	7.34	7.44
y= -101.48 + 0.07x1+ 0.75x2	0.00 0.18 0.33	0.98	0.00	980	7,32	7.47
Lny= -7.86 +1.51 lnx1+0.31 lnx2	0.00 0.00 0.50	0.99	0.00	0.03	2.78	2.63
Y=-101.48+0.07x1+0.75x2	0.00 0.00 0.03	0.98	0.00	3921.8	7.04	7.14
Lny= 1.42 +0.28 lnx1-7.22 lnx2	0.00 0.59 0.03	0.99	0.00	0.02	-2.90	-2.66

Source: Prepared by researchers, based on the Eviews 12 statistical program

Table 4 Diagnostic test results for estimated econometric models

MODEL	Normality test	autocorrelation	Multiple Correlation	heterogeneity;	Ramsey	R^2 – D-W
y= -69 + 0.13 x1	0.61	0.44	-	1.15	need	0.98<1.15
y= -146.51 + 1.82 x2	0.39	0.44	-	1.15	need	0.98<1.15
y= -101.48 + 0.07x1+ 0.75x2	0.57	0.51	176.6	1.80	need	0.98<1.18
Lny= -7.86 -1.51 lnx1+0.31 lnx2	0.08	0.95	78.8	1.88	Not need	0.98<1.88
y=-101.48+0.07x1+0.75x2	0.11	0.00	176.63	0.00	need	0.98>0.29
Lny= 1.42 +0.28 lnx1-7.22 lnx2	0.74	0.88	142.18	0.00	Not need	0.99<1.61

Source: Prepared by researchers, based on the Eviews 12 statistical program

We can explain the results of the two previous tables 3 and 4 as follows:

- **Results of the economic analysis of the estimated models:** Table 3 shows the results of the study of econometric models between economic variables in a certain way, and it indicated the following:

- We see clearly in the simple linear regression equation that every time gross domestic product increases by one unit, this leads to a 13% increase in imports, and when the consumer price index rises, imports increase by 1.82%.

- The multiple linear regression equation and the double log linear regression equation were estimated to compare and prove the direct relationship between the economic variables, and we imply an increase in the coefficient of determination (R2 = 0. 98) or an increase in the explanatory power of the econometric models estimated, since the

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two variables (x1, x2) were able to interpret 98% of the current changes in the dependent variable, that this result, although acceptable from a statistical point of view, may not be in agreement with the data from economic theory, because with rising inflation rates (consumption index x2) this may lead to a decrease in the value of the national currency, which implies an increase in the prices of imported commodities, indicating the need for a decrease in the rate or level of imports.

- When using the dynamic model (ARDL), we notice that it has achieved a qualitative addition in obtaining important economic information. The model emphasized the direct relationship between imports and gross domestic product, and indicated the inverse relationship between imports and inflation (consumer index), and this is consistent with economic theory.

Table 5 The multiple linear regression equation

Dependent Variable: Y Method: Least Squares Date: 07/05/23 Time: 11:01 Sample: 1964 1979 Included observations: 16					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
C	-101.4885	33.08031	-3.067943		0.0090
X1	0.078534	0.055958	1.403450		0.1839
X2	0.758554	0.761246	0.996464		0.3372
R-squared	0.987366	Mean dependent var			100.6563
Adjusted R-squared	0.985422	S.D. dependent var			71.92798
S.E. of regression	8.684477	Akaike info criterion			7.328312
Sum squared resid	980.4618	Schwarz criterion			7.473172
Log likelihood	-55.62650	Hannan-Quinn criter.			7.335730
F-statistic	507.9814	Durbin-Watson stat			1.186381
Prob(F-statistic)	0.000000				

Source: Prepared by researchers, based on the Eviews 12 statistical program

- **The results of the statistical analysis of the econometric models:**

We note the following points when comparing the econometric models:

- A significant increase in the coefficient of determination ($R^2 = 0.98$).

- High power parameters (0.00) for the simple linear regression treatment.

- Non-significance of estimated parameters (0.18, 0.33) in the multiple linear regression equation.

- A significant increase in the value of the information econometric (AIC, SC), for most models, between (7.27-7.47). However, in the logarithmic regression equation,

it was (2.78 - 2.63) respectively. This criterion is important for comparison between models, as it is preferable to decrease its value.

- A relative increase in total significance (0.00) according to the (F) test for all econometric models.

- A significant increase in the sum of squared errors (SSR), as it lies between (980 - 1129). However, it decreased significantly in the logarithmic equation of the multiple regression.

- - After the unit root tests, it was found that the variables are unstable at the level according to (ADF, PP) tests, and that they settled at the first difference (0.003) for the variable (Y) in the presence of the fixed limit, while the variables (X1) and (X2) did not settle at the first difference. This may not allow the use of (ARDL), but if it is used, we note, according to the test (F-Bound test = 9.12), and this indicates the existence of long-term equilibrium relationships. This is a matter of doubt about the compatibility of the tests.

- **Results of econometric analysis of estimated models:**

When studying econometric problems, we note the following in Table (4):

- When estimating econometric models, the random variable or so-called error limit is normally distributed (Jarque - Bera).

- There is no autocorrelation problem for all econometric models estimated using the Breusch-Godfrey LM test. - Some models suffer from the problem of heterogeneity of variance according to the (Breusch-Pagan-Godfrey) test, including the model estimated by the (OLS) method after expanding the sample size by default, and the (ARDL) model, and this negatively affects the reliability of the econometric model.

- Existence of a multiple linear correlation problem in the models estimated (third and fourth) using the (VIF) test, as well as in the (ARDL) model.

- Using the (RESET) test or the (Ramsey test), we note that the simple linear regression models indicate the importance of adding a new economic variable, which means that there is a possibility of error in the description of the estimated econometric model, and the result does not differ in the multiple linear regression equation, except that in the logarithmic equation We note that the test indicated that it is not necessary to add a new variable.

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- When examining the relationship index between (R2 - W-D), we note that the R2 coefficient of determination is lower than the Durbin-Watson W-D test value, which may indicate that there is no false regression problem.

Inference Indicators for Spurious Regression

Certain indicators can be identified to deduce the spurious regression of the estimated econometric model:

- The stability of the direct relationship between the economic variables of the factors affecting imports in all the econometric models reinforces the explanatory power of the estimated model, given that more than one econometric method has been used, as shown by the four equations, and this is a key point when studying the problem of spurious regression, namely the relative stability of the strength and type of economic relationships, Here, we can say that in the first phase, an increase in (GDP) may lead to an increase in imports, but in the second phase, Import rates start to fall due to the diversity of income and production sources, and the relationship can be inverse at this point, but when the consumer price index (inflation) rises, the relationship must be inverse with imports due to the fall in real per capita income and the fall in the value of the local currency, but the sign (x2) was positive, which raises a number of questions and the estimated econometric model becomes an orbit of doubt in the reliability of the parameters when interpreting economic relationships. This calls for an in-depth study of econometric models and methods to arrive at an accurate interpretation that best represents the phenomenon.

- The important point is that in simple linear regression equations, we cannot accept the model from a statistical point of view, due to the acceptance of parameter significance and the increase in the value of the coefficient of determination. However, what raises doubts when estimating the multiple linear regression model are the shortcomings of the simple linear regression equations, as the parameter values are not significant, while the other statistical tests (F, R2, AIC, SC) are very high, indicating the possibility of a spurious regression due to the existence of the multiple linear correlation problem.

- When examining the stability test of the time series, we note that some variables (X1) and (X2) did not stabilize at the first difference, which means when using (ARDL) the model will suffer from false regression as a result of an error in the estimation

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process, which requires the necessity of using other econometric methods, including (VAR) method.

• Note that the use of the regression equation in the presence of the general trend was an attempt to reveal the existence of the spurious regression problem, and we note in table (1) the significance of the general trend, which indicates the existence of general trend relationships between economic variables, which may mean unreal relationships or what is known as spurious regression.

• According to the (Ramsey) test, we find that all econometric models require another economic variable (x), except (the logarithmic equation), given a significant increase in explanatory power ($R^2 = 0.98$). As might be expected in multiple regression equations, there will be a relative decrease in the coefficient of determination, offset by the possibility that there is no urgent need for another variable according to the (Ramsey) test.

• The relationship index between (R^2 - W-D) can be one of the basic indicators for detecting the possibility of spurious regression when the coefficient of determination (R^2) is greater than (D-W), which implies the existence of an autocorrelation problem, but in the case study there are econometric models It does not suffer from the autocorrelation problem, so all models entered (R^2 < D-W).

• We note that the appearance of a spurious regression can result from many points, the most important of which is a narrow range of data values, the number of values in the estimated econometric model being (16) observations, and the absence of a causal relationship between the consumer price index and imports, as well as a relative increase in the fixed limit value (segment parameter).

• In view of the above, we can emphasize the importance of integration between statistical, econometric and economic econometrics, as the relative instability between these standards can place the econometric model in the framework of an unjustified contradiction, increasing the level of non-acceptance of the econometric model, which means the possibility of an inaccurate interpretation of the relationships between the economy and economic phenomena.

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Processing Methods to Avoid the Problem of Spurious Regression

- Use other econometric methods to further investigate the existence of certain indicators important for inferring spurious regression, including (GLS), (ARDL) and (NARDL),

- Estimating relationships from the perspective of non-linear models, including the quadratic regression equation, as well as increasing sample size (N>30), all attempts to avoid the problem of spurious regression in order to obtain a econometric model that explains appearance in the best possible way.

- The importance of testing the stability of time series to find out how economic variables behave over time, and of looking for the co-integration method, which helps researchers to identify appropriate statistical methods to avoid the emergence of the spurious regression problem.

- Focus on integrating economic, statistical and econometric standards to accept the optimal econometric model.

CONCLUSIONS

In order to deduce spurious regression, it is necessary to integrate statistical, econometric and economic tests. In addition, the econometric experimental method allows us to search for the best unbiased estimators, including the comparison method between econometric methods, in order to avoid the problem of spurious regression. Moreover, the indicator ($R2 > D\text{-}W$) is useful for detecting the false regression problem if the autocorrelation problem exists, and it may become suspect if other econometric problems exist. The study suggests the use of the standard experimental method, and the comparison between statistical tests and econometric methods, which may lead to avoiding the problem of false regression. And continuing research in modern econometric methods to infer the problem of false regression. Also, Not adopting simple linear regression equations, as a result of the presence of many economic variables to explain economic and financial phenomena.

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