

Measuring The Impact Of The Corona Pandemic On The Efficiency Of Insurance Activity In The Kingdom Of Saudi Arabia

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Abstract: The research aimed to analyze the impact of the Corona pandemic on the efficiency of insurance activity in the Kingdom of Saudi Arabia. The method of analyzing cross sectional aggregate data for the time series of insurance branches was relied upon to examine the impact of the proposed explanatory variables (expense rate - retention rate - growth rate in premiums - loss rate - corona pandemic). The sectoral underwriting profit variable was relied upon to express the dependent variable. The results of the research concluded that there is a varying effect of the Corona pandemic on the efficiency of the activity of the insurance branches, depending on the different nature of each branch. The combined sectional regression model succeeded in explaining the change in activity efficiency rates for the insurance branches. There is a direct relationship between the activity efficiency of the insurance branches and each of the variables (retention rate - Corona pandemic), and an inverse relationship with each of (expenses rate - growth rate - loss rate). In general, there is a positive trend of the pandemic and the efficiency of activity for each of the insurance branches (health - engineering - property and accidents - protection and savings). While we find that the negative impact of the pandemic on the efficiency of the activity is reflected in the motor insurance branch.

keywords: Covid 19 - efficiency of insurance activity - financial solvency - health insurance - engineering insurance - vehicle insurance - protection and savings insurance - property and accident insurance - insurance sector - Saudi Arabia - data plate form.

Introduction

The insurance authorities have tried hard to maintain an appropriate level of financial and technical indicators due to exposure to the Corona pandemic, while protecting employees and policyholders. In addition to balancing the unexpected increase in claims with the capital and the stability of the financial solvency, which led to an increase in the exposure of the insurance sector to risks as a result of this epidemic (Sama, 2020). This type of risk negatively affects both the assets and liabilities of

insurance companies at the same time (White, 2020). This leads to a decrease in assets relative to liabilities, and therefore the regulatory authorities must continuously verify the impact of the epidemic on the solvency ratios, and the book value of the receivables of insurance companies (Kirti.et.al, 2020) (Harris, 2021). The increase in the severity of the risks to which the insurance sector is exposed leads to the complexity of the insurance operations, and the difficulty of estimating the financial and

technical indicators of the results of the activity, and the matter becomes more complicated when the analysis is done on the basis of the results of the various insurance branches. This requires the provision of more financial, technical and actuarial analysis tools, which work to ensure the soundness of the company's financial position and its ability to fulfill its future obligations. Although insurance companies are considered less risky than the banking sector because they are less exposed to liquidity risks, the increasing interactions between the insurance sector, financial markets and other financial intermediaries, as well as financial innovation, globalization and liberalization of the financial system, made it one of the sectors most affected by global crises (Ramasamy, 2020) (Abdul Qader, 2020). One of the most important effects that resulted from the Corona pandemic was the disruption of the financial stability of the insurance companies. As the values of trade receivables and payables were affected, which requires testing whether the value of insurance companies' dues and obligations also increases during the pandemic period.

The increase in the volume of claims and the decrease in solvency indicators led to more responsibility resulting from the need to strike a permanent balance between the large increase in the number of claims with the stability of capital and solvency (Puławska, 2021) (Lan, 2020). Insurance companies have taken a very wide range of measures to help their clients, which included temporary fee deferrals, fee waivers or even partial refunds of premium payments. This was reflected in the degree of risk borne by insurance companies, which also differs according to the degree of severity of the pandemic in a specific geographical region, as well as according to the type of insurance coverage, as the size of the impact will not be the same in each insurance branch, as a result of the great variation in the impact of the pandemic on risks. The various measures that society is exposed to, as well as the differences in the measures introduced by governments. Also, the extent to which insurance

companies cover certain losses depends on their absorptive capacity for risks and their regulatory and supervisory systems (Stojkoski, 2021) (Choi, 2021) (Puławska, 2021) (Al-Abyad, 2020) (Omran, 2021).

The Corona pandemic provided fertile material for study and analysis for many experts and researchers. As the field of scientific research in the field of insurance and actuarial sciences witnessed a boom in the number of scientific research submitted during the pandemic period, as an attempt by them to identify the expected effects of the pandemic on the insurance markets. (Wang, 2020) aims to analyze the impact of the Corona pandemic on the insurance market in China. He concluded that the pandemic had had a negative impact on many activity rates in the Chinese insurance market, perhaps the most important of which are (income from commercial insurance premiums - the monthly growth rate of premiums - the density of insurance - the depth of insurance). He proposed a set of measures to mitigate the effects of this pandemic, by trying to raise the level of social security, and increase the degree of dependence on digital insurance and electronic marketing tools. In contrast to the negative impact on the activity of the insurance sector, which Yating Wang found in his study, the results of the study (Al-Amayreh, 2020) showed a high impact of the pandemic on the general performance indicators of Jordanian insurance companies. The performance measure was based on four axes (financial - technical - technological - human). Where the impact was positive on the technological dimension. The results showed a unique employment of technological capabilities to work remotely, conduct business and provide the necessary services to customers, accompanied by the availability of protection and security systems that enabled companies to work remotely. The impact was positive in the insurance companies' dealings with the human element, in terms of financial rights, health procedures, creating a safe work environment as much as possible, and work plans. The results showed the interaction of insurance company cadres with the pandemic in terms of performance and

commitment to perform tasks. The study showed a negative impact represented by a decrease in the number of documents subscribed to the general insurance, and a decrease in the volume of credit provided to individuals. (Kirti.et.al, 2020) showed a negative impact of the pandemic on insurance companies. Where the companies under study witnessed widespread financial turmoil across asset classes, and that insurance companies faced many challenges in light of the increase in the number of deaths, and the payments of those companies are large in relation to their capital, and the insurance companies witnessed widespread reductions in the classification of assets, and a continuous decline in interest rates. He recommended tightening control over insurance companies with dangerous holdings, and monitoring financial stability assessments and insurance companies' capital. (Babuna.et.al.2020) He worked on comparing the impact of the pandemic (Covid-19) on the insurance industry, with previous epidemics such as (swine flu) and (SARS), by studying the case of insurance companies in Ghana. He agreed with (Wang, 2020) that there is a negative impact of the pandemic, compared to what was the situation in light of previous epidemics, in terms of economic recession, decreased profits, flight cancellations, and other economic losses, and concluded that insurance companies in Ghana have lost a large part of their profits. capital during the crisis, and recommended that insurance companies in Ghana adapt to remote working, train and equip their staff to work under social distancing regulations, and strengthen and simplify cybersecurity protocols. (Baumann, 2020) It is expected that insurance companies around the world will face large financial losses in the long term due to the crisis, and that these losses will result in a change in the nature of the work of those companies in terms of formulating the insurance policy and reinsurance coverage. He recommended preparing response plans to confront the epidemic, and the need to innovate new insurance products to gain the confidence of shareholders and customers. This is consistent with the study conducted by (Egyptian

Insurance Federation, 2020) entitled "The Impact of the Corona Virus on the Financial Expectations of Insurance Companies," which clarified the difficulty of managing companies during the pandemic period, especially with the multiplicity of agencies that must be taken care of to maintain the safety and security of employees and customers. and enable business continuity. The study referred to the main elements that must be taken into account while preparing the various financial scenarios resulting from the impact of the Corona virus, related to the duration of the pandemic and its impact on new issuances, the impact on total premiums, liquidity, the impact on investment return, and the impact on claims.

(Al-Abyad, 2020) Considering these elements contributed to the Saudi insurance sector overcoming the Corona pandemic. He also attributed this to the fact that the effects of insurance companies operating in the Kingdom are limited in comparison to the conditions of collapse of international companies in light of the outbreak of the pandemic, and as a result of the factors of little exposure of Saudi establishments to international companies, and the nature of the conditions of insurance concentration, in addition to the state's guarantee of a complete treatment for cases of infection with the Corona virus. Previous studies confirm the varying impact of the pandemic on insurance branches in many countries of the world, despite what was explained by (Al-Abyad, 2020) regarding the Saudi insurance market. Studies have shown otherwise for European insurance companies. (Puławska, 2021) based on the use of financial data of European insurance companies from 2010 to 2020, indicates that the pandemic has negatively affected the performance of the insurance sector. The return on assets of German and Italian insurers fell during the pandemic. The solvency ratio also decreased in the Belgian, French and German insurance branches, while the Polish insurance sector was not affected. The value of receivables to Belgian insurance companies has increased. He recommended that mechanisms for managing potential financial problems for insurance

companies during the COVID-19 pandemic should be discussed at the European Union level. Nebolsina, 2021)) indicated that the pandemic and the measures taken to limit the spread of the disease led to a significant disruption of economic activity in countries all over the world, which led to huge losses in the insurance sector. These losses were absorbed by policyholders, because few companies have business interruption coverage that responds to these types of losses. It focused on mechanisms for providing business interruption insurance against pandemic risks with the support of governments, and some of the challenges and considerations necessary to establish such a program. (Nebolsina, 2021) Examined the impact of pandemic-related changes on demand for insurance services due to business interruption, using automatic regression models, on data from fifty states and territories over three time periods. The trend results of the Google search engine "Google Trends" were relied upon as a variable that reflects the impact of the pandemic, and the variable of initial claims for unemployment insurance benefits as internal variables in the built models. The results of Elena and previous studies agreed that there is a direct relationship between claims and the pandemic factor, as the ratio of costs incurred to US GDP due to the pandemic reached seven percent in 2019. The demand for insurance services increased by almost six times. The study recommended the need to adopt joint protection plans between the public and private sectors, to be able to secure a more efficient response to the losses associated with the epidemic that may occur in the future. (Haque.et.al, 2021) An examination of the impact of the pandemic on the insurance industry in Bangladesh. Based on quarterly data for the best performing companies at the level of life and general insurance. The results confirmed the negative impact of the pandemic on the income of quarterly premiums, and the intensity and depth of insurance. (Puławska, 2021) suggested that EU national supervisory authorities contribute to mitigating the impact of the pandemic on the European insurance sector, by trying to balance the increase in the

number of claims with capital stability and solvency. (Stojkoski, 2021) Using a seasonal autoregressive model, he found that during the first half of 2020, activity in the insurance industry contracted by more than 10% to what was expected. The total loss in the industry amounted to about 8.2 million euros. The reserves provided by the Insurance Supervisory Agency as funds to deal with the potential crisis were not sufficient to cover this unexpected volume of losses. (Qian, 2021) indicated that the largest increase in insurance revenues is life insurance, followed by health insurance, while the activity of the motor insurance sector decreased. He also explained that the variance in the geographical impact of the pandemic has contributed to the different results of the activity of the insurance branches, as the worst results are associated with regions that suffer from treatment conditions and a higher medical burden. (Dokunmu.et.al, 2021) Review challenges arising from health burdens, health care delivery, health care coverage before and during the pandemic, health insurance schemes, and strategies for future improvements in Nigeria. The study indicated that the pandemic contributed to a decrease in activity indicators for the health insurance sector. (Yadav, 2021) found a negative impact on the life insurance business mainly in terms of lower sales of new policy, premium income and claims settlement crises, due to the high number of deaths in the Covid pandemic. The study recommended that insurance companies should come up with more innovative customer-centric solutions that provide multiple benefits to policyholders. The pandemic contributed to raising the level of insurance awareness in society, especially towards health and life insurance.

The Kingdom of Saudi Arabia has taken proactive measures towards dealing with the consequences of the Corona pandemic, which included imposing a curfew, while continuing economic activities in the Kingdom at full efficiency. This affected the growth rates of premiums for all insurance products to varying degrees. On the other hand, the pandemic resulted in

an increase in the demand for health care insurance. As the premiums for this type of insurance continued to grow, customers wanted to take advantage of it as a means of managing health risks. The Saudi insurance market represents one of the most important insurance markets in the Arab region, as it witnessed rapid growth rates during the recent period. Where we find that the Saudi insurance market, which includes 34 companies operating in the field of insurance and insurance brokerage, has achieved a growth rate in total written premiums of 8.4% during the year 2022 AD, as the total written premiums amounted to 42 billion riyals. The total written premiums for health insurance amounted to 7.6 billion riyals (annual report of the Saudi Central Bank) (Al-Jazeera, 2021) (Al-Abyad, 2020). As a result of the Saudi insurance companies having huge capital, they have the ability to absorb the losses they face as a result of the pandemic. Many insurance experts in the Saudi market have indicated that the impact of the Corona pandemic is much less compared to other economic branches. This was evidenced by the significant decrease in the number and value of losses resulting from accidents, as a result of the curfew imposed in the Kingdom for long periods during the pandemic, which led to a decrease in the values of claims related to many types of insurance, especially vehicle insurance, as well as health insurance, which the government borne. brunt of it. The insurance systems and policies followed in the Kingdom during the pandemic were also in place, as well as government support, which contributed to alleviating the impact of the pandemic (Al-Omran, 2021) (Al-Jazeera, 2021). The variation in the degree of risks resulting from the Corona pandemic has contributed to increasing the need for mechanisms to ensure the level of solvency of insurance companies, their ability to continue, and to pay obligations, not only at the level of the company

Strategies for insurance agencies to manage the risks of the Corona pandemic

as a whole, but also extends to analyzing the efficiency of the activity of each of the various branches of insurance, due to the variation The impact of the pandemic on the efficiency of the sectoral activity of the insurance authorities. And this is done by relying on the actuarial and statistical models developed as a tool for analyzing the sectoral activity of insurance, during a time series that includes time periods that reflect the impact of the Corona pandemic on insurance activity, to determine the extent of the impact during the short term. This prompted us to present this research as a proposed model for measuring the efficiency of the insurance sectoral activity, reflecting the impact of the pandemic on each of the different types of insurance. The COVID-19 pandemic has negatively affected the performance of the insurance sector. As the forced closure in most countries negatively affected the insurance sector. Insurance companies are interested in the stability of financial systems in the financial markets, and insurance companies seek financial stability for society and companies by insuring their risks. It is therefore particularly important to analyze how the pandemic will affect insurance companies. Preliminary analyzes indicate that the exposure of the insurance sector to risks has increased as the outbreak of the virus severely affected the lives of citizens, the financial sector and all economic activities. Although there are many studies that have been carried out to measure the impact of the Corona pandemic on many economic aspects of society, there is a dearth of studies that dealt with the insurance sector, especially in the Arab region. This prompted the research team to present this study, which aims to "measure the impact of the Corona pandemic on the efficiency of the activity of the various insurance branches in the Kingdom of Saudi Arabia."

Many insurance experts and regulatory bodies have developed several scenarios as an attempt to confront the expected effects of the Corona pandemic on the insurance sector. Renewals,

refunds and liquidation. Where financial and economic crises lead to customers defaulting, and their inability to pay installments. This effect is reflected in both individual and group insurance. The impact of the pandemic extends to individual insurance as a result of the low level of customer income, as well as the inability of the company's marketing apparatus to perform its role efficiently due to the curfew and the restriction of working hours, which works on the inability to interact between customers, agents, brokers and sales representatives. The bancassurance sector was also affected as banks reduced working hours. As for the impact on group insurance, it resulted in the cessation of the activity of many companies and agencies, and even many of them faltered. On the other hand, local or global crises result in an increase in customers' awareness of the role of insurance in facing the risks they are exposed to in times of crisis (Polinkevych, 2021) (Gangopadhyaya, 2020).

Insurance companies must also take into account the impact of crises on incurred claims, especially those resulting from epidemics and pandemics. The role of the underwriting and pricing apparatus for insurance companies is growing, and the actuarial department must account for all factors affecting insurance pricing, especially in times of crisis, such as the expected infection rate with the Corona virus, as a percentage of the total population, and therefore the number of insured persons, and the expected death rate among those infected with the virus. Corona, and this percentage varies according to the age group, health status, demographics, and the characteristics of the health care system. Bearing in mind that the impact of the pandemic on the volume of claims incurred varies according to the insurance sector, as claims resulting from the Corona virus increase in the medical insurance sector, while in the property sector, epidemic risks are generally excluded, but claims may result from business interruption insurance policies and business default insurance. Credit Repayment (Shaw, 2020) (Farrell, 2020).

Liquidity risk management is also one of the most important tools that enable insurance companies to face expected or current crises, as it must ensure that there is sufficient liquidity to cover obligations and expenses. There are many factors affecting the liquidity elements in insurance companies, perhaps the most important of which is setting expectations for future cash flows, which may be affected by the increase in the default rate of loans granted to policyholders, as well as the ratio of outstanding premiums to the total direct premiums, resulting from giving customers an additional period to pay the premiums. . Therefore, decision makers in insurance companies must activate monetary governance mechanisms by limiting unnecessary cash expenditures, and periodic follow-up of liquidity indicators (Deloitte, 2020) (Babuna, 2020).

As the liquidity rates of insurance companies are affected by changes in the rates of return on investment resulting from lower interest rates, which affect bank deposits, government bonds and traded shares. This directly affects life insurance products. Expenses are one of the most important factors affecting liquidity in insurance companies, being the main driver of the company's profits and losses. As the pandemic automatically contributed to reducing operating costs, through remote work mechanisms, a decrease in the percentage of new releases, the cancellation of some of the company's celebrations and seminars, and the postponement of some large projects until the end of the pandemic (Parvathi, 2021) (Ramasamy, 2020).

The risk management policy pursued by the insurance company must include setting parameters dealing with reinsurance, perhaps the most important of which are the mechanisms for verifying the alignment of reinsurance coverage with the coverage provided to customers by the insurance company, especially in the condition of excluding epidemics. As well as making sure that reinsurance compensation is taken into account, as it reduces the volume of claims. It is also necessary

to ascertain the strength of the financial solvency of the reinsurance companies, and to study the possibility that the reinsurance company will not be

able to pay the compensation (Haque 2021) (Levantesi, 2021).

Analysis of the impact of the pandemic on the insurance branches

The proposed model applied using the aggregate cross-sectional data model (PLS) is based on ignoring the effect of significant differences between insurance branches, and therefore it collects data as a single unit regardless of individual differences between branches, which indicates that there is no significant effect of a different Corona pandemic variable on each of the branches of insurance under study. As a result of ignoring the heterogeneity between each of the insurance companies and branches under study, they provide constant coefficients during the time periods of the study for each of the variables proposed for the study. And function (1) shows the structural structure of the proposed model using the cross-sectional aggregate data model (PLS) (Vojinović, 2022) (Farooq, 2021) (Hsiao, 2022).

$$\begin{aligned} \text{Performance}_{it} &= \alpha_0 + \alpha_1 \text{Expenses rate} + \alpha_2 \text{Retention rate} \\ &+ \alpha_3 \text{Growth rate} + \alpha_4 \text{loss ratio} + \alpha_5 \text{COVID} \\ &- 19 \text{ pandemic} \\ &+ \varepsilon_{it} \dots \dots \dots \dots \dots \dots \dots \dots \end{aligned} \quad (1)$$

The previous relationship reflects the structural structure of the aggregate sectional regression model, where the dependent variable (Performance) represents the level of activity efficiency for the various insurance branches. The variable (underwriting profit rate) was used to measure the activity efficiency of the insurance sector. It refers to the company's ability to generate profits from the premiums collected for each of the various insurance classes, which reflects the efficiency of the company's underwriting policy. The proposed model relied on a set of explanatory variables, which the model assumes contribute to changing the underwriting profit rate values. The explanatory variables include a group of changes, which are, in order (expenses rate, retention rate,

premium growth rate, loss rate, and the Corona pandemic). To test the significance of the relationship between each of the dependent variables and the explanatory variables for each of the insurance branches under study (health, vehicles, engineering, property, protection and savings), a sample of five insurance companies operating in the Saudi insurance market was relied on during the period (Q4-2017) to (Q2 2023). The significance of the application of the combined cross-sectional data model (PLS) was examined, which aims to measure the impact of the explanatory variables on the dependent variable, regardless of the individual differences between the insurance branches of the sample, which indicates that there is an equivalent effect of the Corona pandemic on the insurance branches of the study sample. It should also be taken into account that the model used in the study represents one of the types of unbalanced cross-sectional data models, as the time series (23 quarterly periods) has complete data for all branches of insurance except for the engineering insurance sector, which consists of (15 quarter periods). annual). The model is also one of the (Long Panal) models, as the number of quarterly periods is greater than the number of insurance branches under study. The researcher made sure of the stability of the time series for all the variables, and relied on the time series for the first or second difference of the variables that suffer from the problem of instability for both the mean and the variance. The Eviwes 13 statistical program was used to analyze the results. Table (2) shows a summary of the results of the PLS model (Karacor, 2016) (Kumari, 2017) (Hsiao, 2022).

Table 1: Multiple regression model for cross sectional pooled data (PLS)

Variable	C	Expense s	Retentio n	Growt h	loss	COVI D	R- square d	Adjuste d R- squared	F- statisti c
Coefficien t	1.52 4	-0.038	0.557	-0.113	- 1.73 8	0.195	0.554	0.53	22.704
Std. Error	0.31 4	0.088	0.199	0.106	0.19 1	0.245	Akaike info criterio n	Schwarz criterion	Prob(F- statistic)
t-Statistic	7.32 4	-0.649	2.933	-1.319	- 9.71 2	0.799			
Prob.	0.00 0	0.522	0.016	0.198	0.01 2	0.445	3.079	3.232	0

Table 1 shows the results of the regression model for the pooled sectional data (PLS), for each of the insurance branches under study, to examine the impact of the Corona pandemic and a set of explanatory variables on the efficiency of the sectoral insurance activity, which was measured using the underwriting profit rate index. The table shows the significance of the proposed model to describe the regressive relationship between the variables. The value of the coefficient of determination of the model was 53%. That each of the variables (expenditure rate - growth rate - corona pandemic) is not significant at a significant level of 5%. While there is a significant effect for each of the variables (retention rate - loss rate), there is also a direct relationship for the retention rate and underwriting profit for each of the insurance branches. There is an inverse relationship between the rate of loss and the efficiency of the sectoral activity of the insurance branches, which are logical results and are consistent with the results of previous experience. From the foregoing, it is clear that although the model is statistically

Fixed Effects least squares dummy variable (LSDV) model

A cross-sectional data model was applied, which takes into account the individual differences between the results, and therefore there is a different effect for each of the insurance companies

acceptable, it does not explain the results in light of the individual differences between each of the different branches and insurance companies, which was reflected in the significance of the coefficients of the variables in the model. This indicates that the model suffers from a heterogeneity or individuality problem. This enables the interpretation of the difference in the results according to the different units under study. There are also some coefficients that have a trend that differs from our previous experience, such as the coefficient of the variable growth rate of premiums - with a negative sign - although many studies confirmed the existence of a direct relationship to this variable and the underwriting profit rate. Despite the results of the model, the coefficient of the variable that reflects the impact of the Corona pandemic has a positive trend, which means that there is a non-significant positive effect of the Corona pandemic on the efficiency of activity in the insurance branches of the companies under study (Kumari, 2017) (Hsiao, 2022).

and branches, which leads to different coefficients of the model according to the difference of each insurance branch. Where the fixed effect (FE) models analyze data on variables in two directions, one of which is the insurance branches under study (health - vehicles - engineering - property -

protection and savings), and the other is time. Thus, it takes into account the heterogeneity of each of the two directions (insurance branches - time). The cross-sectional data model with a fixed effect allows the collection of all observations, by substituting a single variable representing the different branches of insurance, in order to distinguish the significant individual characteristics of each of these branches, if any. Thus, it provides different regression coefficients for each insurance branch, but they are constant over time. Thus, the model ignores the effect of time, and focuses on the differences resulting from individual differences between the characteristics of the insurance branches.

The fixed-effect (FE) pooled regression model provides the necessary statistical tools to analyze and interpret the variance in the data resulting from individual differences between insurance classes. Where the impact of the Corona pandemic on the efficiency of the activity of the insurance branches differs, depending on the different nature of each branch. The fixed-effect cross-sectional data model assumes that the regression coefficients differ according to the different units under study, which depend on the change in the dependent

variable, which reflects the efficiency of the insurance activity of the insurance branches. By applying the fixed effect (FE) model, the effect of random changes due to change in time (t) can be ignored. Thus, it is possible to measure the significant effect of the explanatory variables on the dependent variable, without falling into the problem of heterogeneity of the units under study, or the problem of autocorrelation. Where the model assumes that each insurance branch has different characteristics from the other branch, and therefore the amount of standard error, as well as the fixed part, will not be related to an instance of other branches. Thus, the (FE) model provides

explanations for all the changes that occurred for the different branches of insurance during the study period, with its ability to eliminate the common effects of variables in the insurance branches. Therefore, the estimated coefficients of the model will not suffer from the problem of bias (Ortynski, 2016).

The application of the sectional regression model with a fixed effect over time is associated with a set of determinants, and perhaps the most important of these determinants is that each dummy variable that is added to represent one of the branches of insurance leads, in turn, to a deduction of a degree of freedom for the model, and the addition of dummy variables may lead to the problem of self-correlation Multicollinearity values. The treatment of this problem depends on deleting one of the dummy variables to be (n-1). In addition, the random error of the model represents a variable that follows a normal distribution with parameters $(0, \sigma^2)$. The fixed-effect (FE) aggregate data panel model was applied to test the hypothesis of different regression coefficients for each insurance branch, as a result of the different effect of explanatory coefficients on underwriting profitability for each of the insurance branches (Karacor, 2016) (Kumari, 2017). The mathematical model, which reflects the application of the FE model, can be formulated as follows:

$$\begin{aligned} \text{Performance}_{it} = & \alpha_{0i} + \alpha_1(\text{Expenses rate})_{it} \\ & + \alpha_2(\text{Retention rate})_{it} \\ & + \alpha_3(\text{Growth rate})_{it} \\ & + \alpha_4(\text{loss ratio})_{it} \\ & + \alpha_5(\text{COVID - 19 pandemic})_{it} \\ & + \varepsilon_{it} \dots \dots \dots (2) \end{aligned}$$

It is evident from the relationship (2) the difference in the regression coefficients for each unit of study (α_{0i}), which is reflected by the addition of the sub-coefficient i, in contrast to the aggregate cross-sectional data model (PLS), which deals with constant coefficients for all branches of insurance (α_0). In order to estimate the coefficients of the model, the relationship between the values of the explanatory variables and the dependent variable

for each of the various branches of insurance under study was examined, and the following table shows the results of the analysis:

Table 2: Multiple Regression Model for Fixed Effect (FE) CT Data

Variable	C	Expense s	Retentio n	Growt h	loss	COVI D	R- square d	Adjuste d R- squared	F- statisti c
Coefficien t	0.93 2	-0.186	0.799	-0.094	-1.15	0.3784	0.837	0.794	27.948
Std. Error	0.19 6	0.063	0.157	0.083	0.16 3	0.1574	Akaike info criterio	Schwarz criterion	Prob(F- statistic)
t-Statistic	4.75 3	-2.945	5.086	-1.141	- 7.06 8	2.8584	n		
Prob.	0	0.011	0	0.428	0	0.016	3.125	2.724	0

The fixed effect model succeeded in explaining 79.4% of the change in activity efficiency rates for insurance branches, compared to 53% for the combined cross-sectional data model (PLS). That is, relying on the individual characteristics of the insurance branches has led to an increase in the coefficient of determination of the model. It is also clear that the coefficients of the model variables are significant except for the growth rate variable, and thus the regression coefficients can be interpreted with a high degree of accuracy. The table shows that there is a direct relationship between the efficiency of the activity of the insurance branches and each of the variables (retention rate - Corona pandemic). While there is an inverse relationship for each of (expenses rate - growth rate - loss rate) on the activity efficiency of the insurance branches. The results show the positive impact of the Corona pandemic on the efficiency of the underwriting activity of the various insurance branches. The growth rate variable shows an inverse trend of change with the efficiency of the underwriting activity. There is a positive trend to the pandemic

and the efficiency of activity for each of the insurance branches (health - engineering - property and accidents - protection and savings). While we find that the negative impact of the pandemic on the efficiency of the activity is reflected in the motor insurance branch. Despite the efficiency of the fixed-effect (FE) cross-sectional data model in interpreting the changes that occurred in the dependent variable, taking into account the individual differences in the characteristics of the different branches of insurance, what is considered in the model is the stability of the values of the coefficients over time. A higher value of the test statistic indicates the ability of the fixed-effect segmental data model (LSDV) to interpret the regression coefficients, in contrast to the lower quality of the pooled model (PLS) (Kumari, 2017) (Hsiao, 2022).

Table 3: The outputs of the regression model (LSDV) for the property and casualty insurance branch

	Coefficients	t Stat	P-value	Regression Statistics	
Intercept	2.222	5.206	0.002	Adjusted R Square	0.781
Expenses rate	-0.562	-2.972	0.017	Standard Error	0.846
Retention rate	-0.289	-0.863	0.512	ANOVA	
Growth rate	0.394	2.721	0.006	F	5.124

loss ratio	-1.475	-3.890	0.004	Significance F	0.000
COVID-19 pandemic	0.806	3.018	0.007		

The value of the coefficient of determination was 78.1%, in a positive direction for the Corona pandemic. That all regression coefficients in the model are significant except for the “retention rate” variable, which is consistent with the explanations that have been presented, that there is no significant effect of the retention rate on the development of the underwriting activity of the property and accident insurance branch. It is clear that there is a positive significant effect of the growth rate in premiums, and a negative effect of the loss rate on

the underwriting profit rate. With regard to the impact of the Corona pandemic, the results reflected a positive significant impact of the Corona pandemic on the development of the underwriting activity of the property and accident insurance branch. This insurance bag during times of crisis.

Table 4: Outputs of the regression model (LSDV) for the protection and savings insurance branch

	Coefficients	t Stat	P-value	Regression Statistics	
Intercept	-0.570	-0.929	0.307	Adjusted R Square	0.6894
Expenses rate	0.147	0.602	0.352	Standard Error	0.7124
Retention rate	0.085	1.079	0.119	ANOVA	
Growth rate	1.106	2.825	0.006	F	3.6257
loss ratio	-1.378	-2.708	0.006	Significance F	0.0121
COVID-19 pandemic	0.647	2.103	0.025		

The proposed variables contributed to explaining 68.9% of the change in the efficiency of the underwriting activity of the Protection and Savings Insurance Branch. Noting that retention and loss rates are not estimated for the protection and savings activity due to the availability of the savings component, the short-term savings effect was assumed to be stable as a consideration to obtain indicators of the efficiency of the underwriting activity only. Referring to the regression coefficients, we find that each of the coefficients (expenditure rate - retention rate) is not

significant at a significant level of 5%. While we find that there is a positive effect of the growth rate variable in premiums. That there is an inverse effect of the loss rate variable on the efficiency of the underwriting activity. It is evident that there is a direct significant effect of the Corona pandemic on the efficiency of the underwriting activity for protection and savings insurance.

Table 5: The outputs of the regression model (LSDV) for the health insurance branch

	Coefficients	t Stat	P-value	Regression Statistics	
Intercept	0.831	28.064	0.012	Adjusted R Square	0.847
Expenses rate	-0.266	-3.115	0.019	Standard Error	0.029
Retention rate	-0.335	-3.432	0.015	ANOVA	
Growth rate	0.160	2.443	0.030	F	395.125
loss ratio	-1.239	-34.528	0.012	Significance F	0.000
COVID-19 pandemic	0.160	2.344	0.034		

The explanatory variables of the proposed model (expense rate - retention rate - growth rate - loss rate

- corona pandemic) succeeded in explaining 84.7% of the change in the dependent variable

(subscription profit rate). Referring to the values of the coefficients of the explanatory variables in the model, we find that they are all significant (P-value < 0.05). Where we find that there is a significant direct relationship for each of (growth rate - Corona pandemic) on the efficiency of the activity of the health insurance branch, which is consistent with the previous result that the Corona pandemic has contributed to the growth of the health insurance branch in the Saudi market. While we find that the increase in the value of retention rates as well as loss rates contributed to an adverse effect on the underwriting profit rates, this result can be explained due to the high value of the loss rate of

the health insurance branch, and therefore it represents one of the poor risks that the reinsurer avoids accepting. Accordingly, the growth in the results of the branch is due to the increase in the volume of premiums, resulting from the increased demand for this type of insurance due to the presence of a health pandemic, with the increase in insurance prices during this period, which contributes to the growth in the volume of premiums in a way that is not matched by a similar rate to the growth in rates Underwriting profits.

Table 6: The outputs of the regression model (LSDV) for the motor insurance branch

	Coefficients	t Stat	P-value	Regression Statistics	
Intercept	0.361	5.008	0.012	Adjusted R Square	0.796
Expenses rate	-0.465	-9.720	0.012	Standard Error	0.129
Retention rate	-0.035	-2.977	0.021	ANOVA	
Growth rate	0.163	0.643	0.503	F	21.395
loss ratio	-0.650	-5.353	0.016	Significance F	0.000
COVID-19 pandemic	-0.052	-3.282	0.017		

There is a negative impact of the high values of expense rates on the underwriting profit rate, and the high values of loss and retention rates have contributed to presenting a negative impact on the underwriting profit rate of the motor insurance branch, and therefore it can be said that it represents one of the bad risk branches that are difficult to accept as reinsurers. Among the most important explanations that support the results reached, the country was subjected to periods of curfews and partial cessation of economic activity, which prompted many to avoid danger. In addition, the low level of income for individuals and the

cessation of activity of many companies has led them to not pay the installments. This is statistically reflected in the negative trend of the Corona pandemic variable in the proposed regression model, which indicates that there is a negative impact of the Corona pandemic on the vehicle insurance sector in the Kingdom. This result also agrees with the statistical trends of the fixed-effect cross-sectional data model. This shows the adverse effect of the pandemic on all results of the branch.

Table 7: Regression Model Outputs (LSDV) for the Engineering Insurance Branch

	Coefficients	t Stat	P-value	Regression Statistics	
Intercept	0.518	0.604	0.486	Adjusted R Square	0.747
Expenses rate	-0.514	-1.725	0.140	Standard Error	0.957
Retention rate	0.811	5.214	0.012	ANOVA	
Growth rate	1.889	2.010	0.096	F	9.691
loss ratio	-1.326	-4.712	0.029	Significance F	0.000
COVID-19 pandemic	1.004	3.300	0.014		

The explanatory value of the model was 74.7%, and therefore the proposed variables of the model succeeded in explaining the change in underwriting profit for the engineering insurance branch. The output of the model reflects the significance of the regression coefficients except for the expense rate variable, where a strong direct relationship appears between each of the retention rate and the underwriting profit of the engineering insurance branch, which confirms the previous findings that engineering risks represent good risks for reinsurers, which led to an increase in insurance rates. retention. Increasing the volume of premiums during the study period contributed to providing significant direct coefficients between each of the variable rate of premium growth and underwriting profit. While we find that there is a significant inverse relationship between each of the loss rate and the underwriting activity of the engineering insurance branch, which explains the high values of the underwriting profit rates as a result of the low loss rates. Finally, we find that there is a statistically significant positive effect of the Corona pandemic on the efficiency of the underwriting activity of the engineering insurance branch, as we find that the pandemic has contributed to an increase in the volume of written premiums, as a result of the tendency of many beneficiaries of factory owners and businessmen to engineering insurance for fear of stopping their productive activity during The pandemic period, as well as the volume of paid claims decreased as a result of the strict controls that were imposed by the Kingdom on industrial activity during this period, within the framework of the protocol dealing with the pandemic.

Conclusion

The aim of the research is to examine the significance of the differential impact of the Corona pandemic on the different branches of insurance, through the application of dashboard models. It was concluded that the fixed-effect regression model FE-LSDV provided high explanatory coefficients compared to the combined cross-sectional data

model (PLS). This is due to the reliance on the individual characteristics of the insurance branches, which led to an increase in the coefficient of determination of the model. The results of the model revealed that there is a direct relationship between the efficiency of the activity of the insurance branches and each of the variables (retention rate - Corona pandemic), while there is an inverse relationship for each of (expenses rate - growth rate - loss rate). There is a positive impact of the pandemic and the efficiency of the activity for each of the insurance branches (health - engineering - property and accidents - protection and savings). The negative impact of the pandemic on the efficiency of the activity is reflected in the vehicle insurance branch. There is a significant direct relationship for each of (growth rate - Corona pandemic) on the efficiency of the activity of the health insurance branch, while we find that the increase in the value of retention rates as well as loss rates contributed to an inverse effect on the underwriting profit rates. That there is a negative impact of the Corona pandemic on the development of the performance of the motor insurance branch in the Kingdom during the study period, as it found a negative impact of the high values of expense rates on the underwriting profit rate. There is a growth in engineering insurance premiums during the Corona period, while we find that there is a contraction in the volume of paid claims, and an increase in underwriting expenses and profit. There is also a strong direct relationship between each of the retention rate and underwriting profit for the engineering insurance branch. There is a significant inverse relationship between each of the loss rate and the underwriting activity of the engineering insurance branch. There is also a positive impact of the Corona pandemic on the efficiency of the underwriting activity of the engineering insurance branch, as we find that the pandemic has contributed to an increase in the volume of written premiums. The property and casualty insurance branch witnessed positive growth in both earned and written premiums. And the decrease in the

volume of claims compared to the volume of written premiums, which contributed to lower loss rates. The results also reflected a positive significant impact of the Corona pandemic on the development of underwriting activity. With regard to the results of the protection and savings insurance branch, it shows an increase in the

volume of written and earned premiums, offset by a consistent increase in both incurred and paid claims, and underwriting expenses. There is also an inverse effect of the loss rate variable on the efficiency of the underwriting activity.

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