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Insurance coverage in unstable region: Managing insurance claim risk amid Kashmir's political landscape

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Abstract: This study investigates the impact of prolonged political unrest on insurance claim amounts in Kashmir. It examines the behavior and coverage provided by insurance companies in high-risk areas, focusing on the hazards and perils associated with terrorism and political uncertainty. By analyzing historical data on political violence and terrorism in Kashmir, the study reveals significant patterns and relationships through descriptive statistics. The findings demonstrate that higher levels of political violence and terrorism lead to increased losses for insurers. Moreover, the study underscores the necessity of tailoring insurance coverage to the specific risks in unstable regions. It suggests employing time series analysis for more accurate pricing of insurance policies during periods of political instability. These insights offer practical implications for insurance companies, policymakers, and stakeholders, facilitating more effective risk assessment, pricing, and risk management strategies in volatile areas. In addition to outlining general customer requirements, the study discusses the measures and regulations needed for commercial insurers to provide economical services in such contexts. This comprehensive analysis enhances the understanding of the effects of abnormal situations like prolonged political unrest in Kashmir. Ultimately, the study proposes the integration of time series analysis into insurance pricing models to better navigate periods of political instability.

Keywords: *Adverse selection, Occurrence, Perils, Reinsurance, Severity, Terrorism risk, Time series.*

1. Introduction

War and conflict have far-reaching consequences for human and physical capital, with far-reaching economic consequences (Omar *et al.*, 2017). In today's economic and political climate, there always remains the constant threat of acts of war and terrorism. Political risks and war hurt insurance (Lindberg and Morndal, 2002). Terrorism is a multifaceted phenomenon with a challenging definition and numerous contributing factors. Some possible causes include the presence of failed states, weak governance, political instability, corruption, poverty, and unemployment, all of which can contribute to terrorism and political upheaval (Mushai, A., & MacGregor, A., 2016). Advancement in technology in recent times has made the world a global village where people are required to travel abroad to different places for their jobs and in some cases to places of political unrest. People do wish to get adequate coverage in such high-risk areas however they find it extremely difficult to get a package as per their requirements. In such situations, it becomes a high responsibility of insurance companies to tailor and manufacture warzone insurance plans that cover business, health, life, accidents, and maybe sometimes disability. Lewers (2008) explained that businesses exposed to terrorism risks can partially address the issue of 'probability.' In the context of insurers, this involves concentrating on the control and management of aggregated risk.

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Terrorism insurance is a specialized form of coverage that has gained prominence in recent decades due to the increasing threat of terrorism worldwide. While having adequate insurance coverage cannot avert the occurrence of the next major terrorist attack, it does offer a crucial financial safety net. This facilitates a faster recovery for corporations and their employees, contributing to essential economic stability (Michel-Kerjan, E., & Raschky, P. A., 2011). Government interventions, industry responses, and ongoing challenges shape the landscape of terrorism insurance. (Barker, D., 2003) explores the economic implications of government intervention in the insurance market to provide subsidies for terrorism insurance in building construction. Catastrophic events, such as natural disasters (e.g., hurricanes, earthquakes, wildfires) or large-scale man-made events (e.g., terrorist attacks), can have profound effects on insurance companies and its stock prices. Ericson, R., & Doyle, A. (2004) explains that even when faced with the distinctive challenges of understanding and managing newly identified catastrophic risks, insurers do not shy away from this 'insurance curse.' Instead, they transform the threat into an opportunity. Lakdawalla and Zanjani (2005) delves into the complex interplay between insurance, self-protection, and the economics of terrorism, shedding light on how individuals and society respond to the unique challenges posed by terrorist threats. They provide insights into the economic incentives and suggested possible policy approaches to address them. Michel-Kerjan, and Raschky, (2011) explores the impact of government policies and interventions on the market for insurance against terrorism-related risks and observe that the insurers business is much less diversified for terrorism coverage than they are for other lines of coverage. Political risk insurance has always been a service rife with ambiguities, particularly regarding the interpretation of legislative rules and grey areas, even though it is evolving and becoming more common in emerging regions. Despite substantial public and private participation in the market post-9/11, Political Risk Insurance only accounted for about 10% of investments made in emerging markets in 2005 (Hamdani *et al*., 2005). Because it is too expensive to buy on the private market, investors are not accustomed to it as a tool, or they do not think it is the best instrument to reduce political risk, the provision and purchase of Political Risk Insurance as a coverage is currently insufficient in unstable governments. Ginsburg (2018) highlighted the factors that can cause political risk and explained how Political Risk Insurance mitigates a scope of issues, for example, political viciousness and armed conflict, government seizure of resources, break of agreement, and failure to localize reserves. Political risks can also impact the investments caused by the government enforcing its policies or restricting the rights of investors (Peinhardt and Todd, 2016). In the current era, most insurance policies by culture continue to exclude terrorist acts, undeclared war, war, and political unrest from their area of business. The year 2014 saw the expansion of both the existing and emerging global terror threats, posing serious challenges for the global (re)insurance industry. According to Oxford Analytica (2018), "55 percent of companies with over USD 1 billion in revenue have suffered a political risk loss, with 43 percent of political risk losses above USD 100 million, consequently, compelling about 68 percent of companies operating in developing markets to scale down their operations, with Russia reported to have recorded the highest and most frequent political risk losses". The most significant barrier to investing in emerging nations over the medium term, according to investors and financial backers, is political risk, which is followed by macroeconomic flimsiness. The spread of the Islamic State in Iraq, continuing Taliban and American activities in Afghanistan, lone-wolf attacks in Canada and Australia, human rights violations in Indian and Pakistan Administered Kashmir, and instability in the booming market of Sub-Saharan Africa raise the prospect of significant claims from local businesses and citizens, as well as international corporations. Understanding the development, limits, and prospects for local and international terrorism coverage in vulnerable markets has become increasingly essential for industry professionals. Particularly as per (Thomann, C., Pascalau, R., & Von Der Schulenburg, J. M. G., 2012), in the aftermath of terrorist incidents, financial institutions, larger corporations, and those located in major cities tend to acquire more terrorism insurance compared to non-financial entities, smaller corporations, and those situated in smaller cities, respectively.

2. Evolution of Political Risk and Terrorism Insurance

Before the 9/11 attack, domestic or international terrorism was not explicitly considered by insurers when pricing their commercial insurance policy, primarily because losses from terrorism have

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historically been small and, to a large extent, uncorrelated (Kunreuther and Michel-Kerjan, 2004). There were quite a few instances post the twin tower attack in Washington, US on November 9 (9/11), where the commercial insurers had not anticipated and hence had not reserved for the losses and catastrophes unleashed by such unwanted events[1]. This was the reason that insurance companies were mostly reluctant given the impact of the 9/11 attack to provide full or partial coverage for such an adverse terrorism loss. The unavailability of packages that could provide security in event of loss to commercial property has had a strategic knock on such commercial property markets. The hot topic about the requirement of coverage for such catastrophes along with the non-occurrence of such events leading to heavy adverse losses in developed countries for the last 20 years, particularly in the aftermath of the 9/11 attack has left a greater impact on the market[1]. Given that, the world atmosphere does not make the threat of a disastrous attack most unlikely to happen, there always remains some probability[1]. However, the vigilance and a round eye particularly with developments in technology and advancements in counter-terrorism activities have put greater barriers to entering than how there were before. Moreover, the terror outfits on the other side find it easier and more effective to get in touch and forward their messages to a larger target audience particularly their followers with the use of Social Networking platforms and easy communications using mobile phones (Whatsapp, Facebook, and Twitter). Though such advantages are somewhat neutered by law enforcement agencies with the help of governments by intercepting terror plots with the help of advanced technology.

It is highly uncommon and there are lesser number of businesses or organizations that have heavily invested in understanding the kind and nature of terrorism exposures that they could anticipate and who have a broad risk management process that naturally transfers the risk. In the past when terrorism capacity (i.e. coverage which is an add-on with other products/coverages) was globally withdrawn post the twin tower attack in America and the similar event in London, UK in 1993, such withdrawals largely impacted and prevented the transactions in commercial property markets1. It was such situations or events to which the governments responded to and manufactured and strategized the terrorism products for commercial property markets and not mainly because of the unavailability of terrorism coverage itself. According to the World Bank "Reducing real or perceived risks to investors across macroeconomic, business, and financing dimensions is a prerequisite for creating markets that can attract the investment needed to create opportunity".

However, a significant challenge persists within the insurance industry as it struggles to formulate adequate models for predicting the characteristics and extent of future instances of extremist, sub-state political violence. Insured individuals prioritize comprehensive coverage, while insurers contend that a sustainable solution for this risk remains elusive (Petrović, Miloš., 2022). Consequently, there is a lack of a suitable benchmark for autonomously pricing this risk, unlike the established models used for managing natural disasters like earthquakes, hurricanes, and flooding (Chalk, P., 2007). The challenging task of efficiently modeling terror packages still acts as a hurdle and barrier and hence continues to alter the provisions of ceded and retro ceded coverages to the commercial markets and thus off-colors such packages and makes them more redundant. Lewers (2008) discussed that in specialist insurance products like terrorism there is not much data available to quantify or predict the loss. Although the nature of such risks has enormously changed over the period and with the improvised abilities to model some areas of these risks, the reinsurers are still uncomfortable and unwilling to provide capacity to insurers1. In the modern insurance market, the development seems to be in the process to build new modeling applications, tools, and techniques, and the embryonic involvement of Insurance–Linked Securities (ILS) capacity in the terrorism packages.

3. Objective

When talking about businesses, two primary factors drive firms to purchase insurance packages to secure their assets:

[1] *Willis Tower Watson, The Terrorism Pool Index: Review of terrorism insurance programs in selected countries; retrieved from https://www.poolre.co.uk/wp-content/uploads/2019/09/Terrorism-Pool-Index-Nov-1.pdf assessed on 20th jan2022*

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- Either the risk tolerance level of the firm is such that they want to secure their business against all odds and are forced genetically to go for the purchase of insurance coverage.
- It also depends mostly on the lending criteria so that it is demonstrated on paper, for an asset that has been purchased after seeking a loan from financial institutes is hence financially protected and secured against all odds or risks.

Given the mammoth losses caused by terrorism to any economy, there have been not that many attempts to find out the major determinants of such untoward happenings and the trends they might follow. This study would focus on understanding different perils and the expectations of both the insured party and the insurer. The goal would be to consider the theoretical ways of mitigating such unfamiliar risks. In section 4 below we have discussed the background of Political Risk and terrorism insurance which would be followed by comparing the terrorism risk with other types of risks. Section 6, discusses the different perils which could be the cause of loss or damage and we will highlight the classification of political risk factors in section 7. Later, section 8 discusses the expectations of different parties involved in the insurance contract. Finally, we would perform a statistical analysis of the losses resulting from political violence and Terrorism in Kashmir.

4. Background to Risk in Context of Kashmir

Prior to 9/11 attack on World Trade Centre Towers and the Pentagon, Standard commercial insurance companies and their policies included terrorism coverages as part of the package1, effectively free of charges as an add-on and the claims whose total incurred losses were driven due to the damages arising due to war or warlike actions including mutinies and insurrections were terminated and excluded from the coverages provided by both commercial and personal insurance policies. Terrorism was elevated to the uninsurable end of the spectrum because the 9/11 terrorist attacks were funded by institutions supported by government agencies officially fighting terrorism (Gori and Padrone, 2007). For a spell, during those times there was no terrorism product as the insurance companies often used to make requests to the respective government departments to allow them to exclude such coverage from the commercial policies altogether. In the initial half of the year 2002, a large number of US states had agreed and approved such requests to exclude the terrorism coverages from standard commercial packages. The unwillingness to share the risk also existed among the reinsurers in places that they believe were vulnerable to odd acts or attacks. Such a situation post the 9/11 attack in the US laid the base to implement one of the important acts in the history of the insurance business in the year 2002 called "The Terrorism Insurance Act (TRIA)", which forms a central loss-sharing strategy for particular claims incurred due to an act certified as an event of terrorism by the said act.[2]

Kashmir has been plagued by political unrest and terrorism for decades, resulting in significant economic and social consequences. The region has witnessed a complex and multifaceted conflict, driven by factors such as political instability, governance challenges, religious extremism, and regional tensions. The untoward acts of violence, including sabotage, terrorism, riots, strikes, and civil commotion, have had devastating effects on the lives of people and the infrastructure of the region.

Insurers and businesses operating in Kashmir face unique challenges due to the constant threat of political violence and terrorism. The volatile environment makes it difficult for insurers to provide comprehensive coverage that meets the specific needs and risks of businesses and individuals in the region. Moreover, the occurrences of these perils follow a distinct trend, with periods of heightened violence followed by relative calm, making it essential for insurers to accurately assess the frequency and severity of these events.

The lack of available data on political violence and terrorism in Kashmir further compounds the difficulty in modeling and pricing insurance coverage. Insurers struggle to quantify the risks involved, resulting in reluctance to provide adequate coverage, and reinsurers are skeptical about offering capacity to insurers in the region.

[2] *Background on: Terrorism risk and insurance, Retrieved from https://www.iii.org/article/background-on-terrorism-risk-and-insurance assessed on 15th February 2022*

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Given this complex landscape, there is a pressing need to understand the specific perils faced by businesses and individuals in Kashmir and develop tailored insurance solutions. By analyzing historical data and employing techniques such as time series analysis, insurers can better assess and price the risks associated with political violence and terrorism in the region.

5. Terrorism Versus Other Risk Areas

In other areas of the insurance business, the insurance sellers usually take inferences from historical experience and estimate roughly how many losses or events are going to happen over a while i.e. frequency and how much of those insured exposures will turn into claims and will be incurred by the company i.e. severity. This historically available data is analyzed by using various analytical techniques to calculate the forecast premium which in a broader sense is equal to the amount of risk the insurers believe they carry in signing a contract or insurance policy with the insured. Some insurers even have enough data sources on natural catastrophes which allow them for measurements of frequency and severity, often supplemented with Catastrophe Modeling[2]. For risks related to political uncertainty or war, on the other side of the coin, frequency and severity data is in very short supply1. Factually these products have low frequency and high severity. Also, such risks are most often geographically concentrated making it more difficult to analyze as more often the factors will differ from one region to another.

A geographic concentration then results in an accumulation of risk, in which people living in the same geographic location purchase insurance from the same provider or seller, exposing one insurer to a possible large loss following a single terrorist act. In addition, this could lead to adverse selection, in which the most at-risk individuals obtain coverage, which is also the group most likely to file claims[2].

6. Understanding the Perils

Terrorism continues to evolve as an ongoing threat and there should be better and flexible ways to mitigate and manage the current and upcoming risks. As per the previous studies, it has been a known fact that in a particular geographic location, the driving factors for any political uprising exhibit an inverted 'Ո' shaped curve. This means that any untoward or terrorist activities slowly start increasing and then reach a boom. That situation continues for a spell till the government takes repressive or oppressive measures and then slowly starts to fall. Before any dedicated insurance service or product is designed to cover the losses resulting from Political events, Terrorism acts, or warlike actions, we must understand and study the likeliness of perils occurring, the exposure and the risks involved, and the aftermath of such occurrences from the experience.
The different Perils occurring are classified as:

6.1. Sabotage

The losses directly resulting from politically motivated violence or acts of terrorism come under sabotage. The potential destruction of life and property brought about by such acts has been significant in recent times.

6.2. Terrorism

There is not a single definition of terrorism; people define terrorism in their own ways. However the "Terrorism Risk Insurance Act of 2002 (TRIA)" specifies what constitutes the event of terrorism for the purposes of that Act to be "a violent act or an act that is dangerous to (I) human life; (II) property; or (III) infrastructure; (iii) to have resulted in damage within the United States, or outside of the Usnited States in the case of-– (I) an air carrier or vessel described in paragraph (5)(B); or (II) the premises of a United States mission; and (iv) to have been committed by an individual or individuals acting on behalf of any foreign person or foreign interest, as part of an effort to coerce the civilian population of the United States or to influence the policy or affect the conduct of the United States Government by coercion." [2]

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6.3. Riots, Strikes, and Civil Commotion:

These can be very destructive to the business establishment and public or private property and can have a greater impact on the mental or physical health of people.

6.4. Political Violence:

This apart from leading to losses in infrastructure or damage to any physical properties can have very negative growth in the health sector. Thus there is a mighty need to develop a political risk insurance coverage that mitigates such risk for businesses, investors, and financial institutions.

6.5. Third Party and Employee Liability:

Similar to politically peaceful places, such risks exist in politically disturbed areas as well. The third-party or employee liability belongs to the casualty insurance category. For example, a person is visiting a store for shopping wherein he/she slips on a wet surface and gets injured. The person can claim the medical expenses from the store owner and in such a situation, the store owner would have taken the insurance policy which would cover such risks occurring in the store facility to the third party which would mostly be the customer. Such type of insurance is known as third-party liability. Similarly, Employee liability is a kind of workers compensation wherein the employer is liable to pay for any loss or damage to the employee and the employer can claim the same from the insurance company if he would have taken the Employee liability policy.

6.6. Loss of event cancellation:

There could be events occurring wherein the entertainment industry can suffer losses due to the cancellation of the scheduled events or programs resulting from a sudden disturbance in the political atmosphere or fear of any terrorist event or warlike action.

6.7. Comorbidities due to injuries:

The injuries occurring to a person in any attack, can lead to some other illness as well e.g. the most prevalent comorbidity in such zones is Post-Traumatic Stress, depression, anxiety, bipolar disorder, or schizophrenia. According to an article published by The Reuters (London) reveals the study by the World Health Organization, one in five people living in war zones suffer from a such illness compared to one in fourteen people who suffer from mental illness in the peacetime population[3]. "Given the large numbers of people in need and the humanitarian imperative to reduce suffering, there is an urgent need to implement scalable mental health interventions to address this burden," the group of researchers said[3]. Considering this, if a well-designed economical product is designed which could reduce the suffering of people can have a bit positive impact on mental health as well.

These are the primary risks that could occur in any politically disturbed area or a warzone. As discussed earlier, given the nature of these perils it is very much difficult to analyze the frequency and severity of any such event and thus making it difficult to price the products based on trend analyses.

7. Classification of Political Risk Factors

The below tree categorizes the different political risk factors on the bases of governmental and societal political risk factors, micro and macro political risk factors, and external and internal political risk factors. There can be many factors varying based on the geography we are looking at, however below are the more common and broad factors. Political risk evolves as a result of numerous events at the national, international, regional, and personal levels (Clark, 2018). The tree allows the reader to distinguish between the different types of specific political risk factors as shown in Figure 1 and Figure 2.

3 Mental illness affects a fifth of people living in war zones, Retrieved from https://www.reuters.com/article/us-health-mental-conflict-idUSKCN1TC2U4, by Kate Kelland published on 12 June 2019, assessed on 20 February 2022.

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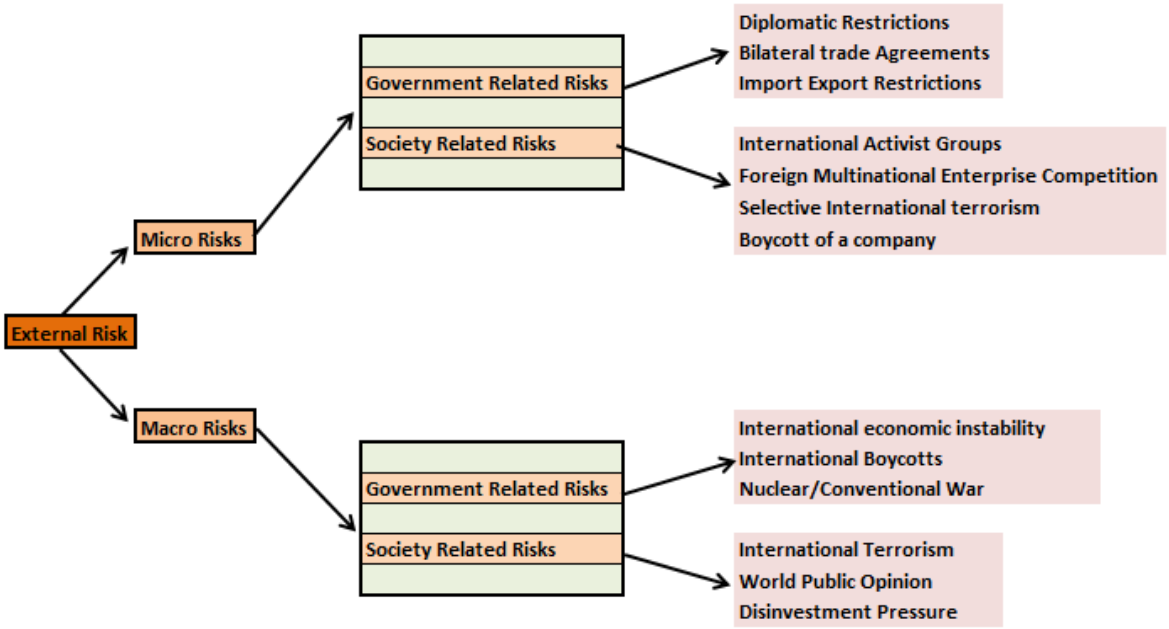

Figure 1.
External political risk factors.

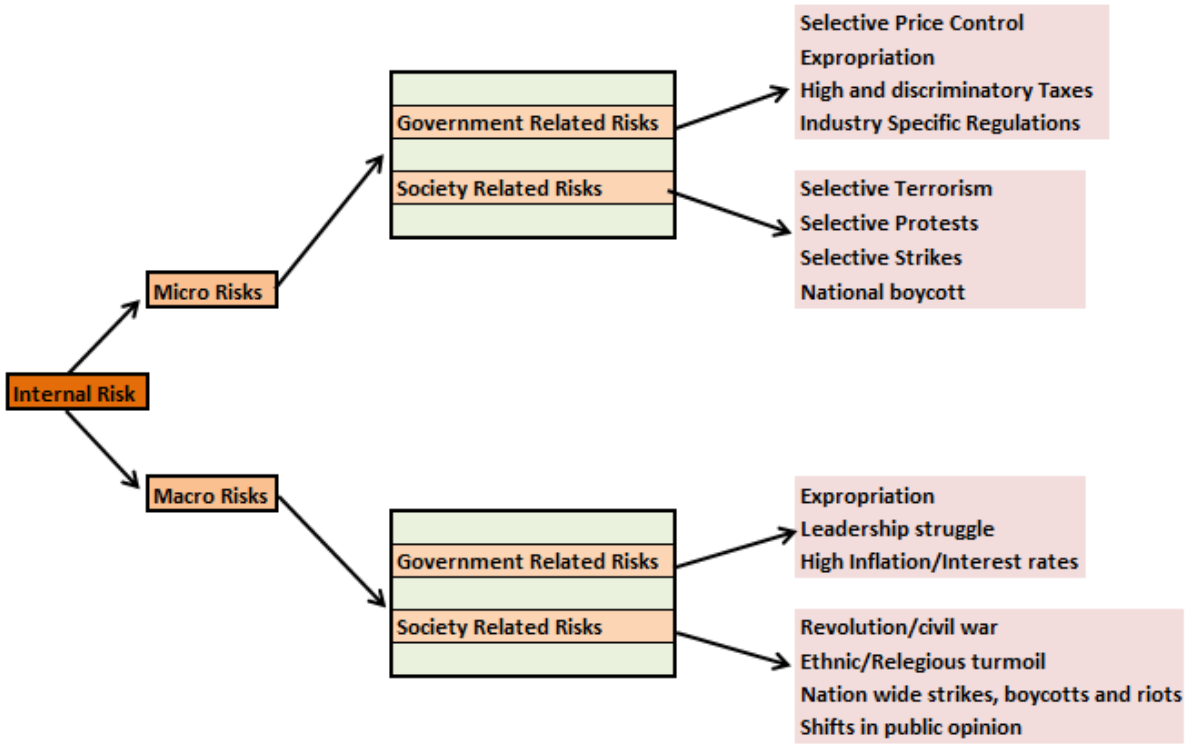

Figure 2.
Internal political risk factors.

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8. Insurer and Insured's Expectations

When analyzing the Property and casualty (P&C) industry and coverages to businesses, the existing insurance solutions do not provide the responsive and broad coverages that are required. Now when we talk about the solutions which should be acceptable to people in general, should have at least below broad features:

- All-encompassing enhanced cover that responds to the current threat that a particular geographical area is facing.
- A flexible approach to tailor coverages and limits to one's needs concerning the property or general insurance and with respect to life.
- A competitive price that makes the deal economical and fair between the insurer and the insured. Alexander Braun in his survey study done in the year 2018 identified price perception as an important factor in purchasing decisions (Braun and Fischer, 2018).
- Simplified access to the product. With the growing technology and digitalization, the insurer should try to make the product available to the customer with ease.

On the other side, from the commercial insurer's perspective, covering the big terrorist catastrophe losses could be a huge burden on the organization's reserves. This acts as a major hindrance for most commercial insurers to enter into such volatile markets. To break such barriers along with manufacturing a policy or a product which perfectly fits the needs and exposures of business, the commercial insurers usually have a below action plan:

- Limit the coverage and provide a cap on the total loss occurring e.g., for a certain policy that covers the risk of riots to business, the insurance company can agree to pay up to a certain amount known as the threshold in the case of adverse happening resulting in loss and this agreement will be done for a certain premium (could be a lump sum or annuity)
- The reluctance on part of the reinsurers to provide capacity to commercial insurers has remained unchanged, despite the changing nature of the risks and improved ability to model some aspects of the risk. There is a heavy need to educate and come up with an agreement with the reinsurers who can support the commercial insurers in such areas.
- The insurance companies should also be backstopped by the government with business-friendly laws, subsidies and guarantee a certain percentage of cover. Government subsidy, paid with non-distortionary taxes, will improve social welfare2. This also connects with the fact that companies with better political affiliations and connections can influence government decisions and can take on more risk as per the moral hazard-based theory (Kostovetsky, 2015). Government policies like regulatory policies, tax, and accounting make it costly for insurers to hold surplus capital and hence act as a hurdle to insure large exposures.

As discussed previously, since the frequency and severity of such risks vary from one part of the world to another i.e., these are geographically concentrated and to analyze the premiums to be charged based on the conditions of a particular region, the commercial insurance companies can categorize the areas into different frequency or severity zones based on the historic data. This would help them to identify which areas the losses could occur more and accordingly these could price their products by adding a significant loading factor. Studying geographical patterns thoroughly is essential for gaining a nuanced understanding (Blok, Connie, Barend Köbben, Tao Cheng, and Agnes A. Kuterema., 2008). The Oxford Analytical and Alert: 24 (in partnership with AKE intelligence) analyzed such a field and came up with the risk ratings and temperatures as of September 2018 as shown in Figure 3. Such analysis could be useful in determining the price of a product.

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Terrorism risk temperature key	
Intensity	Risk Rating
Extremely High	95
High	85
Very High	75
Medium-High	65
Significant	55
Medium	45
Medium-Low	35
Low	25
Very Low	15
Extremely Low	5

Figure 3.
Terrorism risk temperature key.

9. Modeling the risk using Time Series

Insurance risk can be modelled using Time Series analysis, which is a statistical technique to analyze and forecast data points collected over time. The modelling involves identifying patterns or trends in the data, including seasonality and cyclical variations, and using this information to make predictions about future values. Terrorism insurance risk can also be modelled using Time Series analysis. In this case, the analysis would focus on identifying patterns and trends in terrorist activity over time, such as the frequency, severity and location of the attacks. One approach to modelling terrorism risk is to use historical data on terrorist attacks to develop a statistical model that can predict the likelihood of future attacks. This can involve analyzing data of past attacks, including the types of weapons and tactics used, the targets of the attacks and the geographic region in which the attacks occurred. This information can be used to forecast the probability of future attacks in a given area. Another approach is to use event-based models, which focus on identifying and analyzing specific events that could impact terrorism risk. For example, an event-based model might focus on political instability or social unrest in a particular region, and use this information to predict the likelihood of terrorist attacks in that area. However, we require the variables to be stationary as it is one of the important assumptions else the output would be meaningless. Let us consider the above discussed perils as variables for modeling terrorism loss. Generating the autocorrelation and partial autocorrelation functions would be a futile process in case the variables are not stationary. The above variables for a Terrorism loss would form non-stationary series because of the deterministic trend (exponential increase at the start followed by exponential decrease). We could also consider the occurrence of such perils as seasonal or periodical. There might be a period where such activities touch boom due to political disturbances and then as soon as the counteraction is taken by the existing authority using repressive and oppressive measures, the occurrence of such events will again touch zero. To check whether a series is non-stationary, the best practice is to plot a graph. Let us explain this more by taking the example of a particular geographical location in Kashmir and by observing the events unveiled in the past 12 to 15 years. The year 2008 saw a political uprising that continued for 3-4 months followed by a similar uprising in 2009 which again continued for around two months. Then 2010 saw a massive uprising where the shutdown continued for 8 months followed by the year 2016 where a similar uprising continued for nearly 6 months. A similar clamp down occurred in 2019 post 5th August due to political volatility. The common area of interest is that these occurrences led to a massive loss to business apart from human loss.

To remove the deterministic cycle and the seasonal variations, the method of seasonal differencing could be used. Even though the differencing would convert the non-stationary variables into stationary but that would also result in the loss of data in the long run. The stationary series can then be modeled

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and ultimately, we can perform the inverse transform on our model to obtain the model for our original series.

10. Statistical Analysis

The research aims to investigate the potential variations in the data related to Political Violence and Terrorism in the Indian Administered Kashmir over the past several years. To achieve this, the available data has been carefully categorized into distinct groups based on relevant criteria, such as different years or regions. The main objective is to determine whether significant differences exist in the variance among these groups, shedding light on potential patterns or trends in the occurrence of political violence and terrorism over time and space.

To analyze the variance between the groups, we will employ two widely used statistical tests: Analysis of Variance (ANOVA) and Tukey's Honestly Significant Difference (HSD) test. ANOVA is a robust statistical technique that compares the means of multiple groups to determine if there are any statistically significant differences among them. By using ANOVA, we can ascertain whether the variations in the data can be attributed to differences between the groups or whether they are merely due to random chance.

After conducting the ANOVA, the Tukey HSD test will be applied as a post hoc analysis to identify specific group differences, in case the ANOVA shows a significant overall difference. The Tukey HSD test allows us to make pairwise comparisons between the groups, pinpointing which specific pairs exhibit significant differences in their means. This will provide more in-depth insights into the nature of the variations observed in the data and help establish whether certain regions experienced notably distinct levels of political violence and terrorism compared to others.

By performing ANOVA and Tukey HSD tests on the summarized data, we aim to contribute valuable information to the ongoing understanding of the dynamics of political violence and terrorism in the Indian Administered Kashmir. The findings of this analysis can have significant implications for policymakers, researchers, insurance companies and in particular in the region. Moreover, the approach taken in this research can serve as a blueprint for future studies exploring similar phenomena in other geopolitical contexts, ultimately enhancing our collective knowledge and insights into the complex interplay between political violence, terrorism, and their spatiotemporal dimensions (Alam et al., 2024).

Table 1.
Losses from political violence and terrorism in various districts of Kashmir from 2008 to 2020 (Amounts in m's).

Quarter	Anantnag	Baramula	Budgam	Kulgam	Kupwara	Pulwama	Shopian	Srinagar
Q1	121.9	86.8	73.7	62.9	34.0	37.2	37.9	128.2
Q2	24.8	65.6	58.4	91.0	54.9	49.3	66.2	78.6
Q3	39.8	47.8	57.8	35.3	58.8	94.1	84.6	88.3
Q4	92.3	79.8	87.4	36.6	51.9	92.5	42.2	43.6

Table 2.
Losses from political violence and terrorism, zone wise data of Kashmir from 2008 to 2020 (Amounts in m's)

Quarters	Central	North	South
Q1	201.9	120.8	259.2
Q2	137.0	120.5	231.4
Q3	146.2	106.6	253.9
Q4	131.0	131.7	263.6

This research endeavors to explore the impact of eight distinct independent districts on the losses arisen from political violence and terrorism, which is presented in Table 1. To achieve this, we will utilize the statistical technique known as One-way Analysis of Variance (ANOVA), a powerful tool for

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comparing the means of multiple groups to determine if there are any significant differences among them.

The One-way ANOVA procedure will analyze the variance within and between the groups to determine whether the observed differences in means are statistically significant or merely the result of random variability. The null hypothesis (H0) posits that all groups have the same mean, while the alternative hypothesis (H1) suggests that at least one group's mean significantly differs from the others.

The significance level (alpha) chosen through the analysis will dictate the threshold for accepting or rejecting the null hypothesis. Commonly, a significance level of 0.05 is employed, meaning that if the probability of observing the obtained results, assuming the null hypothesis is true, is less than 5%, we reject the null hypothesis in favor of the alternative.

10.1. ANOVA Test Results and Inferences

Table 3.
ANOVA test result for the Table 1 data (Amounts in m's).

Source	Sum of squares (SS)	Degrees of freedom ν	Mean square (MS)	F statistic	p-value
Treatment	3,26,51,51,26,9	7	46,64,50,18,1	0.6325	0.7245
Error	17,69,85,64,92,2	24	73,74,40,20,5		
Total	20,96,37,16,19,1	31			

Table 3 shows the ANOVA test result for the losses from political violence and terrorism in various district of Kashmir. The obtained p-value linked to the F-statistic derived from the one-way ANOVA exceeds the threshold of 0.05. This implies that, at this chosen level of significance, there is insufficient evidence to conclude significant differences among the various treatments. Consequently, supplementary comparison test i.e., the Tukey HSD may not yield definitive insights into identifying specific pairs of treatments that exhibit significant distinctions. The data, within the context of the one-way ANOVA, does not strongly indicate the presence of markedly different treatment pairs.

We would perform a similar investigation and check the impact of three distinct independent zones on the losses arisen from political violence and terrorism, which is presented in Table 2:

Table 4.
ANOVA test result for the Table 2 data (Amounts in m's).

Source	Sum of squares (SS)	Degrees of freedom ν	Mean square (MS)	F statistic	p-value
Treatment	37,60,36,79,85,3	2	18,80,18,39,92,6	41.215	2.946E-05
Error	4,10,56,98,55,5	9	45,61,88,72,8		
Total	41,70,93,78,40,6	11			

Table 4 shows the ANOVA test result for the losses from political violence and terrorism zones wise data of Kashmir. The obtained p-value associated with the F-statistic from the one-way ANOVA is below 0.05, indicating a notable distinction among at least one of the treatments. Subsequent to this, we would perform Tukey HSD test. This supplementary analysis is expected to pinpoint specific pairs of treatments that exhibit significant dissimilarities.

10.2. Tukey HSD Test and Inferences

The p-value associated with the F-statistic in the one-way ANOVA is less than 0.01, indicating a strong indication that there are significant differences between one or more treatment groups. In this scenario, there are three treatments (denoted as k = 3), and we intend to utilize Tukey's HSD test. This test will be applied to all possible pairs of these three treatments. Its purpose is to precisely identify which specific pairs exhibit statistically noteworthy differences.

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Initially, we determine the critical values of the Tukey-Kramer HSD Q statistic using three treatments (k = 3) and nine degrees of freedom (ν = 9) for the error term. This is done for two significance levels, α = 0.01 and α = 0.05, using p-values in the context of the Studentized Range distribution. The critical values we derive for Q at α = 0.01 and α = 0.05 are $Q_{Critical}^{\alpha=0.01,k=3,v=9} = 5.4244$ and $Q_{Critical}^{\alpha=0.05,k=3,v=9} = 3.9452$, respectively.

Subsequently, we create a Tukey test statistic using the data in our sample columns. This statistic is then compared against the relevant critical value. By utilizing the Tukey-Kramer confidence limits and employing algebraic manipulations, we streamline the calculations. For each set of compared columns, a parameter is computed. In this context, we refer to it as the Tukey-Kramer HSD Q-statistic, or more simply, the Tukey HSD Q-statistic:

$$Q_{i,j} = \frac{|\bar{x}_i - \bar{x}_j|}{s_{i,j}}$$

Where the denominator of the fraction in the preceding equation is derived from:

$$s_{i,j} = \frac{\hat{\sigma}_e}{\sqrt{H_{i,j}}} \qquad i, j = 1,2, \dots, k; i \neq j.$$

The value $H_{i,j}$ represents the harmonic mean derived from the observations in columns labeled i and j. It's important to note that when the column sample sizes are equal, the harmonic mean simplifies to the common sample size. However, when comparing columns with differing sample sizes, the harmonic mean falls between these two sizes. This specific harmonic mean is essential for implementing the Tukey-Kramer procedure in cases where column sample sizes vary. The value $\hat{\sigma}_e = 21{,}358{,}575.0536$ corresponds to the square root of the Mean Square Error (MSE), which was determined to be 456,188,728,319,978.6875 in the initial one-way ANOVA analysis. Note that $\hat{\sigma}_e$ remains consistent for all pairs under comparison. The sole variable among different pairs when calculating $s_{i,j} = \frac{\hat{\sigma}_e}{\sqrt{H_{i,j}}}$ is the denominator, representing the harmonic mean of the respective sample sizes in comparison. Assessing whether the Tukey-Kramer confidence interval encompasses zero is tantamount to determining if $Q_{i,j} > Q_{Critical}$, The latter value is determined based on the desired significance level α (p-value), the number of treatments k, and the degrees of freedom for error ν, as explained earlier.

k = 3 treatments

Degrees of freedom for the error term ν = 9

Critical values of the Studentized Range Q statistic:

$Q_{Critical}^{\alpha=0.01,k=3,v=9} = 5.4244$ and $Q_{Critical}^{\alpha=0.05,k=3,v=9} = 3.9452$

Below is color-differentiated outcome, where red indicates insignificance and green signifies significance. This assessment pertains to determining if $Q_{i,j}$ surpasses $Q_{Critical}$ for pertinent treatment pairs. Furthermore, we provide the associated significance (expressed as p-value) for the observed Q-statistic $Q_{i,j}$.

Table 5.
Tukey HSD results for the Table 2 data.

Treatments Pair	Tukey hsd Q statistic	Tukey hsd p-value	Tukey hsd Inference
Central vs North	3.1934	0.113854	insignificant
Central vs South	9.1735	0.001005	** p<0.01
North vs South	12.3669	0.001005	** p<0.01

The study investigated the impact of geographical location on losses in three distinct groups: Central, North, and South. The Tukey test, revealed intriguing findings regarding the variations in losses among these regions. Specifically, the Tukey test indicated that there is an insignificant difference in losses between the Central and North groups, suggesting that the two regions experienced similar levels of losses.

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These results have several important implications for understanding the regional disparities in losses. The lack of significant difference between the Central and North groups suggests that factors influencing losses in these regions might share similarities, leading to comparable outcomes. It is essential for stakeholders and policymakers to further investigate these commonalities to identify best practices or risk mitigation strategies that can be shared between these regions.

11. Conclusion

In addition to the devastating loss of human lives, the economic ramifications of terrorism are substantial. The need for heightened security measures and expenditures to counteract terrorist threats, coupled with the uncertainty experienced by consumers and investors, disruptions in supply chains and business operations, and a potential contraction of industries, all contribute to adverse effects on economic progress. Our analysis indicates that the main factor sustaining the continued demand for terrorism-related financial products is the persistent necessity for comprehensive insurance coverage against all forms of terrorist or politically motivated risks. This trend is further underscored by the hesitance of reinsurance companies to offer adequate support to commercial insurers, particularly in scenarios involving the most catastrophic acts of terrorism. To have a product that covers terror acts or political hazards, a commercial insurer has to do a detailed study of a particular geographical location, understand the hazards and perils, give the rating to the area as per the frequency and severity of occurrences and then price the product which would be beneficial to both. The use of the time series concept could be very beneficial in terms of modeling the occurrences of such events. The reinsurers can come forward and support the commercial insurers and increase their capacity to cover the losses. On the other hand, the governments can also take measures and backstop the commercial insurers. The insurers can use the better models to predict and estimate by using various mathematical and statistical models.

The statistical test from the data highlights the need for tailored risk management approaches for each region to address the unique risk factors and minimize potential financial impacts. By leveraging these insights, insurance companies and policymakers can enhance their understanding of regional risk patterns and make informed decisions to safeguard against losses effectively. The identified variations in losses emphasize the significance of geographical location as a critical factor influencing risk exposure and financial outcomes for individuals, businesses, and insurance companies. Understanding and accounting for these regional differences can enable more accurate pricing of insurance policies, optimal allocation of resources, and the development of targeted risk management strategies to protect against potential losses.

12. Practical Implication

The analysis of Political Violence and Terrorism data in the Indian Administered Kashmir can be highly valuable for actuaries and insurance companies in the context of pricing and reserving for insurance policies. Actuaries, who are professionals responsible for assessing and managing risk for insurance companies, rely on data-driven insights to make informed decisions about setting insurance premiums and establishing appropriate reserves. The analysis can be useful for:

i. Risk Assessment and Pricing: The analysis can reveal patterns and trends in the occurrence of political violence and terrorism over time and across different regions. Actuaries can use this information to assess the risk associated with providing insurance coverage in specific areas or during certain periods. Higher levels of political violence and terrorism may indicate an increased risk of potential losses for insurance companies, which may need to be reflected in higher insurance premiums for policyholders in those regions or timeframes.

ii. Tailoring Insurance Coverage: By understanding the variations in risk across different groups, insurance companies can tailor their coverage offerings more effectively. They can design insurance products that address the specific risks faced by customers in regions or years with higher incidences of political violence and terrorism. This segmentation approach allows insurance companies to provide more relevant and cost-effective coverage to policyholders.

iii. Reserving and Financial Stability: The findings from the analysis can assist in determining the

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appropriate level of reserves that insurance companies should hold to cover potential claims arising from political violence and terrorism-related incidents. Adequate reserving is essential to ensure the financial stability of insurance companies and their ability to fulfill their obligations to policyholders in the event of significant losses.

iv. Reinsurance Decisions: Reinsurance is a risk management strategy employed by insurance companies to mitigate their exposure to large and catastrophic losses. The insights gained from the analysis can help insurance companies make more informed decisions about their reinsurance needs, especially in areas or timeframes where the risk of political violence and terrorism is higher. Reinsurance can provide an added layer of protection to insurance companies, allowing them to manage their capital and protect their financial stability.

v. Regulatory Compliance: In certain regions or countries, regulatory authorities may require insurance companies to consider specific risk factors when pricing and reserving for policies. Understanding the variations in political violence and terrorism risk can ensure that insurance companies comply with such regulations and demonstrate responsible risk management practices.

Overall, the analysis of Political Violence and Terrorism data in the Indian Administered Kashmir offers valuable insights into the risk landscape, enabling actuaries and insurance companies to make data-driven decisions, optimize their pricing strategies, and strengthen their overall risk management practices. By leveraging this information, insurance companies can provide more accurate, tailored, and financially sustainable insurance products to their customers while effectively managing potential risks and uncertainties.

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