

## **Motor Insurance Pricing Assistant (Gemini)**

### **Project Overview**

This project was the creation of an AI-powered pricing simulator, built using Google Gemini. It replicates the decision-making process used in Australian insurance pricing through the decomposition of premiums into claim frequency and claim severity.

This system is designed solely as an educational tool, based on actuarial concepts and reasoning.

### **Objective**

To simulate the decision-making process of Australian insurance companies and how risk is assessed across:

- Driver characteristics (age, prior claims, experience)
- Vehicle risk classes
- Geographic exposure

### **Pricing Framework**

The model decomposes premiums into:

$$\text{Premium} = \text{Frequency} \times \text{Severity} + \text{Expenses} + \text{Profit Margin}$$

Where frequency revolves around factors such as age, experience, prior claims and postcode. Severity revolves around the vehicle itself (price, repair costs and availability of parts).

The AI assistant separates these parts to mirror GLM pricing frameworks.

### **Ethical Review**

The AI assistant has an ethical layer incorporated into it, which highlights when sensitive variables influence the risk assessment. The model seeks to demonstrate indirect discrimination concerns and subsequent potential impacts.

### **Governance**

The model avoids

- Citing proprietary insurance data
- Fabricating figures
- Using precise premiums
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### **Model Limitations**

- No empirical dataset calibration
- Sensitive to prompt phrasing
- Unable to quantify uncertainty

### **Example Cases**

#### **Case 1**

**Input:** 50-year-old, male, 3228, Toyota Camry, 30 years licensed, 0 prior claims

#### **Output:**

As a senior pricing actuary in the Victorian motor insurance market, I will assess this risk profile using standard actuarial decomposition. This analysis assumes a comprehensive car insurance policy under current Victorian regulatory frameworks.

### Risk Classification

This profile is classified as a Mature, Low-Risk Operator. The combination of significant driving experience and a clean claims history places this risk in a preferred tier for standard motor portfolios.

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### Frequency Drivers

Driving Experience: With 30 years licensed, the "learning curve" risk is negligible. Actuarial logic suggests that experienced drivers have better hazard perception.

Claims History: 0 prior claims is a primary indicator of a low-frequency risk. It suggests a high "No Claim Bonus" (NCB) or high rating tier.

Vehicle Type: The Toyota Camry is statistically associated with "conservative" driving cohorts compared to high-performance or enthusiast vehicles.

Postcode (3228): This covers the Bellarine/Torquay region. While subject to some tourist traffic seasonality, it generally avoids the high-density congestion and "stop-start" accident frequency of the Melbourne CBD.

### Severity Drivers

Vehicle Repairability: The Toyota Camry is a high-volume vehicle in Australia. Parts availability is high, and repair methods are standard, which keeps the "Average Cost per Claim" (ACPC) moderate.

Postcode Environment: Regional/suburban areas like 3228 may have higher average speeds than the CBD, which can lead to higher impact severity if an accident does occur, though this is offset by lower frequency.

Sum Insured: As a common mid-size sedan, the total loss payout is predictable and stable compared to luxury imports.

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### Conceptual Premium Indication

The pure premium is derived from the following logic:

$$\text{Premium approx.} = (\text{Frequency} \times \text{Severity}) + \text{Expenses} + \text{Profit Margin}$$

Frequency: Expected to be significantly below the portfolio mean.

Severity: Expected to be at or slightly below the portfolio mean.

Expenses: Includes Victorian Stamp Duty (10%) and GST (10%), plus acquisition and admin costs.

### Risk Commentary

The primary risk for this profile is not behavioural, but environmental—such as weather events (hail in regional Victoria) or third-party negligence. The "30 years licensed" metric is a strong "cap" on the risk premium, as it signals a driver who has successfully navigated multiple decades of changing road conditions.

## Ethical & Regulatory Considerations

Gender: In Australia, insurers can use gender as a rating factor if it is based on actuarial or statistical data. While males historically represent higher risk in younger cohorts, this disparity often narrows significantly in the 50+ age bracket.

Postcode: Use of geography is standard but must be balanced to ensure "insurance deserts" aren't created. In this case, 3228 is a standard risk zone.

Pricing Fairness: Under the General Insurance Code of Practice, the premium must reflect the underlying risk. Charging a "loyalty tax" to long-term low-risk drivers is a point of increasing regulatory scrutiny by ASIC.

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## Summary of Premium Indication

Premium Indication: Low

Note: For educational purposes only

## Case 2

**Input:** 23-year-old, female, 3000, BMW m3, 3 years licensed, 1 prior claim

### Output

As a senior pricing actuary in the Victorian market, I will assess this risk profile using standard actuarial decomposition. This analysis assumes a comprehensive car insurance policy within the context of the high-density Melbourne CBD environment.

## Risk Classification

This profile is classified as a Young Adult, High-Performance Risk. The combination of limited driving experience, a high-performance vehicle, and a recent claims history places this risk in a high-volatility tier for motor portfolios.

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## Frequency Drivers

Driving Experience: With only 3 years licensed, the driver is still within the "high-risk" developmental window. Actuarial logic shows a strong correlation between low years licensed and increased collision frequency.

Prior Claims: 1 prior claim at age 23 is a significant weighting factor. Statistically, a driver with a recent claim has a higher probability of a second claim within 12–24 months compared to a "clean" history.

Vehicle Type: The BMW M3 is a high-performance vehicle. In actuarial modelling, the "power-to-weight" ratio is often a proxy for increased frequency of speed-related incidents.

Postcode (3000): Melbourne CBD. This environment has a very high frequency of "fender-benders," parking incidents, and third-party collisions due to extreme traffic density and complex intersections.

## Severity Drivers

**Vehicle Cost/Repairability:** The BMW M3 is a luxury performance vehicle. Repair costs (ACPC) are high due to specialized parts, sensors (ADAS), and the requirement for manufacturer-authorized repairers.

**Total Loss Risk:** The high market value of an M3 means a "write-off" event results in a substantial payout compared to a standard commuter vehicle.

**Theft/Vandalism:** CBD postcodes (3000) often carry a higher loading for theft and malicious damage, increasing the expected severity of non-collision claims.

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### Conceptual Premium Indication

The pure premium is derived from the following logic:

$$\text{Premium approx.} = (\text{Frequency} \times \text{Severity}) + \text{Expenses} + \text{Profit Margin}$$

**Frequency:** Expected to be significantly above the portfolio mean (High-density + Young Driver).

**Severity:** Expected to be very high (Luxury Performance Vehicle).

**Expenses:** Includes Victorian Stamp Duty (10%) and GST (10%), plus higher reinsurance costs for high-value assets.

### Risk Commentary

This risk profile presents a "double peak" challenge: the driver is statistically more likely to have an accident (Frequency) and that accident is statistically likely to be expensive (Severity). The age/vehicle combination often triggers "underwriting referrals" where manual intervention may be required to set appropriate excesses (e.g., high "Young Driver" and "Inexperienced Driver" excesses).

### Ethical & Regulatory Considerations

**Age/Gender:** While younger drivers (particularly males) historically pay more, Victorian insurers must ensure these loadings are based on rigorous statistical evidence to avoid "ageism." Females in this bracket often see slightly lower frequency rates than males, but the high-performance vehicle may normalize this gap.

**Postcode Pricing:** Rating by postcode 3000 reflects the objective reality of CBD congestion but can be seen as penalizing city dwellers who may actually drive fewer kilometres.

**Affordability:** Regulators (ASIC/APRA) monitor for "price walking" and ensure that high-risk individuals still have access to transparent pricing, even if the premium is elevated.

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### Summary of Premium Indication

Premium Indication: High

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