**📌 Question 1: Changes in PSI (Pearson's Chi-Squared) Over Time**

**List any time periods in which you noticed any changes upward or downward in these statistics. Note that a statistically significant change has occurred when the statistic is well over the number of probability bins.**

**✅ Significant Observations:**

1. **avg\_income\_cat**
   * Significant spikes observed around **2003, 2008, 2014, and 2022**.
   * PSI frequently exceeds 15–20, which likely surpasses the number of bins, indicating meaningful distributional change.
2. **credit\_limit\_cat**
   * Dramatic spike around **2010**, with PSI exceeding **30**, indicating a major shift.
   * Additional upward spikes in **2016** and again a minor rise post-2020.
3. **density\_cat**
   * A clear **upward trend from 2002 to 2020**, with PSI values reaching and exceeding **140**.
   * This consistent rise suggests a structural population change, potentially due to urbanization trends or shifts in customer density.
4. **fico\_cat**
   * Extreme PSI spikes in **2008** and **2021**, both exceeding **300–500**, likely indicating massive shifts in credit behavior due to economic shocks (e.g., Great Recession and COVID-19 pandemic).
   * Otherwise relatively stable in other years.
5. **fico\_missing**
   * Alarming spikes in **2008** and **2021**, where PSI exceeded **1000 and 3000**, respectively.
   * Suggests drastic changes in the presence of missing FICO scores—possibly due to data quality issues or sudden influxes of unscored customers.
6. **homeownership**
   * Sharp rise around **2019–2021**, with PSI over **70**, indicating a notable shift in homeownership trends.
   * Possibly reflecting post-pandemic housing market dynamics.
7. **income\_cat**
   * Very high values in early 2000s (up to **35 in 2003**), moderate stability in the mid-years, with recurring peaks in **2017** and **2020–2022**.
8. **num\_bankruptcy**
   * Notable spikes in **2007–2009**, with PSI reaching near **15**, indicating elevated bankruptcies during financial crisis.
   * Some variability continues through the 2010s but declines post-2020.
9. **num\_late**
   * Highest PSI values around **2002–2003** and **2010**, peaking above **25**.
   * Likely reflecting consumer payment stress during economic downturns.
10. **past\_def**

* Peaks observed in **2006, 2013, and 2015**, where PSI exceeds **10–14**.
* Indicates periodic changes in historical default behaviors.

**📌 Question 2: Nature of Distributional Changes in Explanatory Variables**

**For each variable, determine what type of change seems to have occurred (e.g., mean shift, variance shift, skew, mode shift).**

**✅ Descriptive Observations:**

1. **avg\_income\_cat** – Likely experiencing **periodic shifts in income distribution**, such as transitions between middle and higher income categories, possibly reflecting economic expansion or recession effects.
2. **credit\_limit\_cat** – A major **upward mode shift** around 2010 implies that customers were granted either significantly more or fewer credit limits. Possibly due to post-recession tighter credit policies.
3. **density\_cat** – A **gradual upward trend** suggests a **population migration** from rural to more urban/suburban areas, or shifts in service areas over time.
4. **fico\_cat** – The massive spikes reflect **abrupt categorical shifts** in credit scores, likely due to **systemic changes in consumer creditworthiness** or data reporting standards during crisis periods.
5. **fico\_missing** – These changes likely stem from **data availability issues** or operational shifts. The extreme spikes suggest a significant **increase in missingness**, potentially when new customer bases were introduced or integrations changed.
6. **homeownership** – Post-2018 PSI spikes suggest a **demographic shift** in customers, possibly more renters than owners entering the dataset, or changes in how homeownership was tracked.
7. **income\_cat** – The changes suggest a **reclassification or migration** of customers into different income brackets over time, often seen during economic booms or downturns.
8. **num\_bankruptcy** – The patterns suggest **sporadic increases in bankruptcy rates**, especially during recession periods. Likely reflects a **variance and mode shift** in the bankruptcy count distribution.
9. **num\_late** – Peaks suggest **temporal increases in payment delinquencies**, especially during periods of financial stress.
10. **past\_def** – These are likely **discrete increases in the number of defaults**, reflecting macroeconomic influences on financial behavior.