Predicting salaries in the GTA

A Bayesian approach

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Outline

1. Research motivation
2. Labour Market in ILUTE
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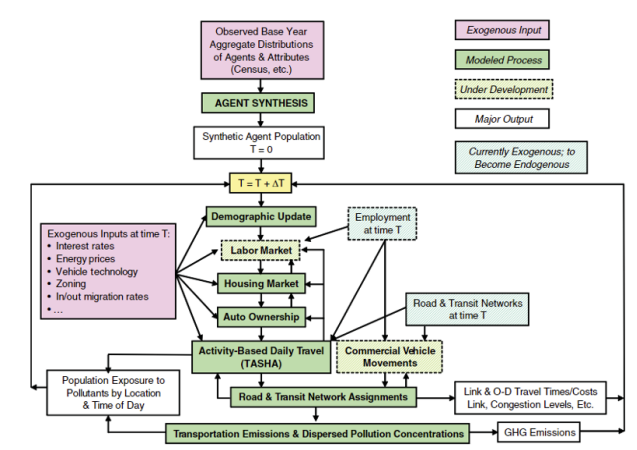
1. Research motivation

- Transportation models have grown in complexity, but some inputs are still considered **exogenous**.
- Work (HBW) is the **second most frequent** trip purpose in the GTA (TTS, 2016).
- Place of residence, place of work, household income, and auto ownership are **directly or indirectly related** to the labour market.

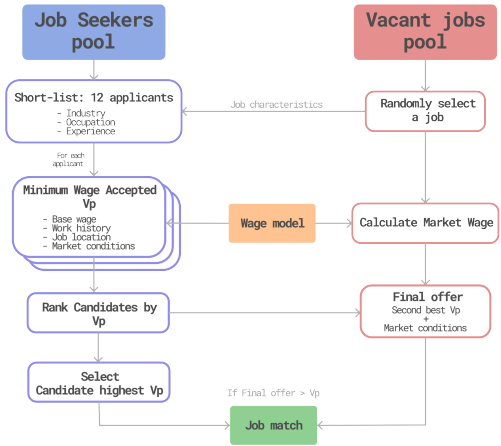


ILUTE flowchart (Miller et al, 2021).

2. Labour Market in ILUTE

Job matching process

- Wages **facilitate the interaction** between agents in the labour market
- Wages **allocate labour** to the most efficient use
  - Industries
  - Occupations
  - Regions

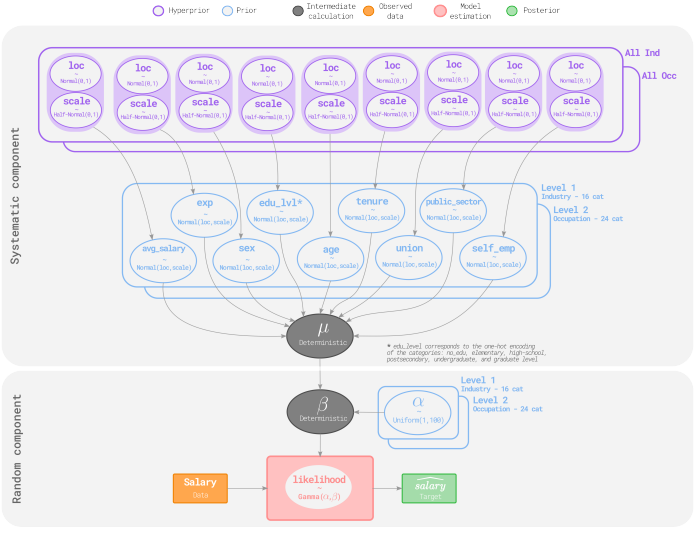


Job search and matching process in ILUTE (Adapted from Harmon, 2013).

3. Predicting salaries in ILUTE

Model structure

- Labour markets are organized in a **hierarchical** structure
  - Industries
  - Occupations
- The proposed model uses a **Hierarchical Gamma GLM** and **Bayesian inference**

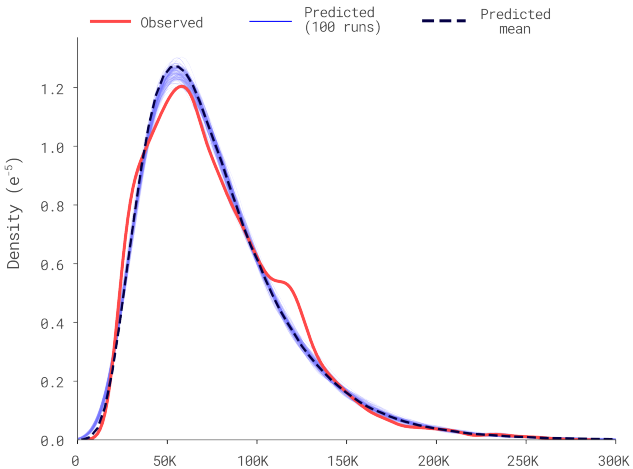


Proposed salary model

3. Predicting salaries in ILUTE

Results - Aggregated level (GTA)

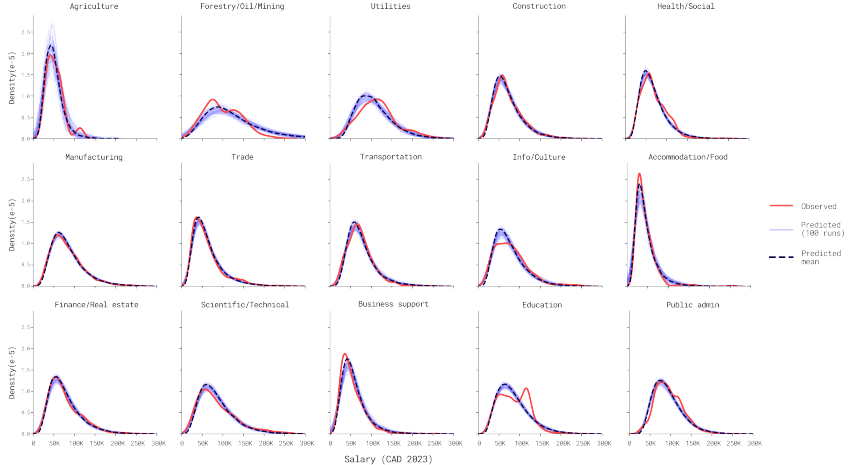
- Annual salaries are **positive** and **right skewed**.
- The proposed model resembles the observed distribution by using the **Gamma random component**.



Observed and predicted annual salary distribution for the GTA

3. Predicting salaries in ILUTE

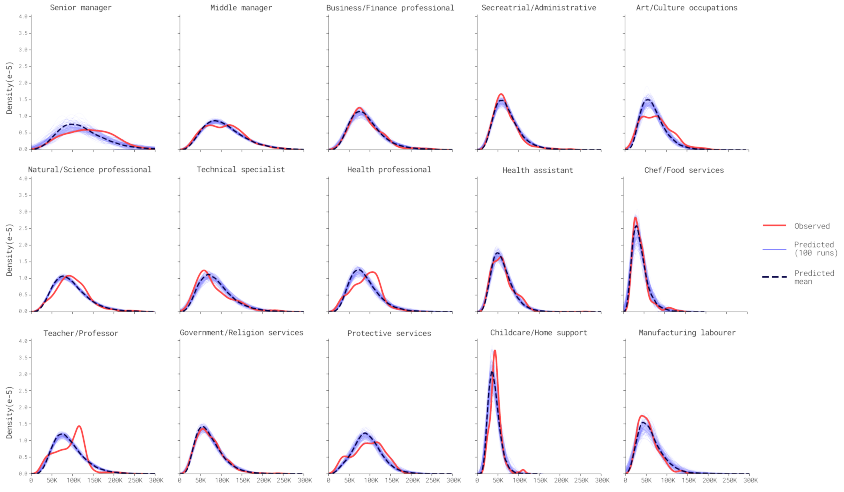
Results - Aggregated level (Industry)



Observed and predicted annual salary distribution by industry for the GTA

3. Predicting salaries in ILUTE

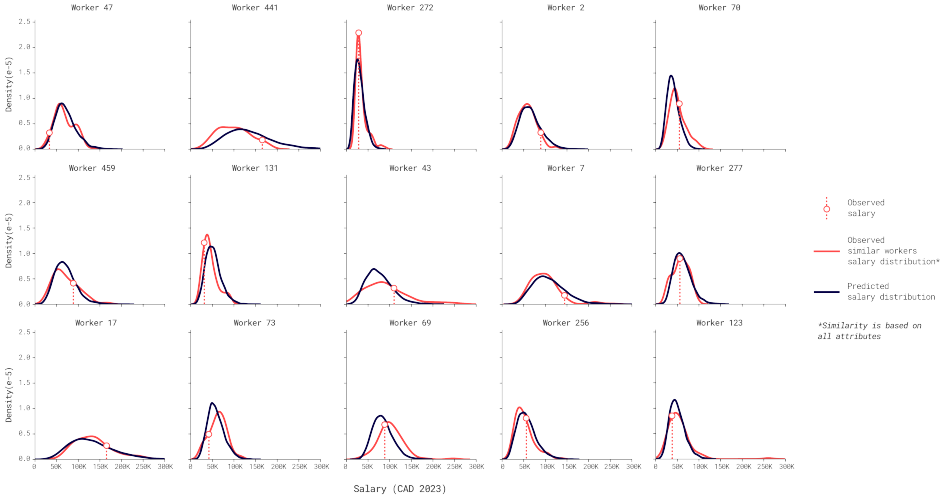
Results - Aggregated level (Occupation)



Observed and predicted annual salary distribution by occupation for the GTA

3. Predicting salaries in ILUTE

Results - Disaggregated level (Worker)



Observed and predicted salaries for randomly selected workers

4. Conclusions

- Considering the hierarchical structure of the labour market has several advantages in the proposed model:
  - Improves the **prediction accuracy** of salaries by sharing information across industries and occupations.
  - Enhances the **robustness** by reducing the effect of outliers *(Shrinkage effect)*.
  - Both **information sharing** and **shrinkage effect** reduces the risk of **overfitting**.
- The **Gamma random component** allows the model to capture the **right skewness** of the observed salary distribution.
- Replacing point estimates with **probability distributions** might improve the interactions within the ILUTE labour market module.

Questions?

Thank you for your attention!