Know Your Fair Housing Price
Fair Housing Price Calculator

Group 1

We provide a solution to predict a fair housing price.

Scenario		What are the conflicts?
Solution		What is the product?
Impact		How will it make a difference?
Mitigation		What is the future improvement?

4 types of stakeholders have demand on fair house price.

Government
- Tax revenue
- Policy making

Home sellers
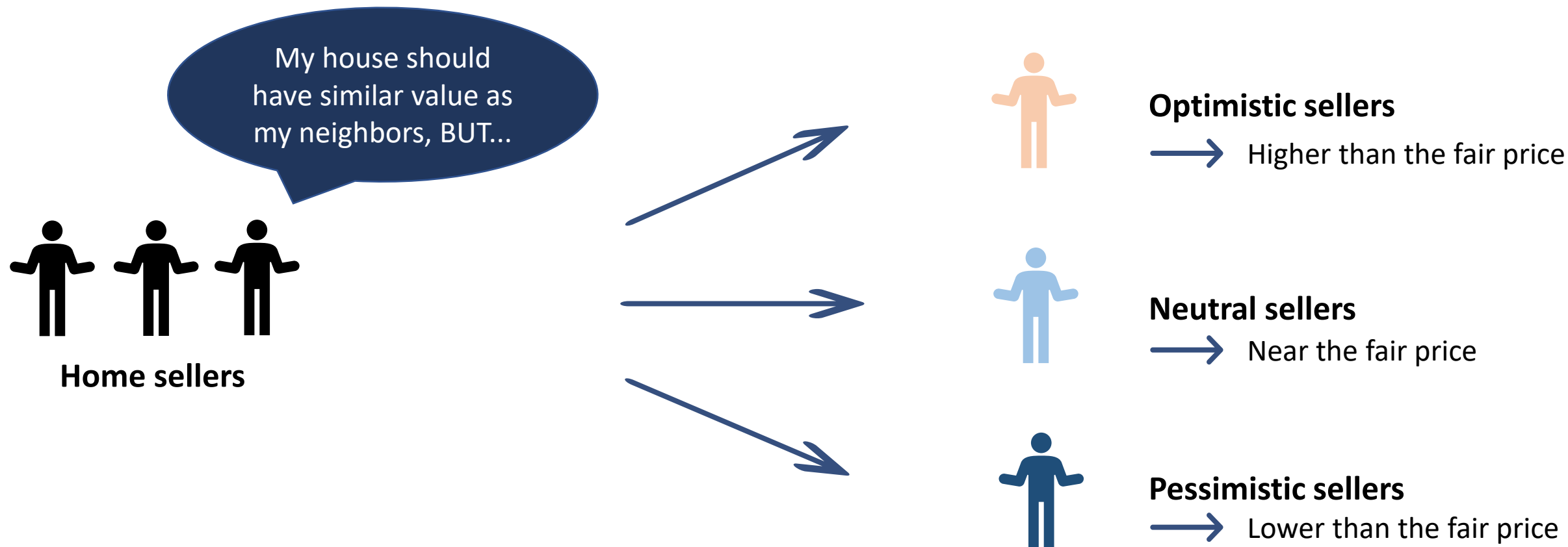- Private housing market
- Price maximizer

Banks
- Home appraisal
- Home refinancing

Insurance Corporate
- Property insurance
- Risk Minimizer

Source: HomeLight Blog, The Balance.

Our focus is on the sell side, especially for individual home sellers.

My house should have similar value as my neighbors, BUT...

Home sellers

Optimistic sellers
→ Higher than the fair price

Neutral sellers
→ Near the fair price

Pessimistic sellers
→ Lower than the fair price

Source: Real Estate Economics

Additionally, pricing may go wrong even if hiring an agent.

It should be the price as some recent transactions, BUT given the current market conditions, …

Seller agencies

Seller's market → Higher than the fair price

Neutral market → Near the fair price

Buyer's market → Lower than the fair price

For better pricing, we propose a solution with enriched dataset.

Factor Category	Variable Example	
Home Features	**Gross living area, overall quality, year built**	
	+	
Macroeconomics	**Monthly unemployment rate**	**Enriched**
	+	
Market Sentiment	**proxy for house market trading volume**	**Dataset**
	+	
Policy	**monthly national average mortgage rate**	
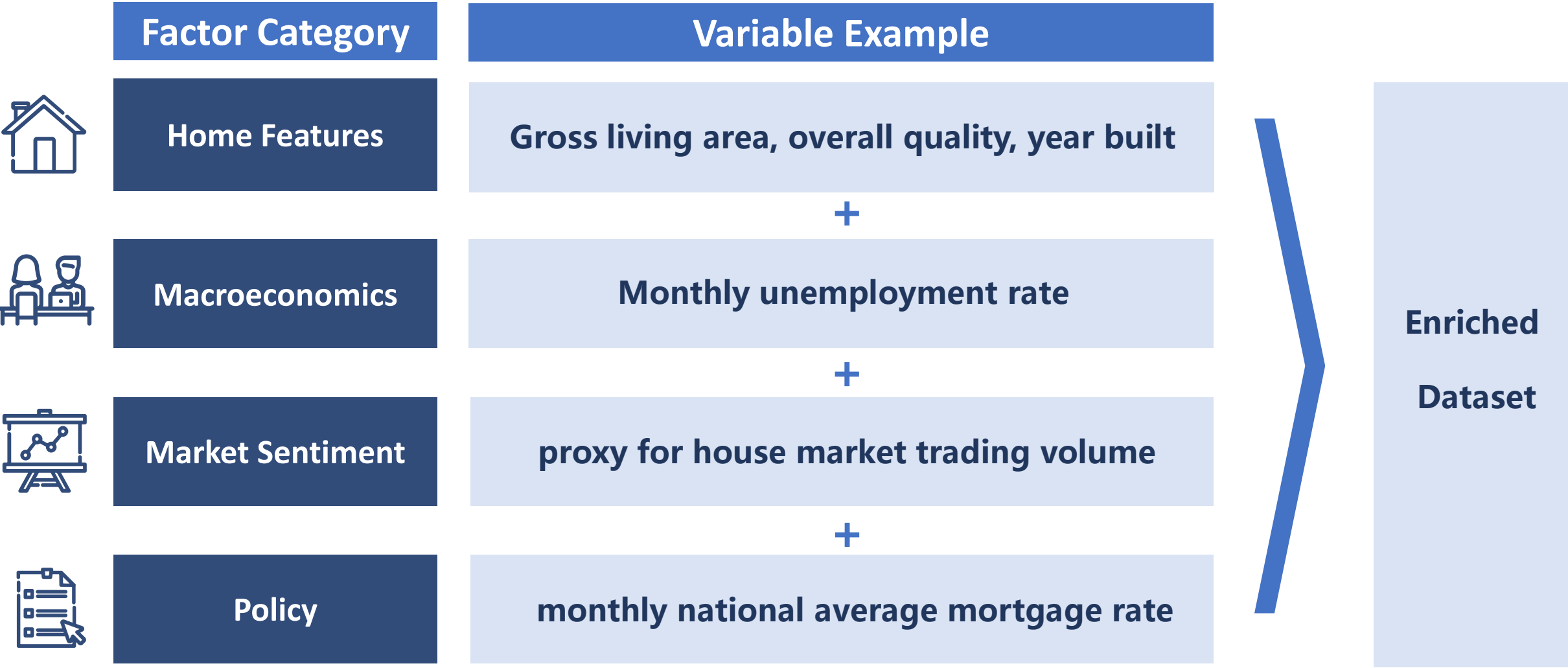
Source: Kaggle , Google Trends, Iowa Data, Federal Housing Finance Agency

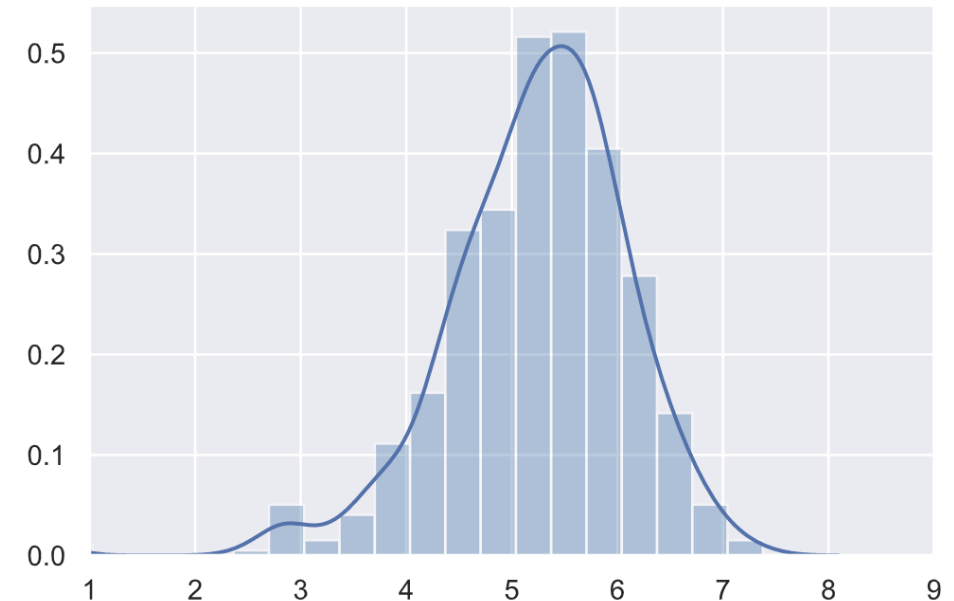# To obtain robust and accurate result, data preprocessing is performed.

✓ Use log transformation to solve right-skewed distribution problem.

✓ Transformed variable examples: LotFrontage, MasVnrArea, BsmtFinSF1
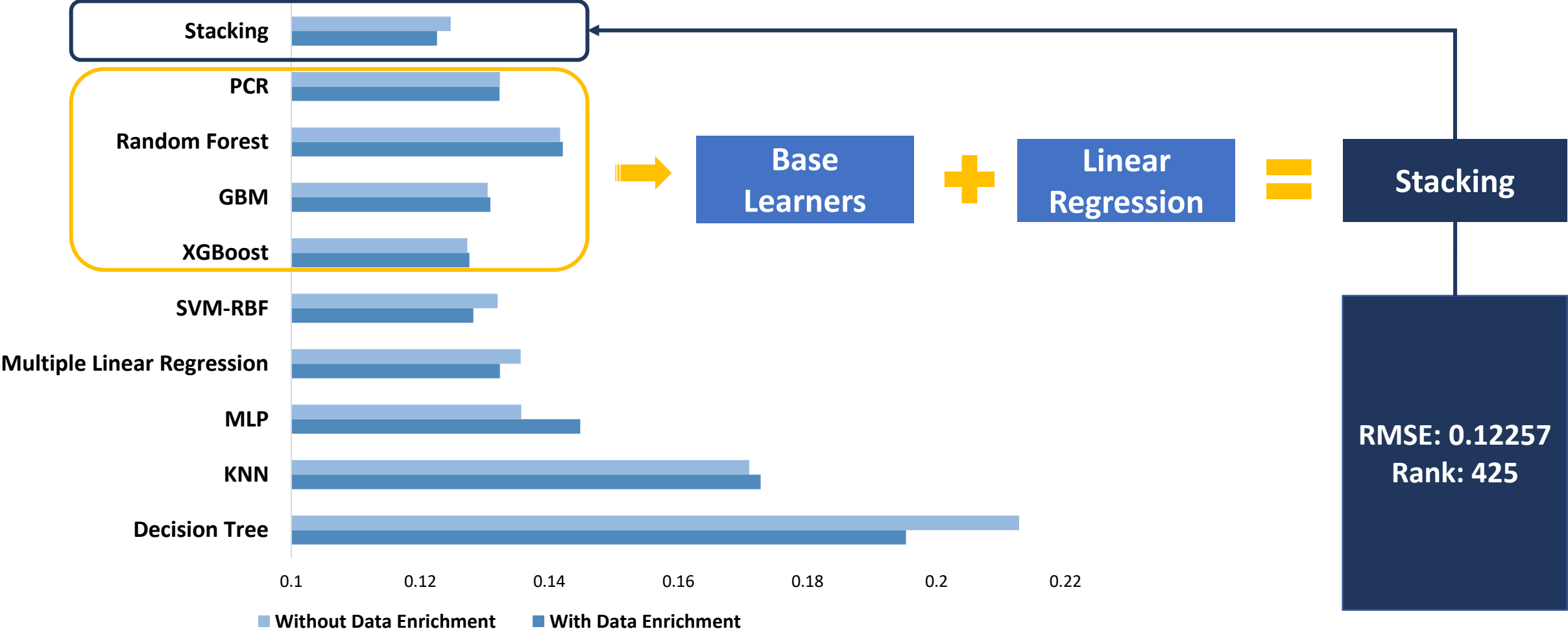

Before Log Transformation
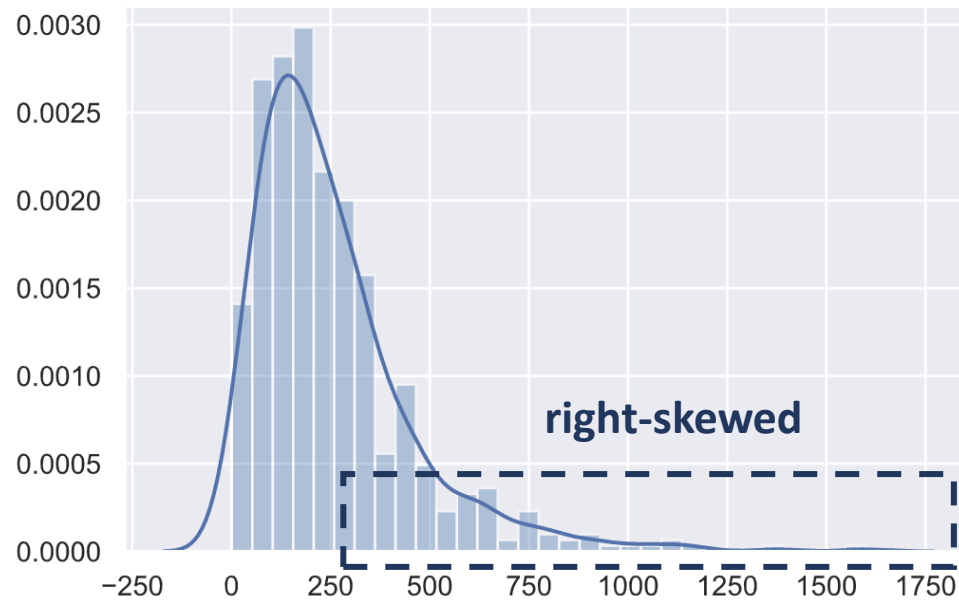
After Log Transformation

right-skewed

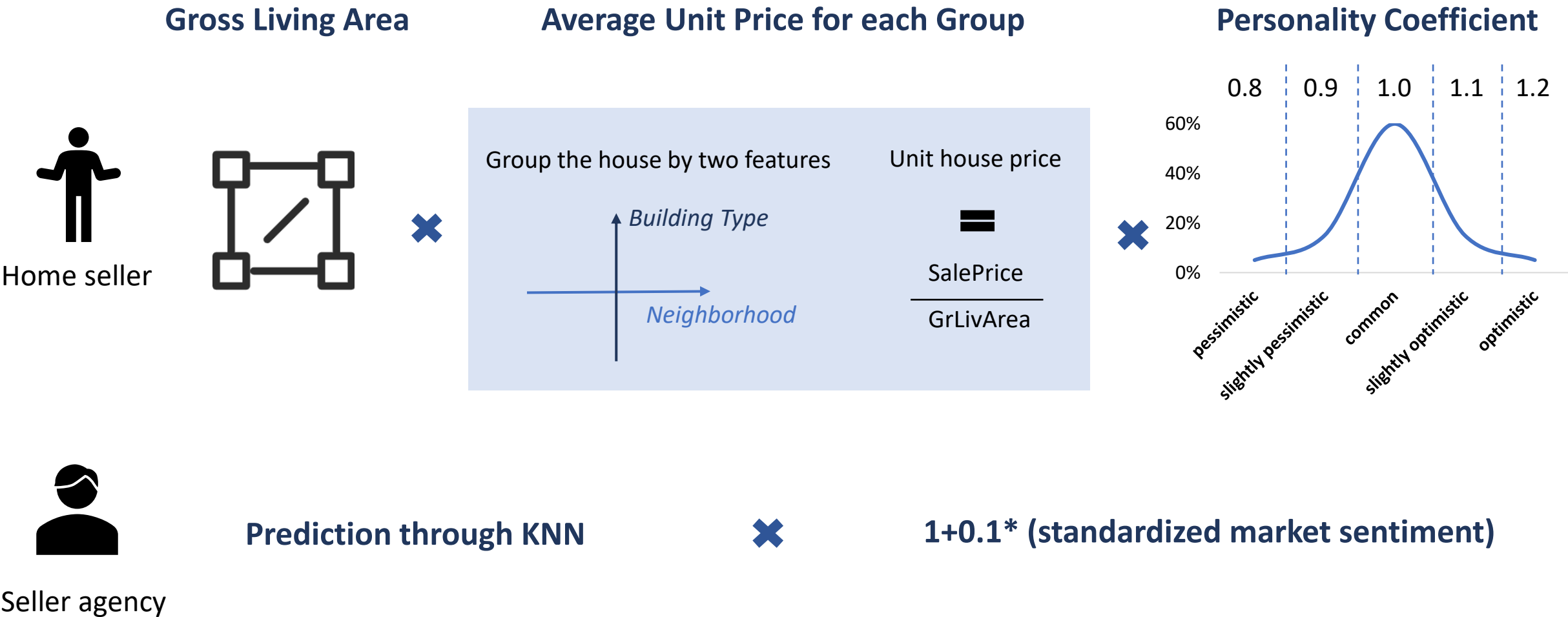# Stacking is the best model among all available models.
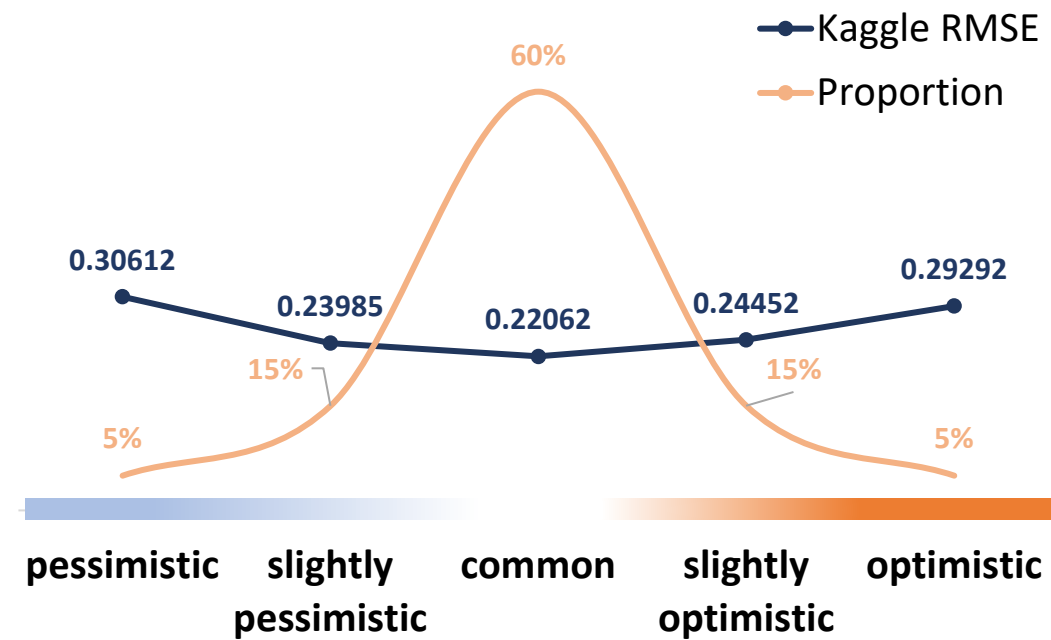

Model Performance - RMSE

Base
Learners

+

Linear
Regression

=

Stacking

RMSE: 0.12257
Rank: 425

Models (top to bottom): Stacking, PCR, Random Forest, GBM, XGBoost, SVM-RBF, Multiple Linear Regression, MLP, KNN, Decision Tree

X-axis: 0.1, 0.12, 0.14, 0.16, 0.18, 0.2, 0.22

Legend: ■ Without Data Enrichment ■ With Data Enrichment

Group I

We also simulate the prediction process of home seller and agency as our benchmark.

Gross Living Area

Average Unit Price for each Group

Personality Coefficient

Home seller

×

Group the house by two features

Unit house price

↑ *Building Type*

→ *Neighborhood*

$$= \frac{SalePrice}{GrLivArea}$$

×

0.8 0.9 1.0 1.1 1.2

60%
40%
20%
0%

pessimistic
slightly pessimistic
common
slightly optimistic
optimistic

Seller agency

Prediction through KNN

×

1+0.1* (standardized market sentiment)

Executive | Scenario | Solution | Impact | Mitigation | Summary

Our model provides more significantly more accurate fair price.

Group I

Compared with home seller benchmark

Kaggle RMSE
Proportion

0.30612
0.23985
0.22062
0.24452
0.29292

60%

15%
15%
5%
5%

pessimistic | slightly pessimistic | common | slightly optimistic | optimistic

Improve 47.84%

Compared with seller agency benchmark

RMSE

0.25
0.2
0.15
0.1
0.05
0

0.20002

0.12257

agency

stacking
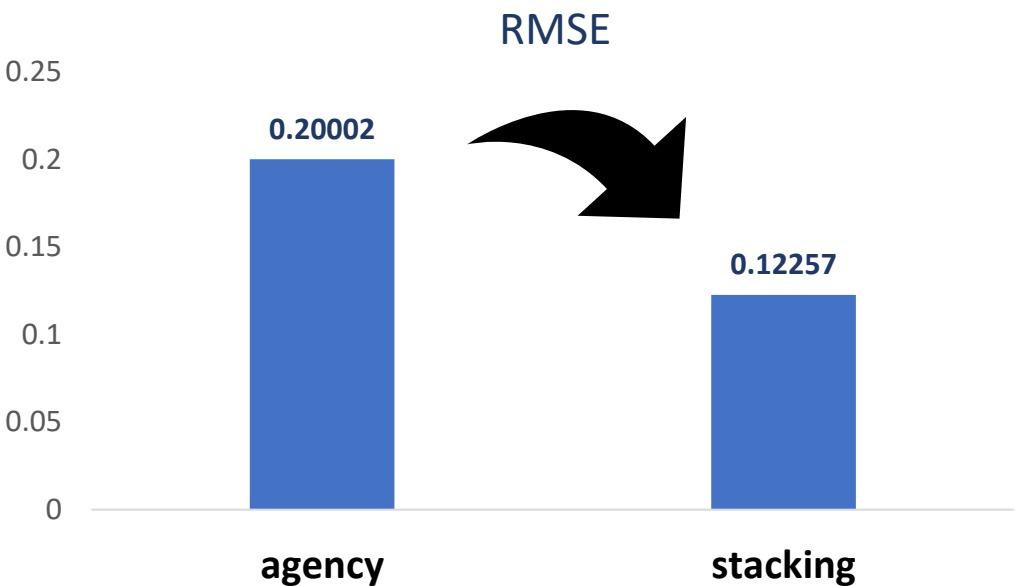
Improve 38.72%

Following two cases show the superiority of our model.

Case 1
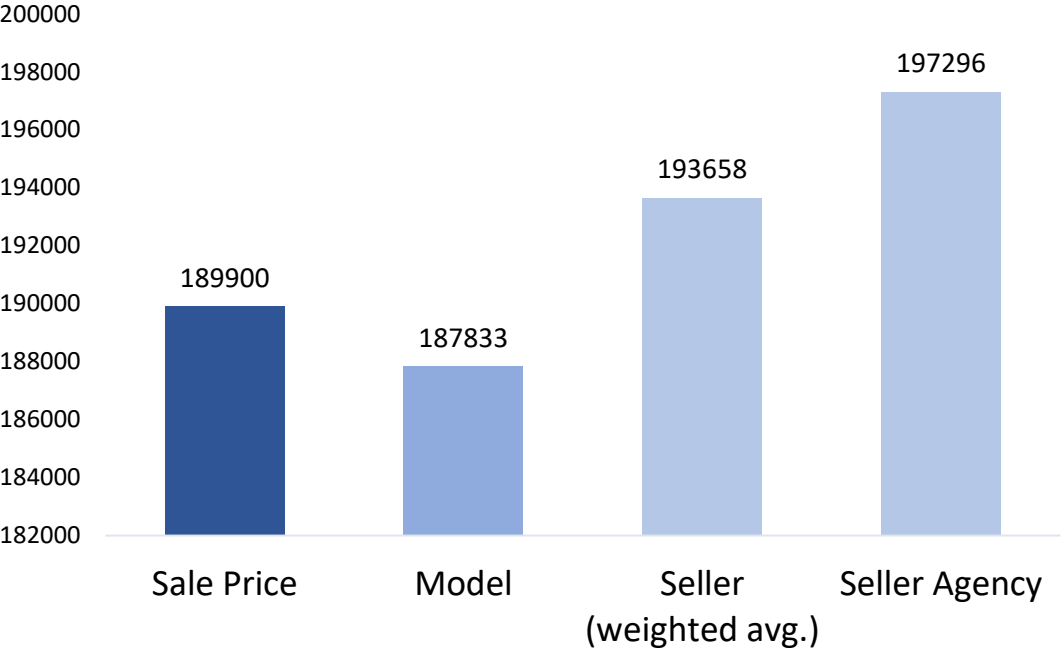
Case 2

Saving selling time
Relatively profitable price
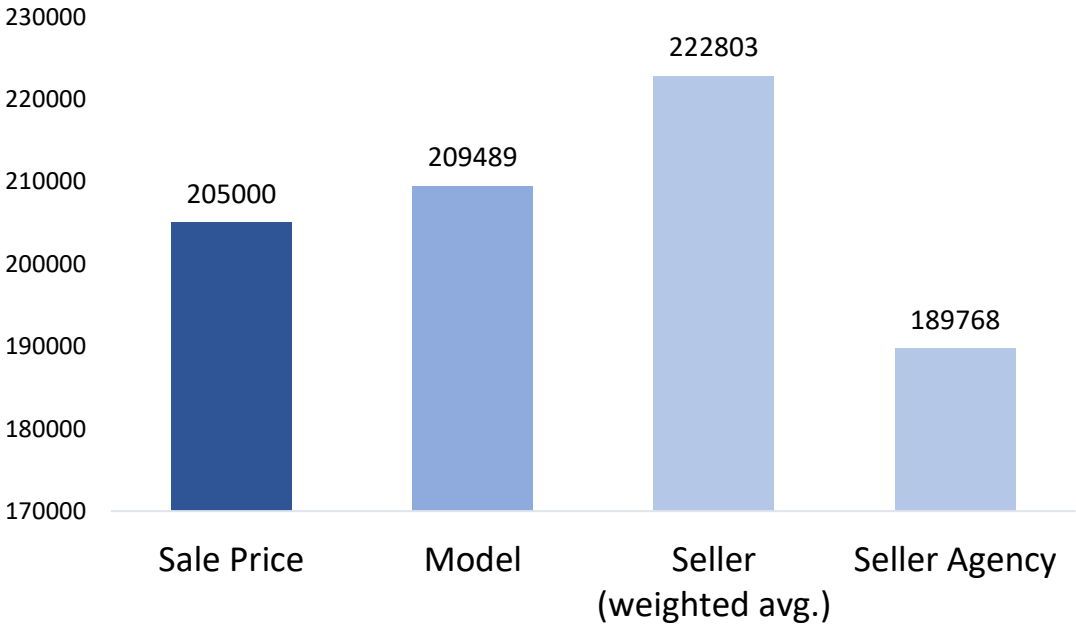
Gain more profit
Relatively short selling time

There are 2 mitigations worth your investment.

Anticipated Risk	Mitigation

➢ **Model building**
    • Lack of data across the time
    • Delete important near-zero variance features
 	
➢ **Model assumption**
    • House features mainly determine the price
	➢ **Data enrichment**
	    • Instance: other cities in Iowa
	    • Attributes: decoration, location…
	
	➢ **Algorithm-based adjustment**
	    • Weight of different category of features

We provide a promising fair housing price calculator for home sellers.

Group I

		Home Sellers	Seller Agencies
Scenario		Not professional and irrational	Not precise sense on market trend
		Inaccurate estimation on housing price	
Solution		🏠 + 📈 + 💲 + ★	stacking → Fair price
Impact		47.84% ↑	38.72% ↑
Mitigation		Data enrichment on instance and attribute Algorithm-based weight adjustment	

Thanks for your listening!

Group I