LINCOLN INSTITUTE
OF LAND POLICY

Valuing Land in Detroit

Using the Option Value Approach

Urban Economics and Public Finance Conference
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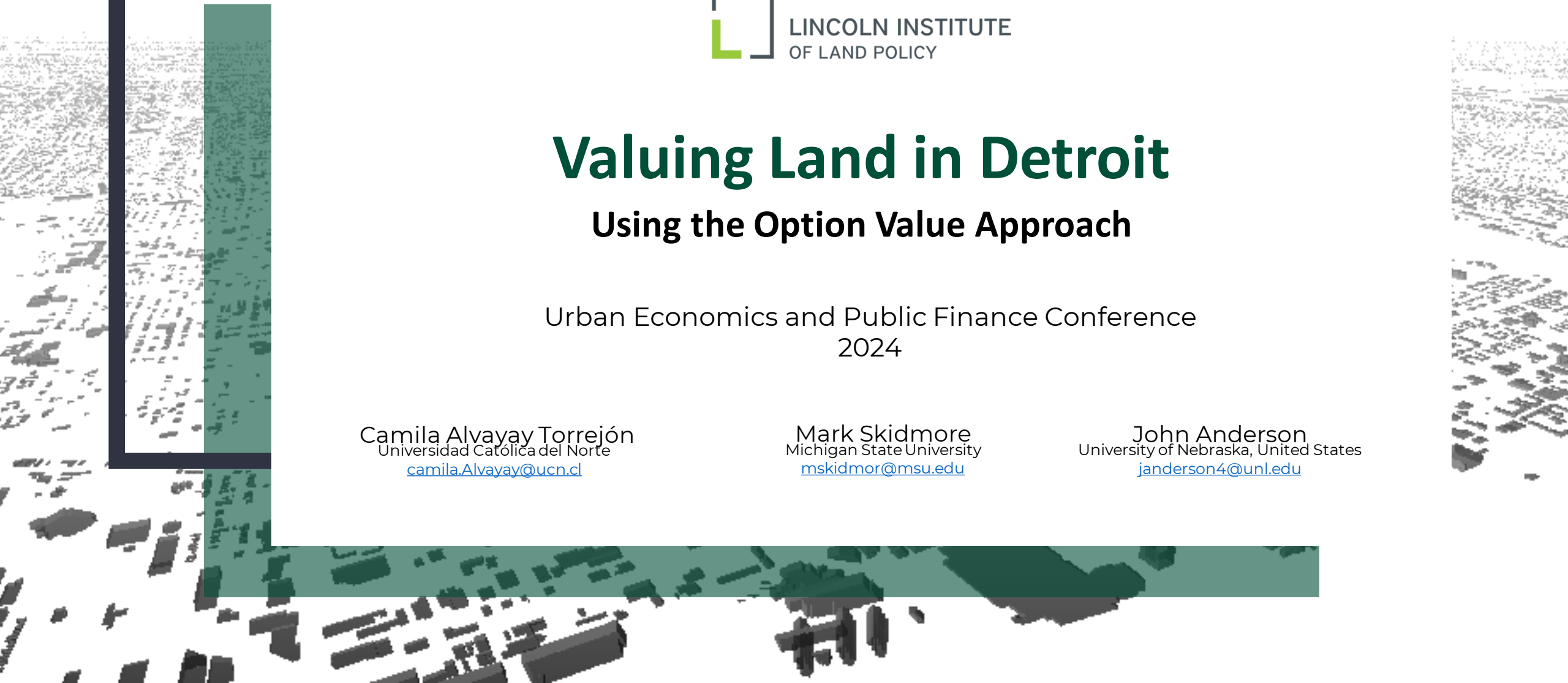


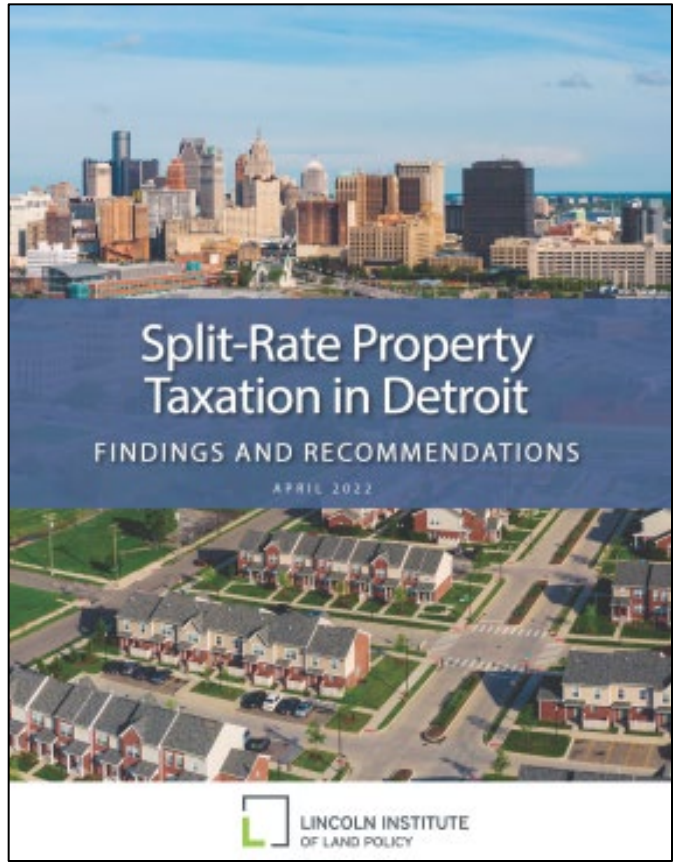
Background

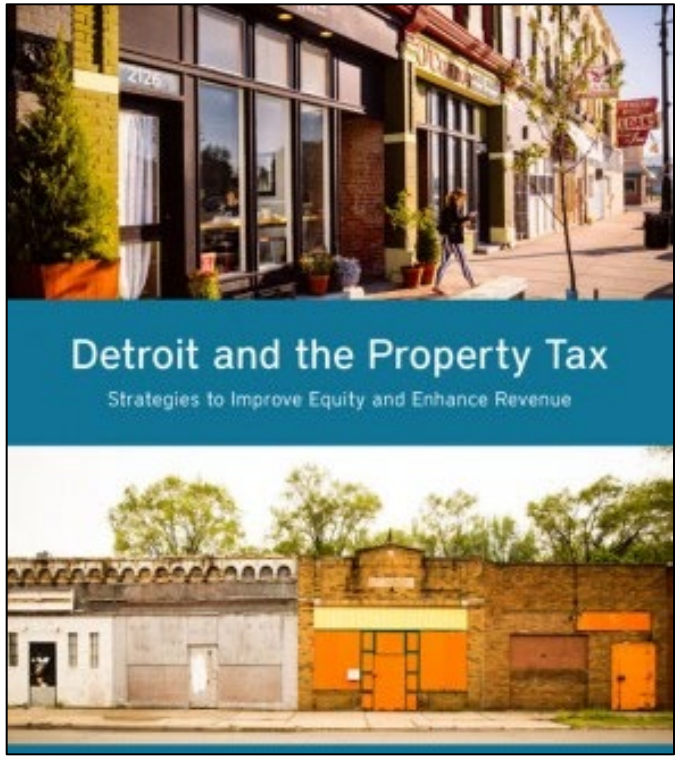
- This project fits into a decade long history of research on Detroit's property tax & property market that includes many partners
  - **Supported by Lincoln**
  - Fernanda Alfaro, Camila Alvayay Torrejón, Nick Allen, James Alm, John Anderson, Andrew Hanson, Zach Hawley, Timothy Hodge, Daniel McMillen, Dusan Paredes, **Gary Sands**, Mark Skidmore, Zhao Yang
- Detroit's collapsed real estate market beginning in 2008.

Lincoln Supported Activities

- ❑ Will a Greenbelt Help to Shrink Detroit's Wasteland? (Mark Skidmore, Lincoln Land Lines, 2014)
- ❑ Detroit and the Property Tax: Strategies to Improve Equity and Enhance Revenue (Gary Sands & Mark Skidmore, Lincoln Report, 2015)
- ❑ Split-Rate Property Taxation in Detroit: Findings and Recommendations (John Anderson & Nick Allen Lincoln Report, April 2022)
- ❑ Many other working papers & writings

Will a Greenbelt Help to Shrink Detroit's Wasteland?





Lincoln Supported Activities

Alm, J., Hodge, T. R., Sands, G., & Skidmore, M. (2014). Detroit **property tax delinquency**: Social contract in crisis. ***Public Finance and Management***, *14*(3), 280-305.

Sands, G., & Skidmore, M. (2014). Making ends meet: Options for **property tax reform** in Detroit. ***Journal of Urban Affairs***, *36*(4), 682-700.

Hodge, T. R., Skidmore, M., Sands, G., & McMillen, D. (2015). **Tax Base Erosion and Inequity** from Michigan's **Assessment Growth Limit**: The Case of Detroit. ***Public Finance Review***, *43*(5), 636-660.

Hodge, T. R., Sands, G., & Skidmore, M. (2015). **Assessment Growth** Limits and Mobility: Evidence from Home Sale Data in Detroit, Michigan. ***National Tax Journal***, *68*(3), 573-599.

Hodge, T. R., McMillen, D. P., Sands, G., & Skidmore, M. (2017). **Assessment inequity** in a declining housing market: The case of Detroit. ***Real Estate Economics***, *45*(2), 237-258.

Paredes, D., & Skidmore, M. (2017). The net benefit of **demolishing dilapidated housing**: The case of Detroit. ***Regional Science and Urban Economics***, *66*, 16-27.

Hodge, T. R., Sands, G., & Skidmore, M. (2017). The **land value gradient** in a (Nearly) collapsed urban real Estate Market. ***Land Economics***, *93*(4), 549-566.

Alvayay Torrejón, C., Paredes, D., & Skidmore, M. (2021). **Housing demolition** and property tax delinquency: Evidence from Detroit. ***Journal of Urban Affairs***, *43*(5), 702-723.

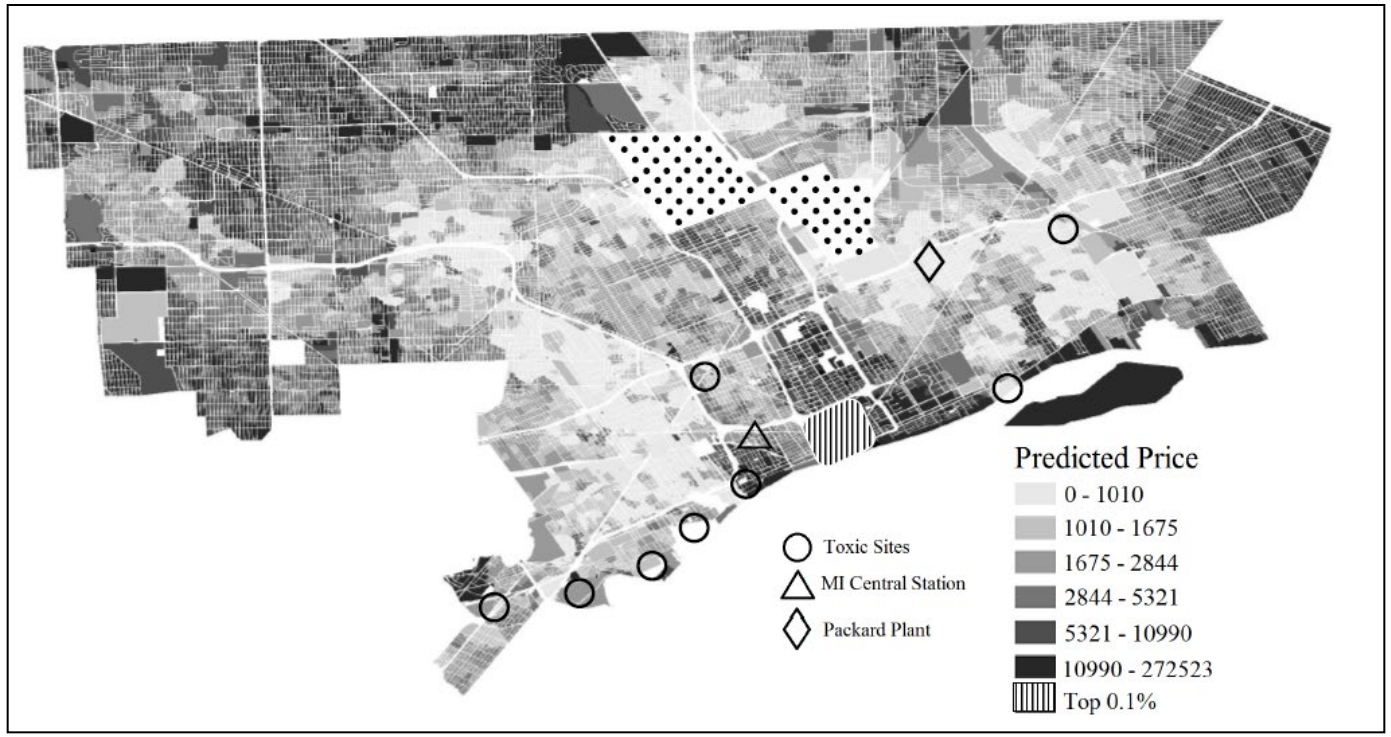
Alfaro, F., Paredes, D., & Skidmore, M. (2022). The Effect of **Property Assessment** Reductions on Homeownership: A Quasi-Dynamic Economic Analysis. ***Public Finance Review***, *50*(6), 704-731.

Alfaro, F., Paredes, D., & Skidmore, M. (2022). The Effect of **Property Assessment** Reductions on Tax Delinquency and Tax Foreclosure. Revised and resubmitted to ***National Tax Journal***.

The Split-Rate Tax in Detroit

- Enabling State Legislation Awaits Enactment
  - **Mayor Dugan Has Become a Champion of the Split-Rate Tax**
  - Nick Allen (Ph.D. student MIT) was and continues to be a key figure in Detroit
- Split-rate taxation requires accurate and assessment of land separate from structures that is feasible to implement
  - Camila Alvayay Torrejón's dissertation topic
  - Market Value = Use Value + Option Value

Predicted Citywide Land Values Based on Vacant Land Sales (From Hodge, Sands, & Skidmore (2017)



The Problem: Erosion of the property tax base in Detroit

- ❑ “Under Detroit’s property tax system, **blight is rewarded, and building is punished.** Detroit homeowners pay among the highest property taxes in Michigan” (City of Detroit, 2023)
- ❑ High level of property tax delinquency.
- ❑ Uneven distribution of tax burdens, **inflated property assessments**.

The Problem: Erosion of the property tax base in Detroit

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DETROIT

Detroit overtaxed homeowners $600M. Years later, advocates still seeking reparations.

Emma Stein
Detroit Free Press

Published 4:55 p.m. ET Jan. 22, 2022 | **Updated 3:52 p.m. ET Jan. 23, 2022**

View Comments

The city of Detroit overtaxed homeowners by at least $600 million between
and 2016. After a City Council proposal failed in 2020, Detroit City Council
President Mary Sheffield and the Coalition for Property Tax Justice revealed

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DETROIT

Tax justice group calls on Detroit to fix 'unfair' property assessments

Charles E. Ramirez
The Detroit News

Published 4:26 p.m. ET July 7, 2021 | **Updated 5:29 p.m. ET July 7, 2021**

View Comments

Detroit — Community activists Wednesday celebrated thousands of Detroit and Wayne County homes spared from tax foreclosure this year amid the pandemic and renewed a call for Detroit officials to halt inflated property tax assessments

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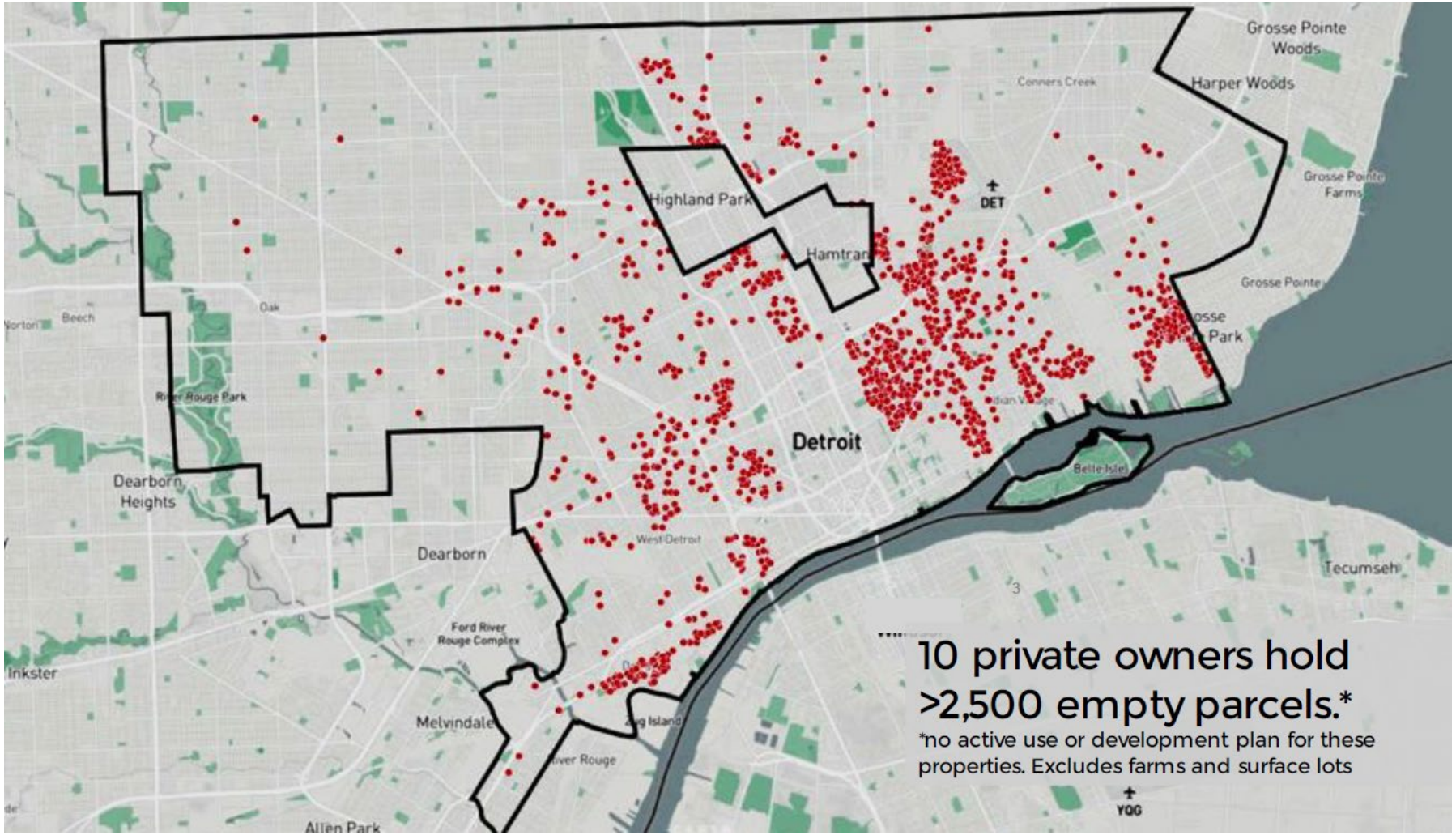
NEWS > 7 IN DEPTH

Detroiters still seeking compensations for overassessed property taxes 12 years later

The Problem: Erosion of the property tax base in Detroit



Source: City Council Presentation Land Value Tax Proposal, October 10, 2023.

A Possible Solution:

Split-rate tax

- **Recommendation:** local property tax reform (Sands and Skidmore, 2015).
  - A land value tax or a split-rate tax **applies a higher tax rate on land than on improvements**.
  - The split rate property tax policy alternative is intended to foster **growth and urban renewal**.

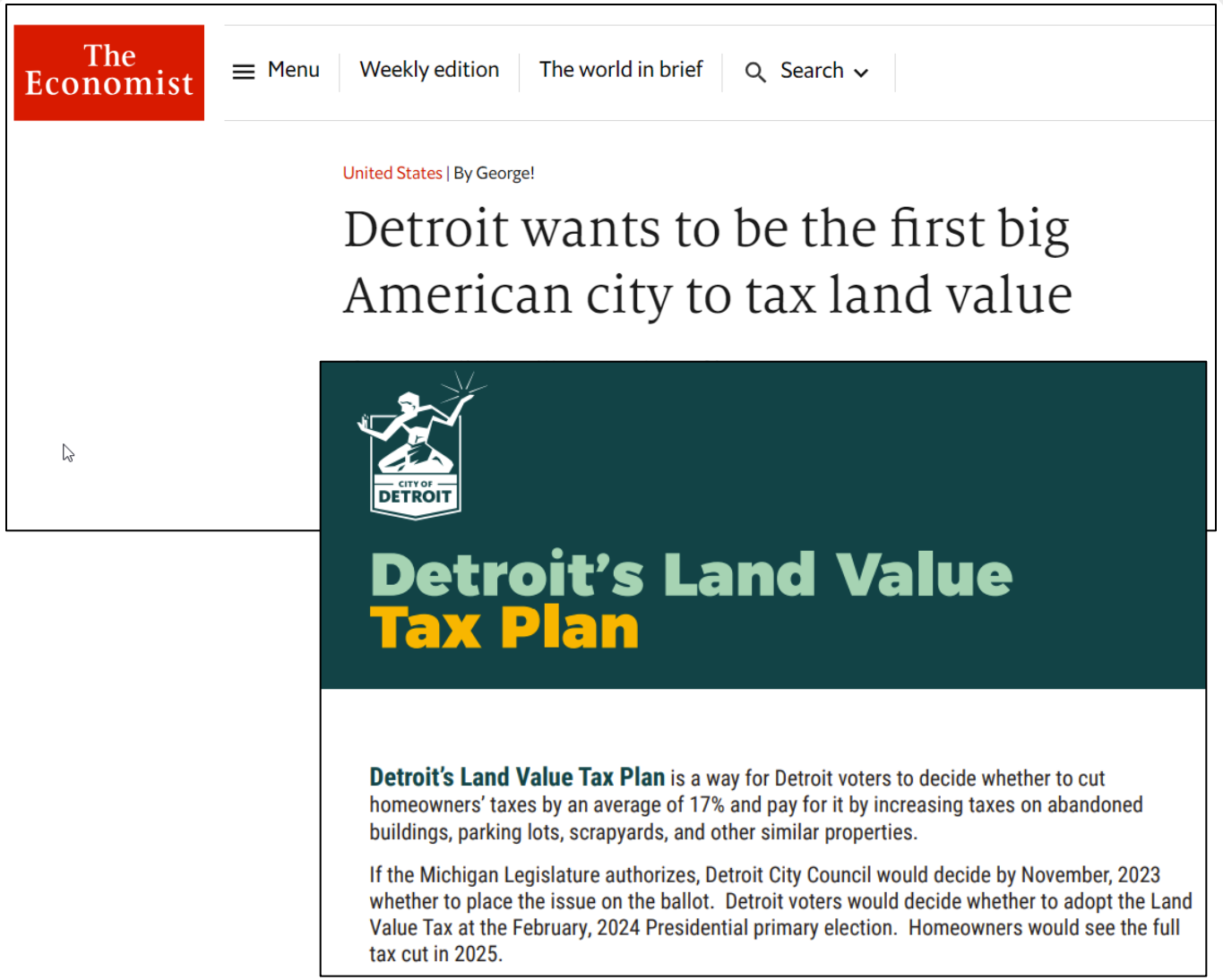
Challenge

Accurate and timely assessment of land value separate from improvements (Dye & England, 2010).

Why Is It Important?

First paper to present evidence of Option Value in Detroit

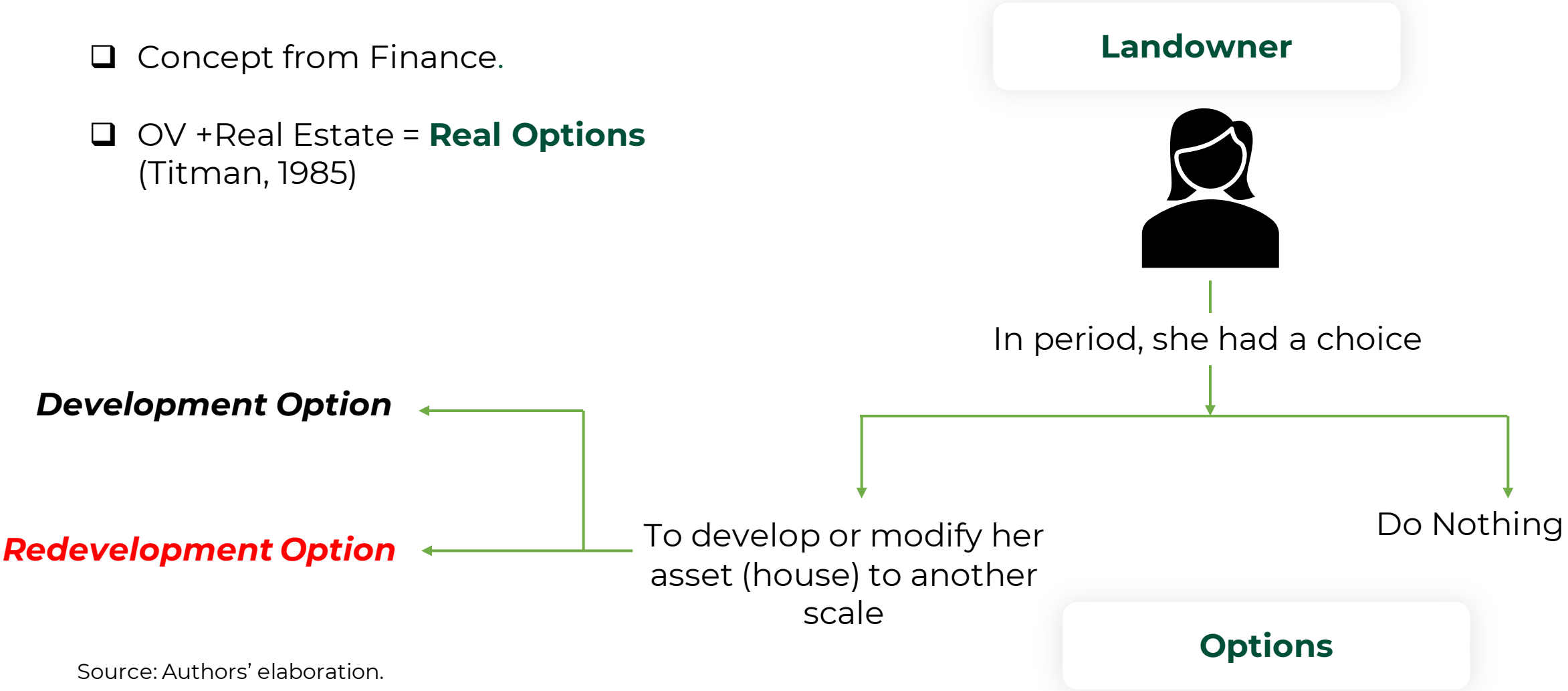
We propose a simple method to measure land values.



Detroit voters would decide whether to adopt the Land Value Tax on November 2024 ballot.

Real Options and Urban Land Valuation: Literature Review

- ❑ Concept from Finance.
- ❑ OV +Real Estate = **Real Options** (Titman, 1985)



Source: Authors' elaboration.

Real Options and Urban Land Valuation: Literature Review

Empirical evidence of redevelopment option in Hedonic Models

Authors & Year	*Option Value Variable*	*Results*
Clapp & Salavei, (2010)	(1) $Intensity_{Assessor} = \frac{Assessed\ Structure\ Value}{Assessed\ Land\ Value}$ (2) $Intensity_{Const} = \frac{Interior\ Square\ Footage\ (ISF)}{Average\ ISF\ Nearby\ New\ Construction}$ (3) Percent of neighboring sales recently torn down identified by the town assessor.	32% of market price is option value.
Clapp et al. (2012)	$Intensity_{Assessor} = \frac{Assessed\ Structure\ Value}{Assessed\ Land\ Value}$	Mean option value of 29%-34% for properties most similar to vacant land. Average town has option value of about 6%.
Clapp et al. (2013)	$D(Development\ Potential) = \frac{current\ floor\ space}{maximum\ allowed\ floor\ space\ st\ zoning\ regulations}$	The elasticity of house value with respect to development potential is 15% on average over the full sample period.

Source: Authors' elaboration.

Theoretical Considerations

The call option model of Land Value

- Main idea land ownership gives the owner the right without obligation to develop or redevelop her property Clapp et al. (2012)

- **Assumptions:**
  - Option to redevelop as a single **irreversible** call option.
  - Landowner (and developer) is risk-neutral and that at time t, she has a unit of land ($L = 1$) and an **initial scale of housing ($\bar{Q}$).**
  - Then, at any time $s \geq t$, the landowner is able to **redevelop land on a scale equal to Q**.

Theoretical Considerations

The call option model of Land Value

- The functions of cost of redevelopment and rent per unit of the redeveloped property are given by equations (1) and (2).

Potential Structure

Initial Structure

$$C(Q, \bar{Q}) = Q^{\eta_2} \bar{Q}^{\eta_1} \quad (1)$$

$$R\big(Q, x(t)\big) = Q^{b} x(t) \quad (2)$$

$\eta_2 > 0$

$0 > b > -1$

Shocks from the demand side

Theoretical Considerations

The call option model of Land Value

- Developer's problem: find the optimal time to execute the option and the optimal redevelopment scale that maximizes the expected net present value of the existing property

E(NPV) of rents up to T **E(NPV) since T**

$$z(x,\bar{Q}) = \max_{T,Q} E_t \left\{ \int_t^T \bar{Q}^{b+1} x(s) e^{-\rho(s-t)} ds + \int_T^\infty Q^{b+1} x(s) - Q^{\eta_2} \bar{Q}^{\eta_1} e^{-\rho(T-t)} \right\}$$

$$st \quad dx(t) = \alpha x(t) dt + \sigma x(t) dz(t) \qquad (3)$$

Geometric Brownian motion

$\rho = Discount\ Rate\ and\ Interest\ Rate$

Theoretical Considerations

The call option model of Land Value

- Clapp et al. (2012)
- The solution to the optimization problem is an optimal development density, Q^*, and a critical value x^* such that it is optimal to redevelop a property with scale Q^* if $x \geq x^*$.

Option Value

Z1: No redevelop

Z2: Redevelop

$$z(x,\bar{Q}) = \begin{cases} Z_1 = \frac{\bar{Q}^{b+1}x}{\rho-\alpha} + B\bar{Q}^{\alpha_0}x^{\beta_1} & if\ x < x^* \\ Z_2 = \frac{g\bar{Q}^{b+1}x}{\rho-\alpha} - g\frac{\eta_2}{b+1}\bar{Q}^{\eta_2+\eta_1} & if\ x \geq x^* \end{cases} \quad (4)$$

Intensity

$$g, \beta_1, \alpha_0, B = f(\rho, b, \eta_1, \eta_2, \alpha, \sigma^2) \qquad \beta_1 > 0 \qquad \alpha_0 < 0$$

$$Market\ Value = Use\ Value + Option\ Value$$

Theoretical Considerations

The call option model of Land Value

- The solution to the optimization problem is an optimal development density, Q^*, and a critical value x^* such that it is optimal to redevelop a property with scale Q^* if $x \geq x^*$.

Option Value

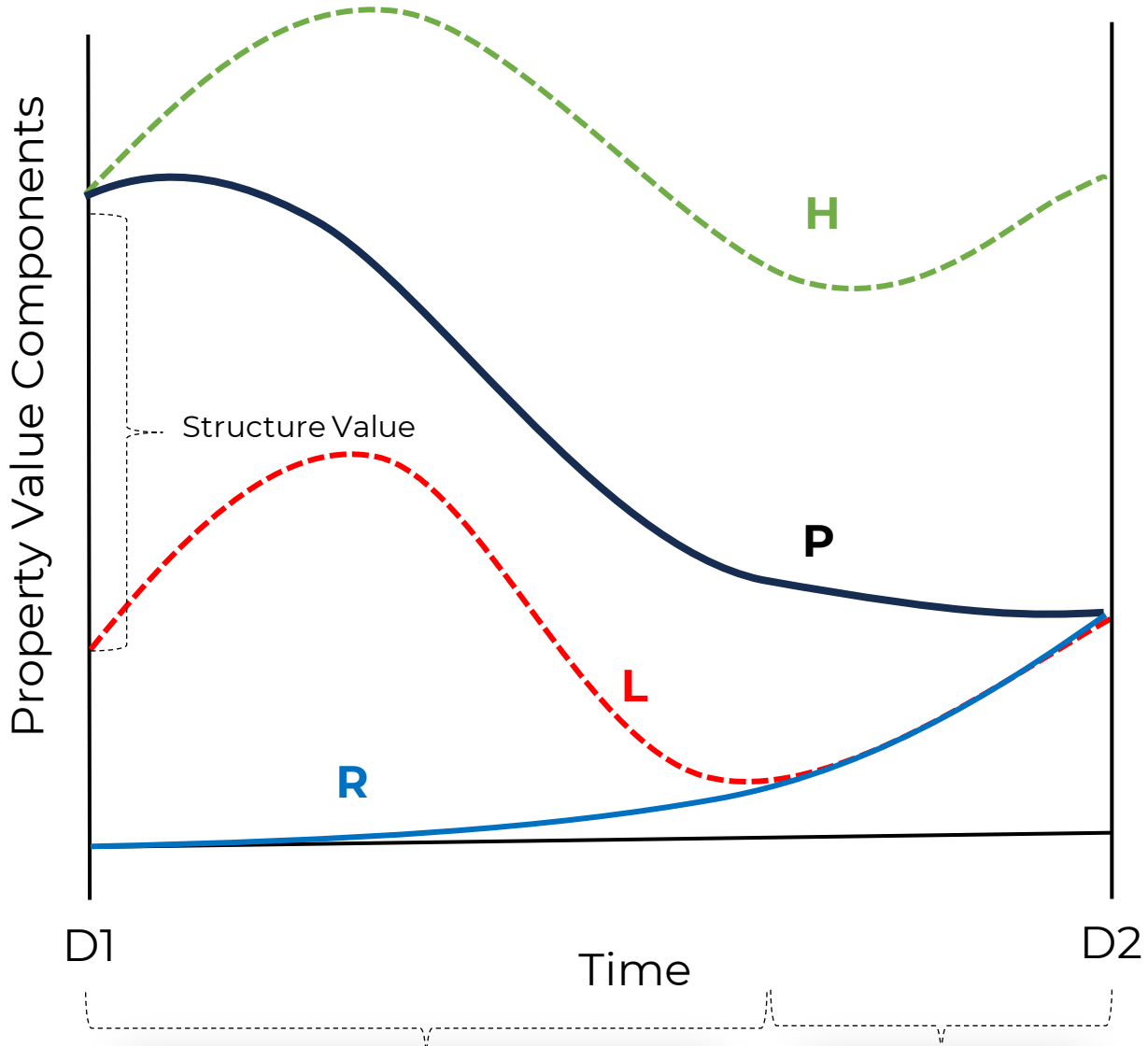
$$F(\bar{Q}) = P(\bar{Q}) = B_0 \bar{Q}^{b+1} + B_1 \bar{Q}^{\alpha_0} \quad (5)$$

Intensity

$$B_1 > 0 \qquad \alpha_0 < 0$$

$$Market\ Value = Use\ Value + Option\ Value$$

Land Value and Option Value



H=Value of HBU at time of Development

P=Property Asset Value (depreciated)

L=Land Value (as if vacant)

R=Redevelopment Option Value

D1=Redevelopment at time 1

D2=Redevelopment at time 2

$$L = use\ value\ of\ land + R$$

$$L \cong R$$

Identification Strategy

Step 1: Estimate Option Value for Detroit Residential Properties

- From the theoretical model:

$$P_i = \boldsymbol{\beta_0}' \boldsymbol{q_i^0} + \varepsilon_i \quad (6)$$

$$P_i = \boldsymbol{\beta_0}' \boldsymbol{q_i^0} + \beta_1 (q_i^0)^{\alpha} + \varepsilon_i \quad (7)$$

$$Intensity_i = f\left(\frac{S}{L}\right)$$

Intensity: a scalar aggregation index for the amount of structure per unit of land, as a **proxy variable for the option to redevelop.**

Intensity

Option Value

Identification Strategy

Step 1: Estimate Option Value for Detroit Residential Properties

- Using OLS estimator, we can estimate the following specifications:

***First Specification**: Hedonic Model including the Option Value*

$$lnP_i = \boldsymbol{\alpha' q_i} + \boldsymbol{\beta_1} \ln \boldsymbol{Intensity_i} + \varepsilon_i \quad (8)$$

Hypothesis: $\frac{\%\Delta Price}{\%\Delta Option\ Value} \approx \frac{lnP}{\ln Option\ Value} = -\hat{\beta}_1 > 0$

***Second Specification**: Model including the Option Value and Depreciation Effect*

$$lnP_i = \boldsymbol{\alpha' q_i} + \beta_1 \ln \boldsymbol{Intensity_i} + \beta_2 \ln \boldsymbol{Intensity_i \times Age_i} + \beta_3 \ln \boldsymbol{Intensity_i \times Age_i^2} + \varepsilon_i \quad (9)$$

Hypothesis: $\frac{\%\Delta Price}{\%\Delta Option\ Value} \approx \frac{lnP}{\ln Option\ Value} = -\left(\hat{\beta}_1 + \hat{\beta}_2 \times Age_i + \hat{\beta}_3 \times Age_i\right) > 0$

Identification Strategy

Step 1: Estimate Option Value for Detroit Residential Properties

- Using OLS estimator, we can estimate the following specifications:

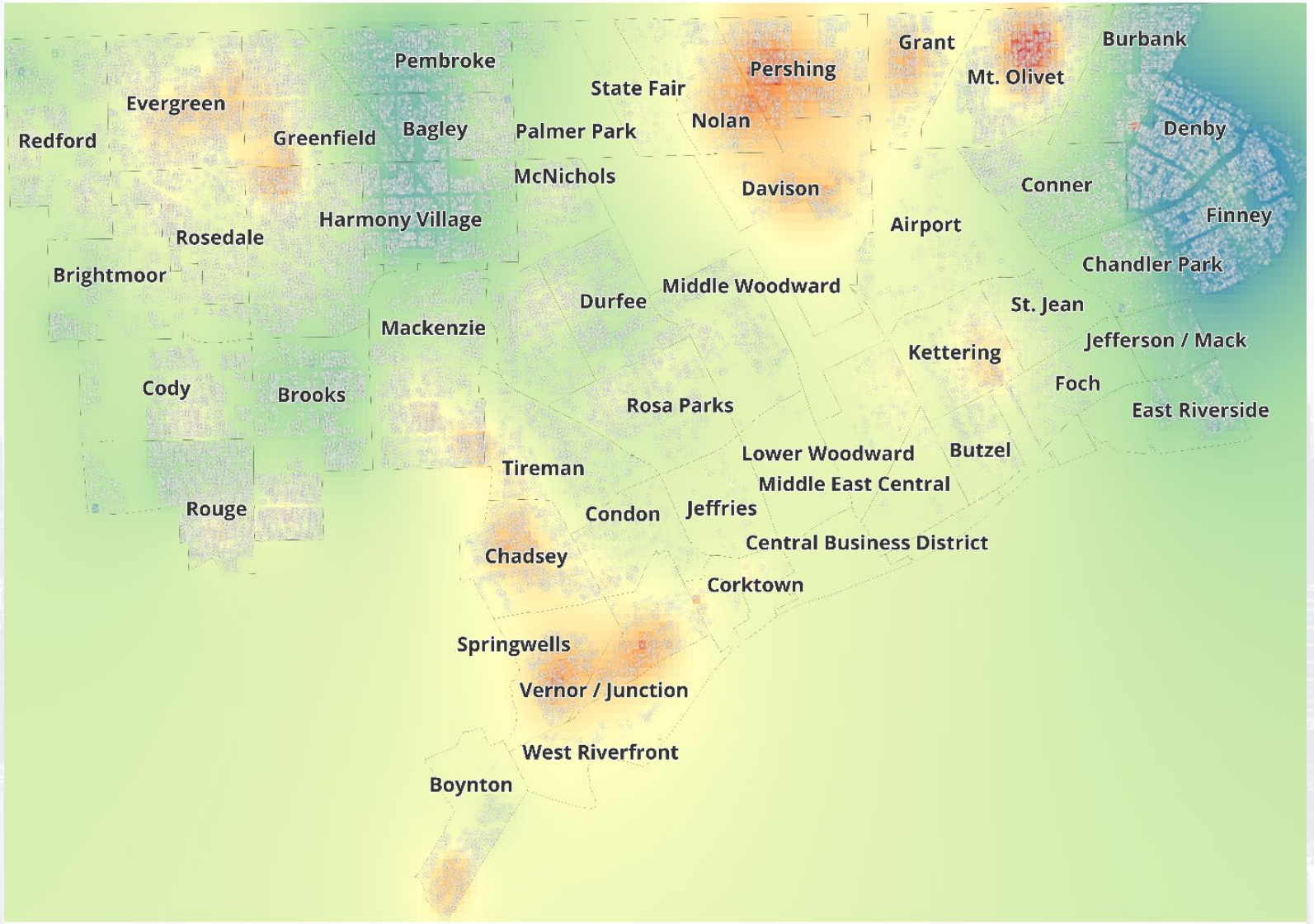
Third Specification: **Hedonic Model including the Option Value, Depreciation Effect and Neighborhood Housing Quality**

$$lnP_i = \boldsymbol{\alpha}'\boldsymbol{q_i} + \beta_1 \ln Intensity_i + \beta_2 \boldsymbol{nhood\_quality_i} + \beta_3 \ln Intensity_i \times \boldsymbol{nhood\_quality_i} \times Age_i + \beta_4 \ln Intensity_i \times \boldsymbol{nhood\_quality_i} \times Age_i^2 + \varepsilon_i$$

- Nb: Number of blighted properties within 0.5-mile radius over three years prior to sale.
- Fa: Average fine amount for blight infractions per property.
- Blight Intensity Score (BIS)=$Nb \times Fa$

$\boldsymbol{nhood\_quality}$ $\quad Blight\ Index = \dfrac{BIS}{BIS_{maxneighborhood}}$

Heat Map of the Blight Index



Source: Authors' elaboration.

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Identification Strategy

Step 1: Estimate Option Value for Detroit Residential Properties

Hypothesis 1: Increased land use intensity decreases property prices, suggesting a rise in option value.

Hypothesis 2: The devaluing effect of land use intensity on price intensifies with property age, indicating a greater option value for older properties.

Hypothesis 3: Higher neighborhood blight scores diminish the option value, with the impact of intensity on price being less adverse in areas with more blight.

Identification Strategy

Step 1: Estimate Option Value for Detroit Residential Properties

1) Relative 2D Intensity Measure

$$Intensity_{2D\_05,i} = \frac{Interior\ Square\ Footage_i}{\frac{1}{J}\sum_{j\neq i}^{J} Interior\ Square\ Footage_j}$$

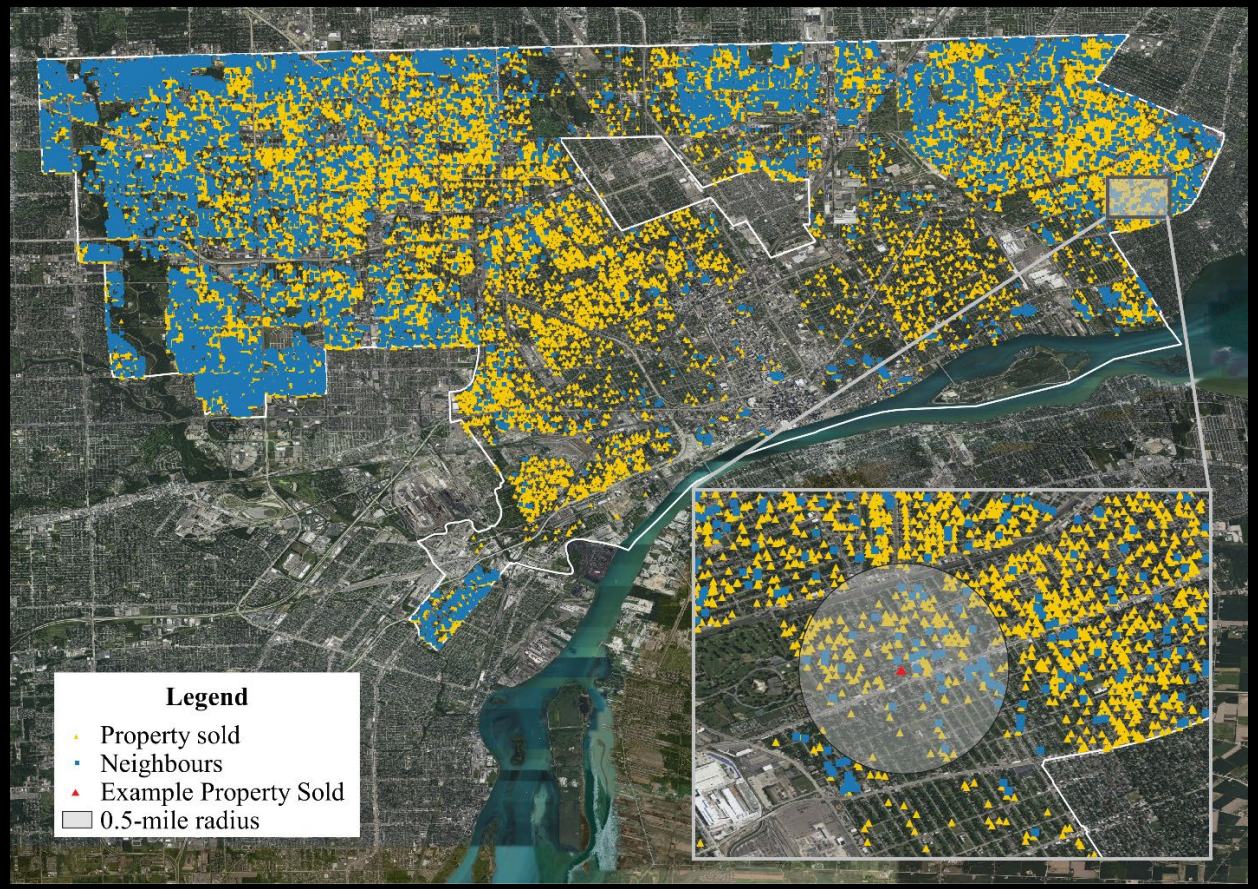
2) Relative 3D Intensity Measure

$$Intensity_{3D_{05},i} = \frac{Volume_i}{\frac{1}{J}\sum_{j\neq i}^{J} Volume_j}$$

Neighbors Criteria

- Located within 0.5 miles from property i.
- =<60 years
- Sold within three years.
- Market transaction filters.

Example of the construction of the variable *Intensity*



Source: Authors' elaboration.

Identification Strategy

Step 2: Estimating Land Value Using Option Value

Predicted Option Value

Predicted Values from Poisson Regression

$$\widehat{OV} = \hat{P}_i - \hat{P}_{maxint,i}$$

Predicted Values as HBU

Predicted Land Value

$$Use\ Value\ of\ Land\ =\ f(Location\ Characteristic, Lot\ size)$$

$$\widehat{LV} = \widehat{LV_{nooptionvalue}} + \widehat{OV_i}$$

→ **Properties far from Redevelopment Time**

$$\widehat{LV} = \widehat{OV_i}$$

→ **Properties close to Redevelopment Time**

Data

Descriptive Statistics Full Sample Residential Transactions (2012 to 2019)

Table 2: Summary Statistics of the Full Sample (Continuous Variables)

Variable	Definition	N	Mean	SD	Min	Max
Dependent Variables (Panel A)						
Price	Sale Price	122117	14927.05	21233.96	436.00	175830.00
Ln Price	Natural Logarithm of Sale Price	122117	8.64	1.53	6.08	12.08
Key Independent Variables (Panel B)						
$Intensity_{2D_{05}}$	$\frac{Interior\ Square\ Footage_i}{\frac{1}{J}\sum_{j\neq i}^{J} Interior\ Square\ Footage_j}$ within a radius of 0.5-mile	122117	1.10	0.43	0.08	8.48
$Ln\ Intensity_{2D_{05}}$	Natural Logarithm of $Intensity_{2D_{05}}$	122117	0.04	0.32	-2.52	2.14
$Intensity_{3D_{05}}$	$\frac{Volume_i}{\frac{1}{J}\sum_{j\neq i}^{J} Volume_j}$ within the census tract	122117	1.34	0.82	0.04	16.97
$Ln\ Intensity_{3D_{05}}$	Natural Logarithm of $Intensity_{3D_{05}}$	122117	0.17	0.47	-3.18	2.83

Source: Authors' elaboration.

+Sale Year, House Characteristics, Distances, 53 Neighborhoods.

Preliminary Results

Table 4: Hedonic regressions with option value measured as intensity.

		First Specification	*Second Specification*	*First Specification*	*Second Specification*	*Third Specification*	*Third Specification*
	(1) Standard Hedonic	(2) Option Value (2D Int O.5)	(3) Option Value with Depreciation (2D Int 0.5)	(4) Option Value (3D Int 0.5)	(5) Option Value with Depreciation (3D Int 0.5)	(6) Option Value (3D Int 0.5x nhood quality)	(7) Option Value with Depreciation (3D Int 0.5 x nhood quality)
$Ln\ Intensity_{2D05}$		-0.475***	1.032***				
		(0.0268)	(0.259)				
$Age\ x\ Ln\ Intensity_{2D_{05}}$			-0.0316***				
			(0.00617)				
$Age^2\ x\ Ln\ Intensity_{2D_{05}}$			0.000161***				
			(0.0000369)				
$Ln\ Intensity_{3D_{05}}$				-0.192***	1.125***	-0.210***	-0.214***
				(0.0146)	(0.173)	(0.0157)	(0.0157)
$Age\ x\ Ln\ Intensity_{3D_{05}}$					-0.0252***		
					(0.00415)		
$Age^2\ x\ Ln\ Intensity_{3D_{05}}$					0.000112***		
					(0.0000249)		
$Blight\_index$						-0.0235	-0.00333
						(0.0270)	(0.0272)
$Ln\ Intensity_{3D_{05}} x Blight\_index$						0.127**	5.106***
						(0.0423)	(0.826)
$Age\ x Ln\ Intensity_{3D_{05}} x Blight\_index$							-0.111***
							(0.0190)
$Age^2\ x Ln\ Intensity_{3D_{05}} x Blight\_index$							0.000608***
							(0.000109)
Year Effects	YES	YES	YES	YES	YES	YES	YES
Neighborhoods Effects	YES	YES	YES	YES	YES	YES	YES
Constant	0.198	-2.838***	-2.599***	-1.199***	-0.902***	-1.193***	-1.237***
	(0.291)	(0.286)	(0.294)	(0.253)	(0.257)	(0.253)	(0.254)

Source: Authors' elaboration.
*** Significant at the 5 percent level.
** Significant at the 1 percent level.
* Significant at the 0.1 percent level.

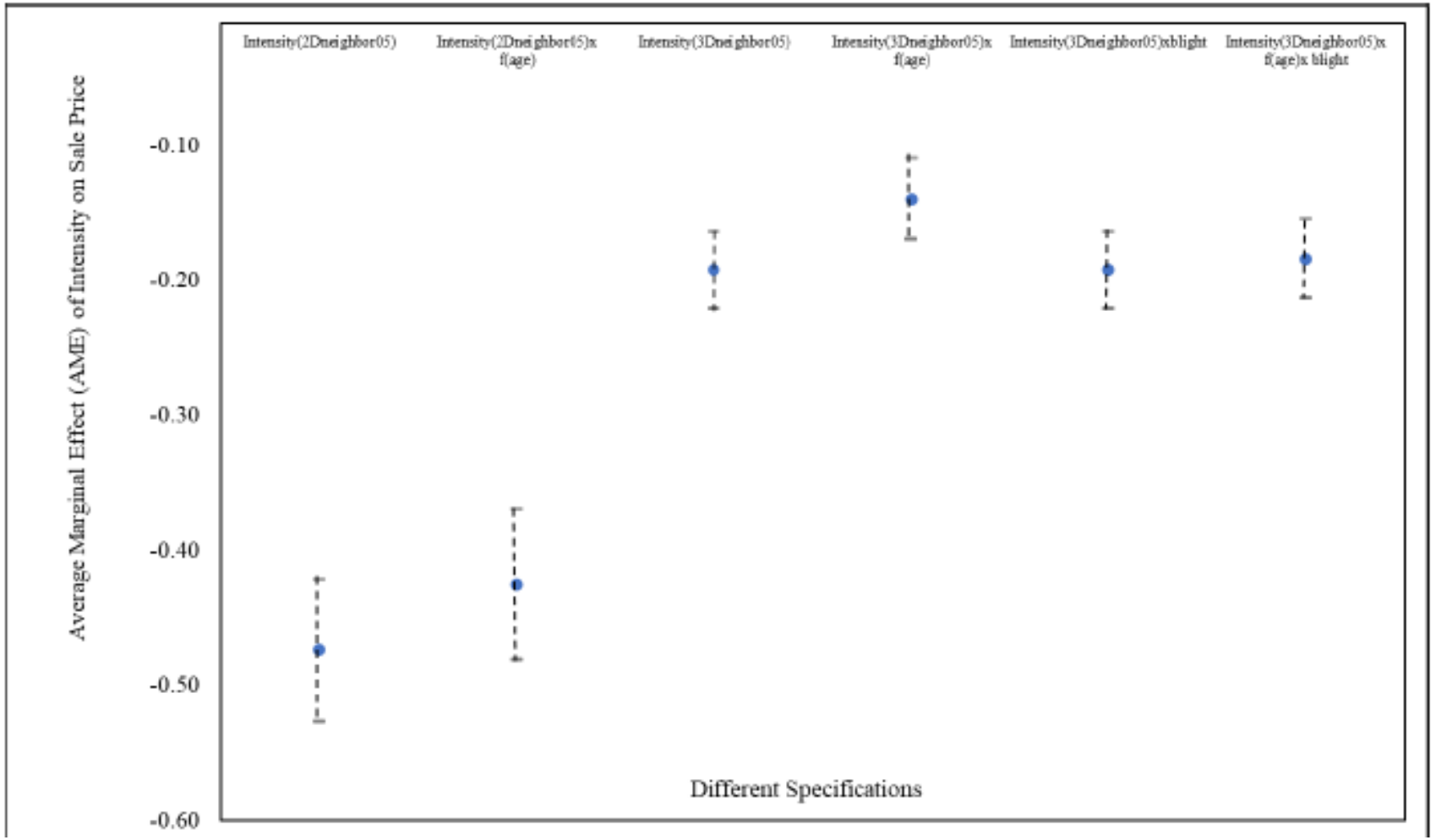
Results

First Step: Evidence of Option Value in Detroit's housing transactions

Evidence supporting H1

In our most robust specification, having a 100% of option value increases the value of the property by approximately 18%.

Average Marginal Effect of Intensity on the value of the property in different



Source: Author's calculations.

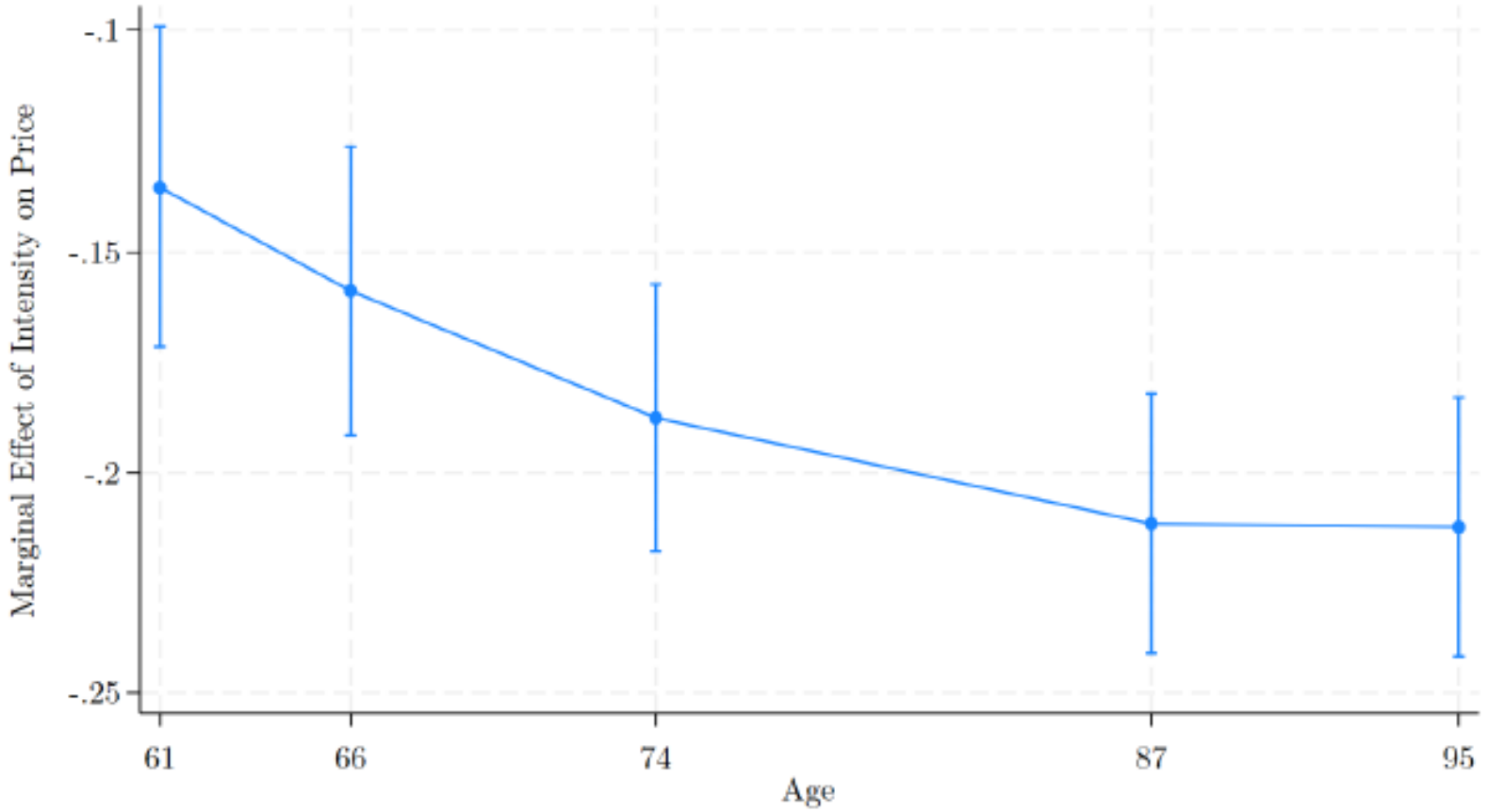
Results

First Step: Evidence of Option Value in Detroit's housing transactions

Evidence supporting H2

The older the property is, the higher the impact of the redevelopment potential (option value) on sale prices.

Average Marginal Effect of Intensity on Price Across Different Age Groups



Source: Author's calculations.

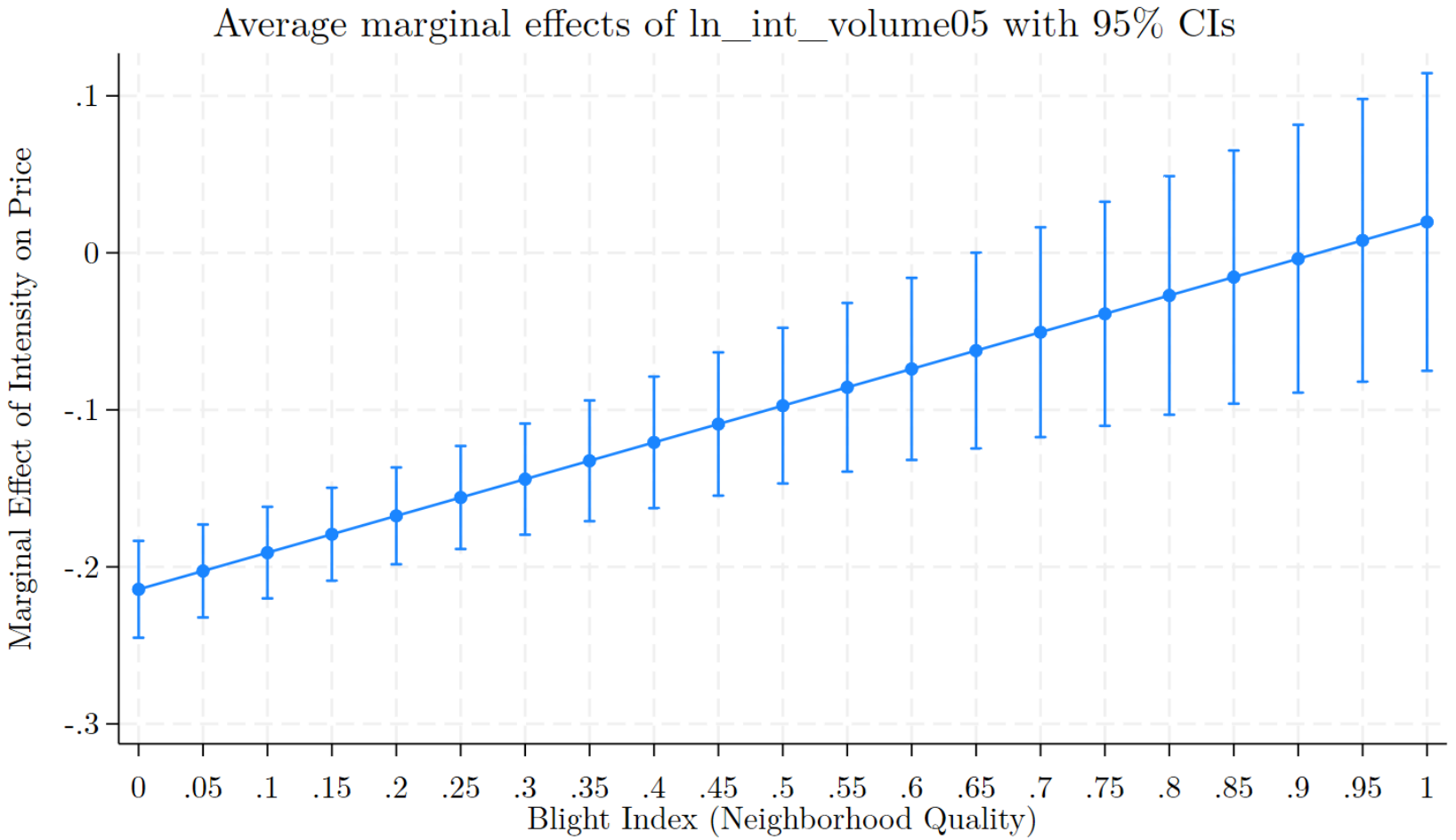
Results

First Step: Evidence of Option Value in Detroit's housing transactions

Evidence supporting H3

Worse quality neighborhoods, meaning values of the blight index close to 1, are associated with less impact of the redevelopment option on prices.

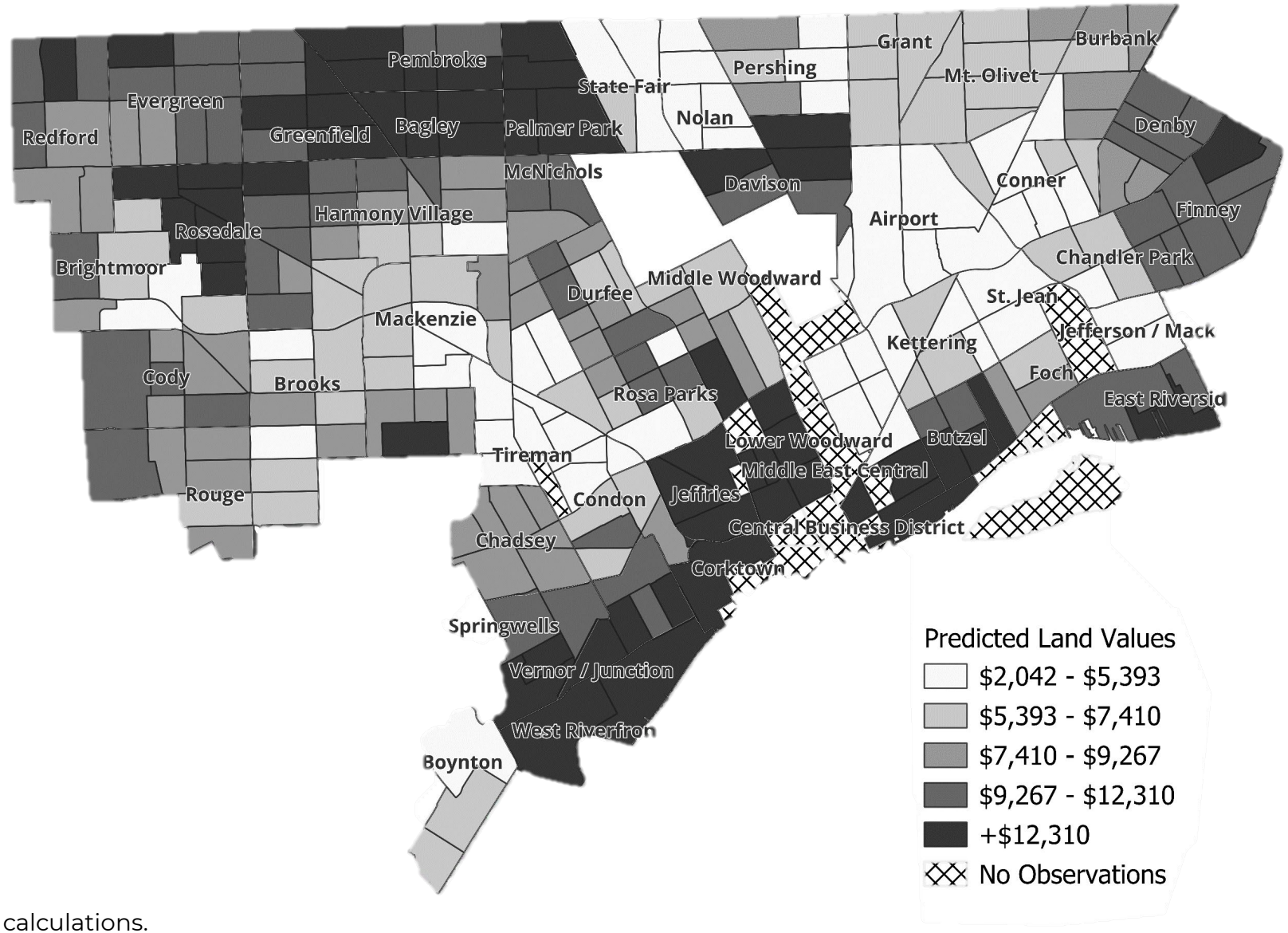
Average Marginal Effect of Intensity on Price Across Different levels of the Blight Index



Source: Author's calculations.

Results

Second Step: Predicted Land Values



Source: Author's calculations.

Summary and Conclusion

Valuing Land in Detroit Using the Option Value Approach

A 1% increase in three-dimensional intensity (property volume relative to neighbors) results in a **0.18%** decrease in prices.

Spatial analysis reveals neighborhoods with **high option values indicating unaccounted redevelopment potential**.

Including option value significantly raises predicted land values, particularly for higher-valued properties.

Limitations

Valuing Land in Detroit Using the Option Value Approach

Big bias selection since we are not account for vacant lots. **New Data with vacant lots.**

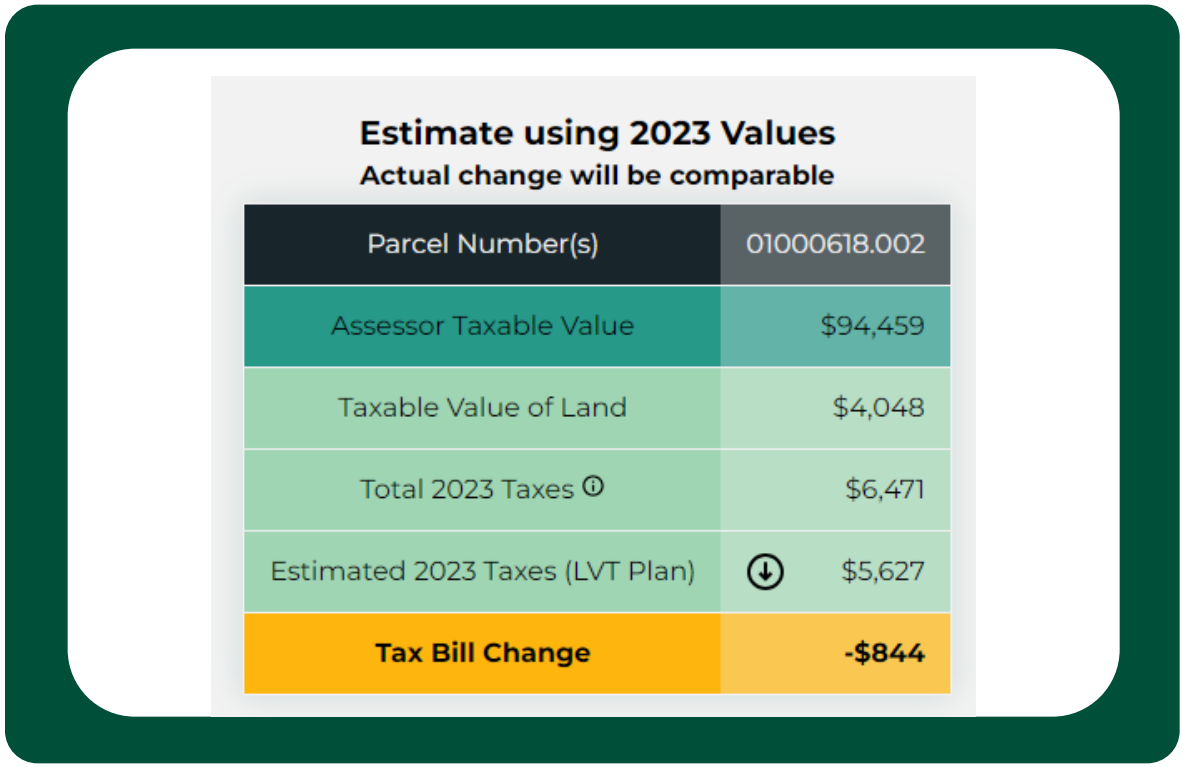
Potential OVB. **Can we do more?**

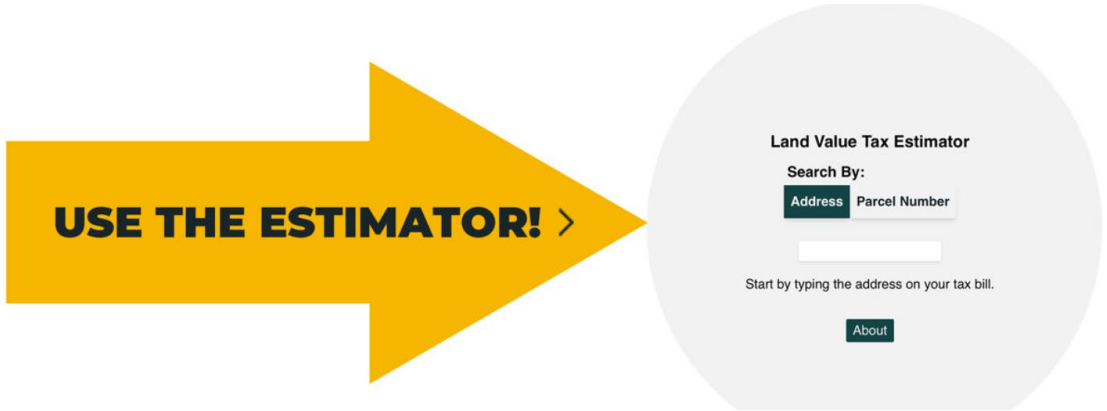
Our efforts must contribute to understand the potential impact of the tax reform.

Current Work:

The Land Value Tax Plan of Detroit

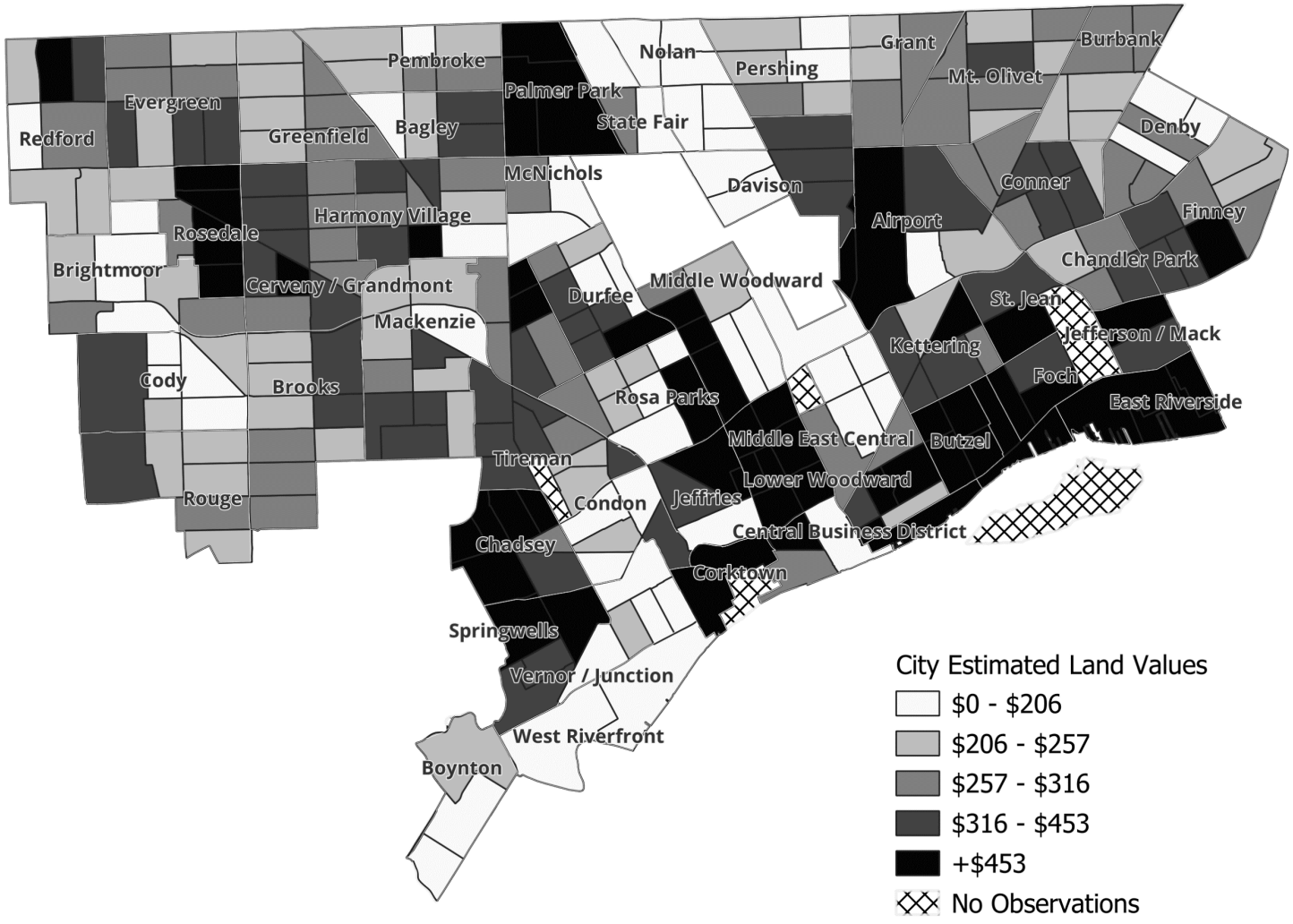
- Educational tool that provides an estimate of your tax bill if the Land Value Tax proposal were in effect in 2023.
  - **Web scrapping process.**
  - Information on land values estimates, taxes, mill rates, assessed total value, etc.





Source: https://detroitmi.gov/departments/office-chief-financial-officer/land-value-tax-plan

Estimated Land Values from the City



Source: Authors' elaboration

***Only Using 18% of the data collected.**

Estimated Land Values from the City

Tax Exemption + LVT Replacement

Legislation lets voters in any Michigan community create

1 **Universal Tax Exemption**

Remove some local taxes on all taxable real property

-14 mills

+

2 **Replacement Land Value Tax**

Replace with new tax on the taxable value of land

+118 mills

Lower taxes on use and development are replaced by higher taxes on holding land

Source: City Council Presentation Land Value Tax Proposal, October 10, 2023.

LINCOLN INSTITUTE
OF LAND POLICY

Valuing Land in Detroit

Using the Option Value Approach

Urban Economics and Public Finance Conference
2024

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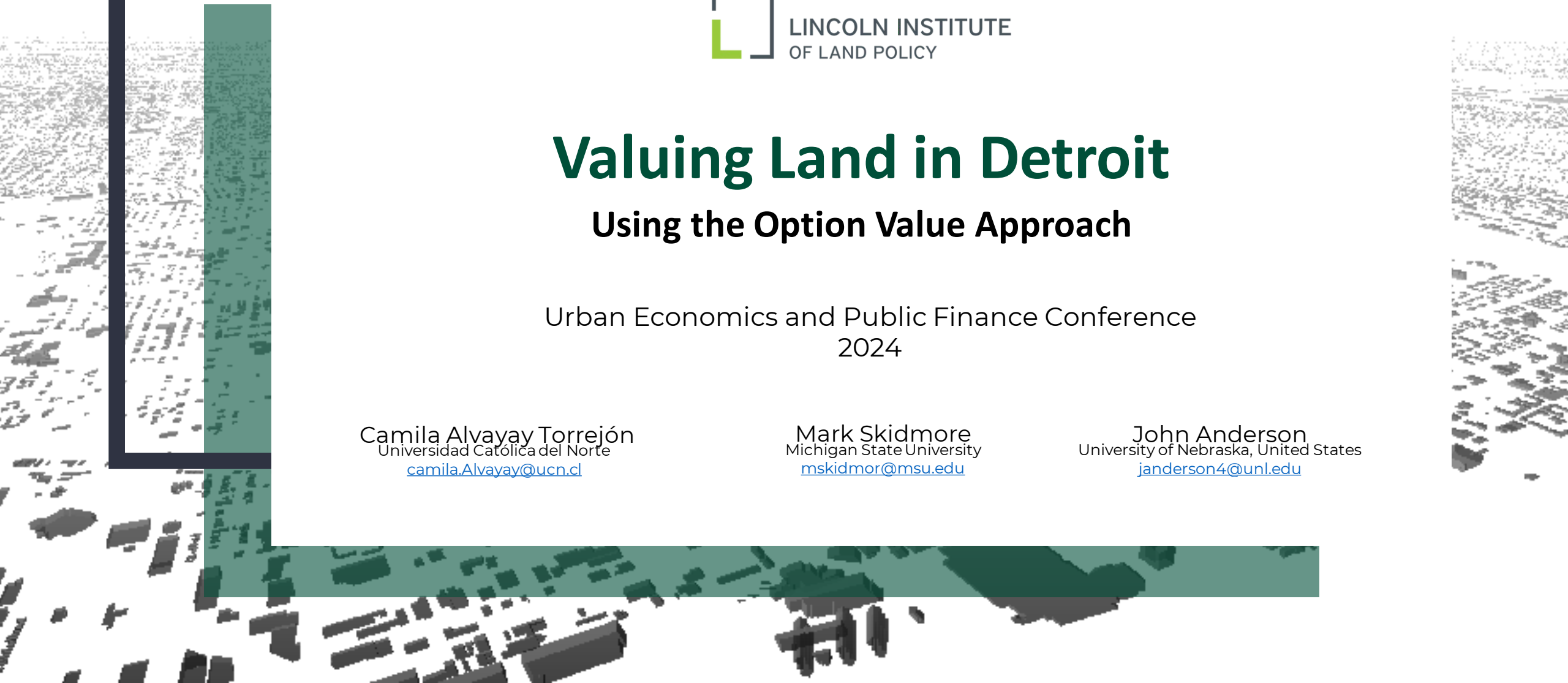


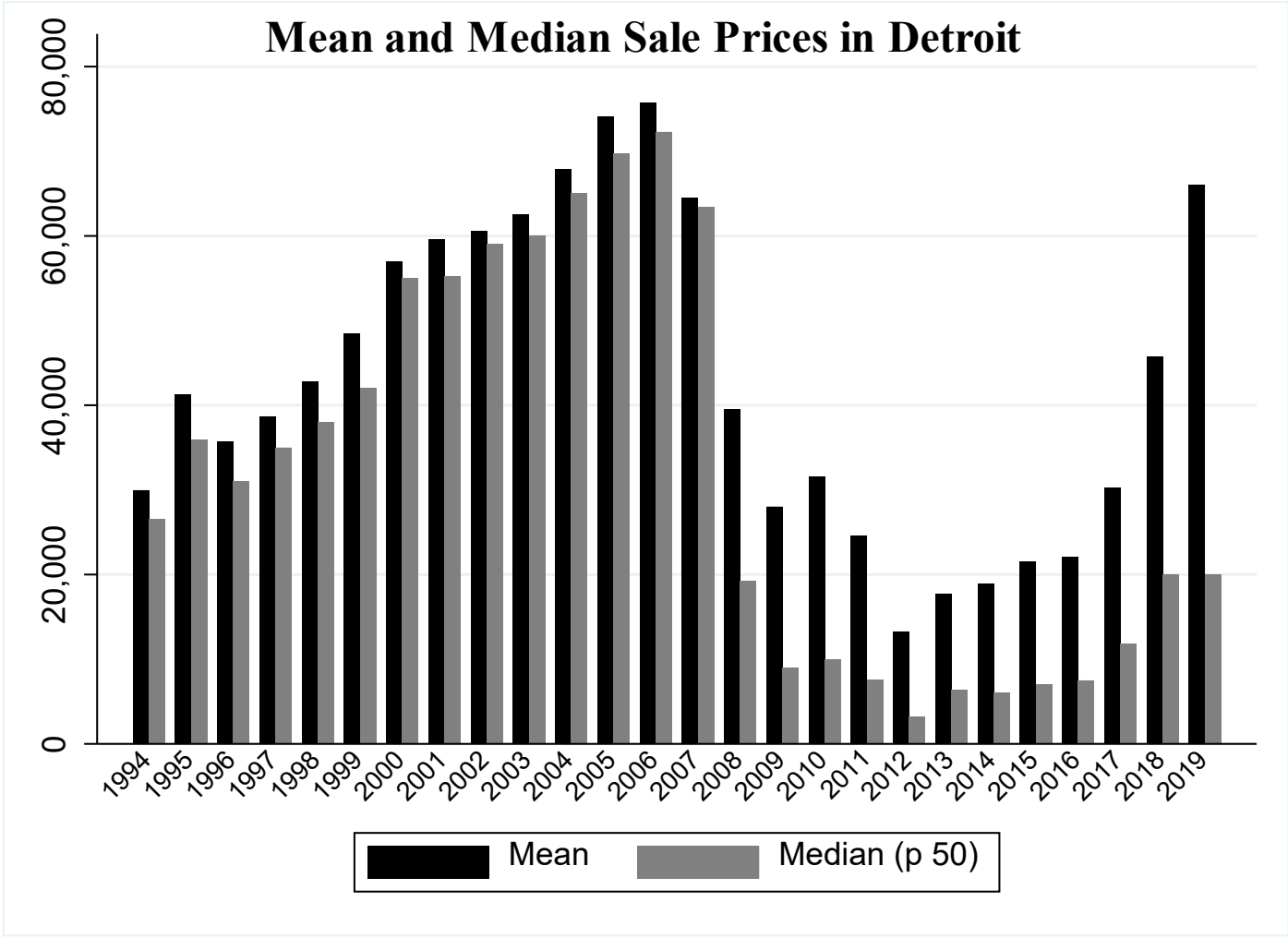
Appendix

1) Zillow ZTRAX database

- ZTRAX contains two sources of information: 1) ZTrans, which is the property transaction database, and 2) ZAsmt, which is the tax-assessment information.

2) Building Permits Database

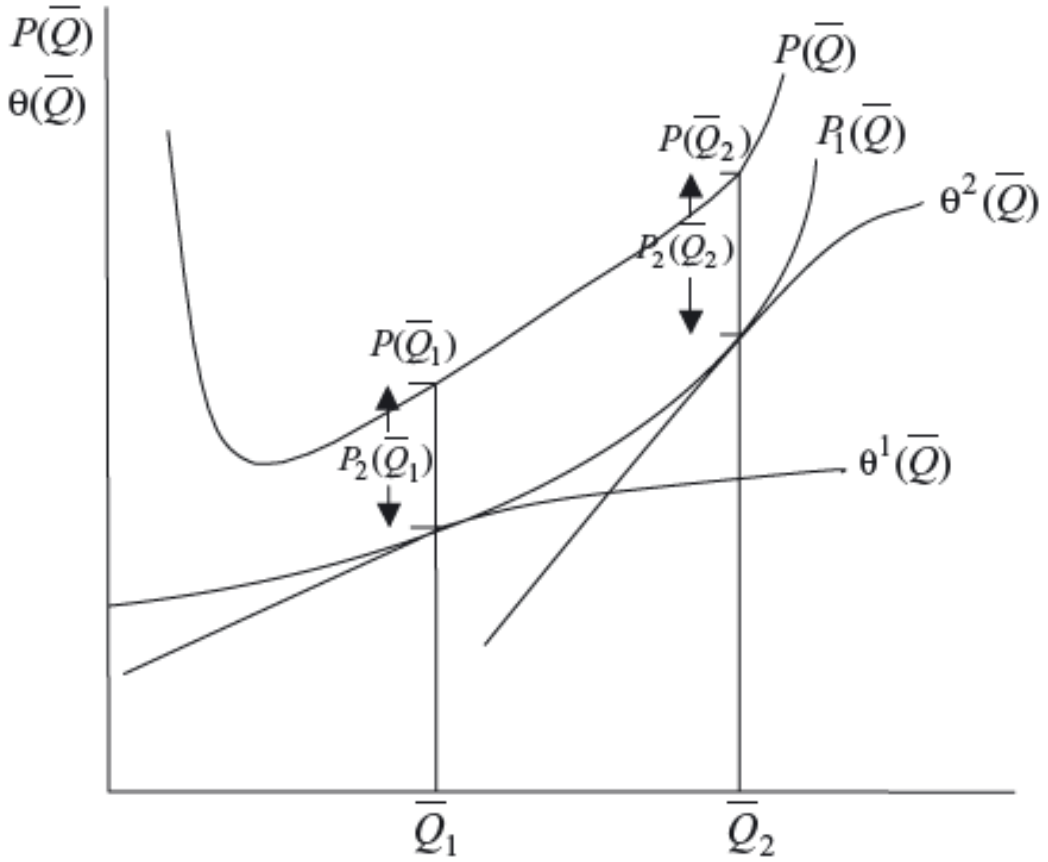
- “Building permits are required for any of the following: Construction or alteration of a structure” (Construction Codes in Michigan). This data contains information from 2010 to 2019.


Mean and Median Sale Prices in Detroit
0
20,000
40,000
60,000
80,000
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Mean
Median (p 50)

Identification of market transactions

Step Number	Description	Observations
0	All transactions in Detroit	387,738
1	Remove observations with coordinates with missing values	387,530
2	Select transaction from 2009-2019	338,841
3	Remove duplicate observations	324,538
4	Identify transactions prices that reflect fair market value	171,479
	4.1 Filter by type of deed (268,405)	
	4.2 Filter by document type (217,969)	
	4.3 Filter by intra family sale (217,784)	
	4.4 Filter by transfer tax exempt (171,479)	
5	Select residential properties	170,667
6	Remove sales price outliers and properties that sold more than seven times	162,222
	6.1 Removing prices below p1 and above p99 (168,044)	
	6.2 Eliminate properties with more than 7 sales (162,222)	

Figure 1 ■ Hedonic equilibrium with additive option value.



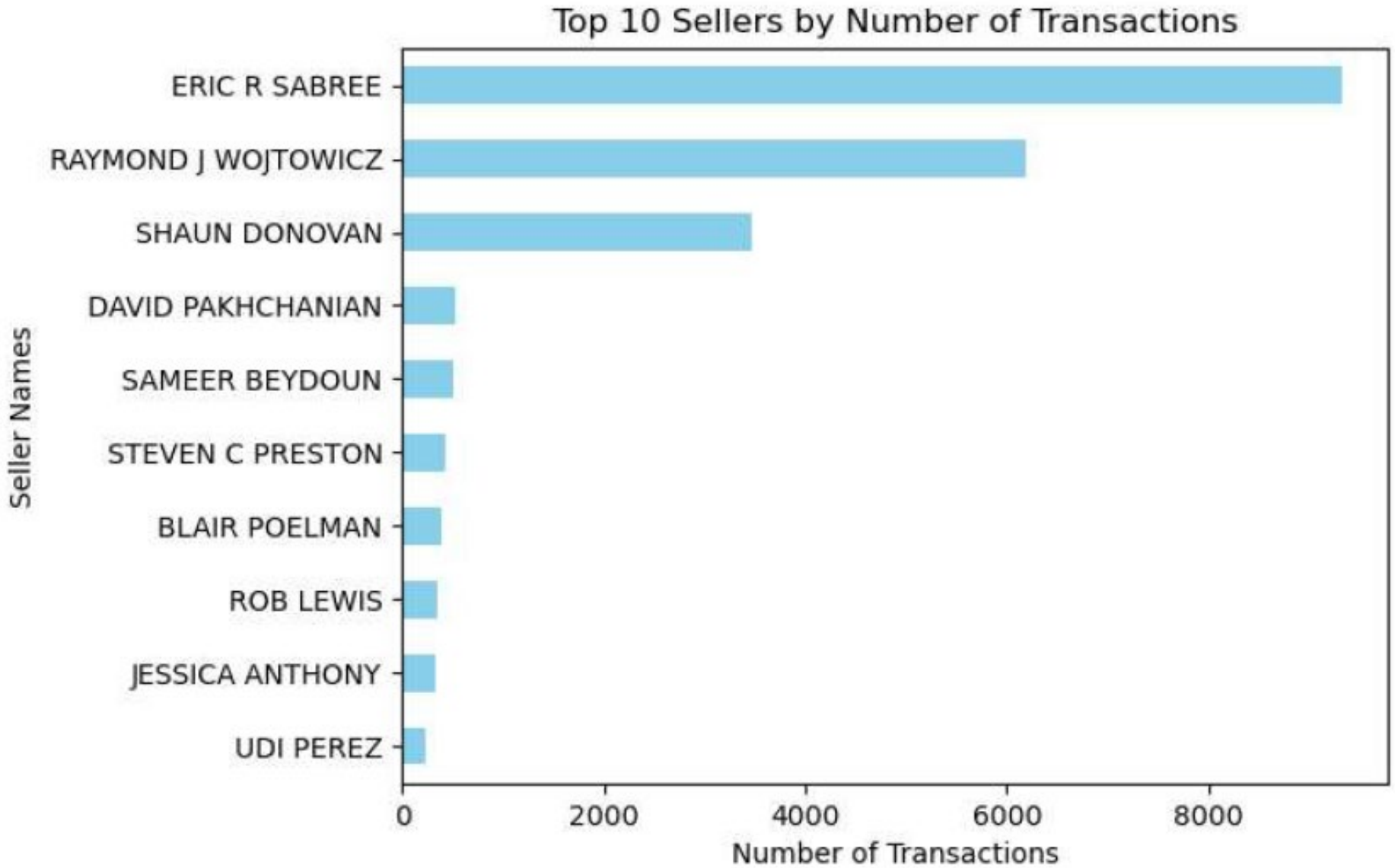
Notes: $\theta^i(\overline{Q})$ is the consumer i's bid function, compensated for the income effects (options and asset value in place) associated with changes in $\overline{Q}_j$ where j indexes the intensity. $P(\overline{Q}_j)$ is the value of the property at any time t: the sum of the asset value in place, $P_1(\overline{Q}_j)$, and the option value to redevelop, $P_2(\overline{Q}_j)$; see Equation (13) for details. The $\overline{Q}_j$ are inelastically supplied as in real options theory.

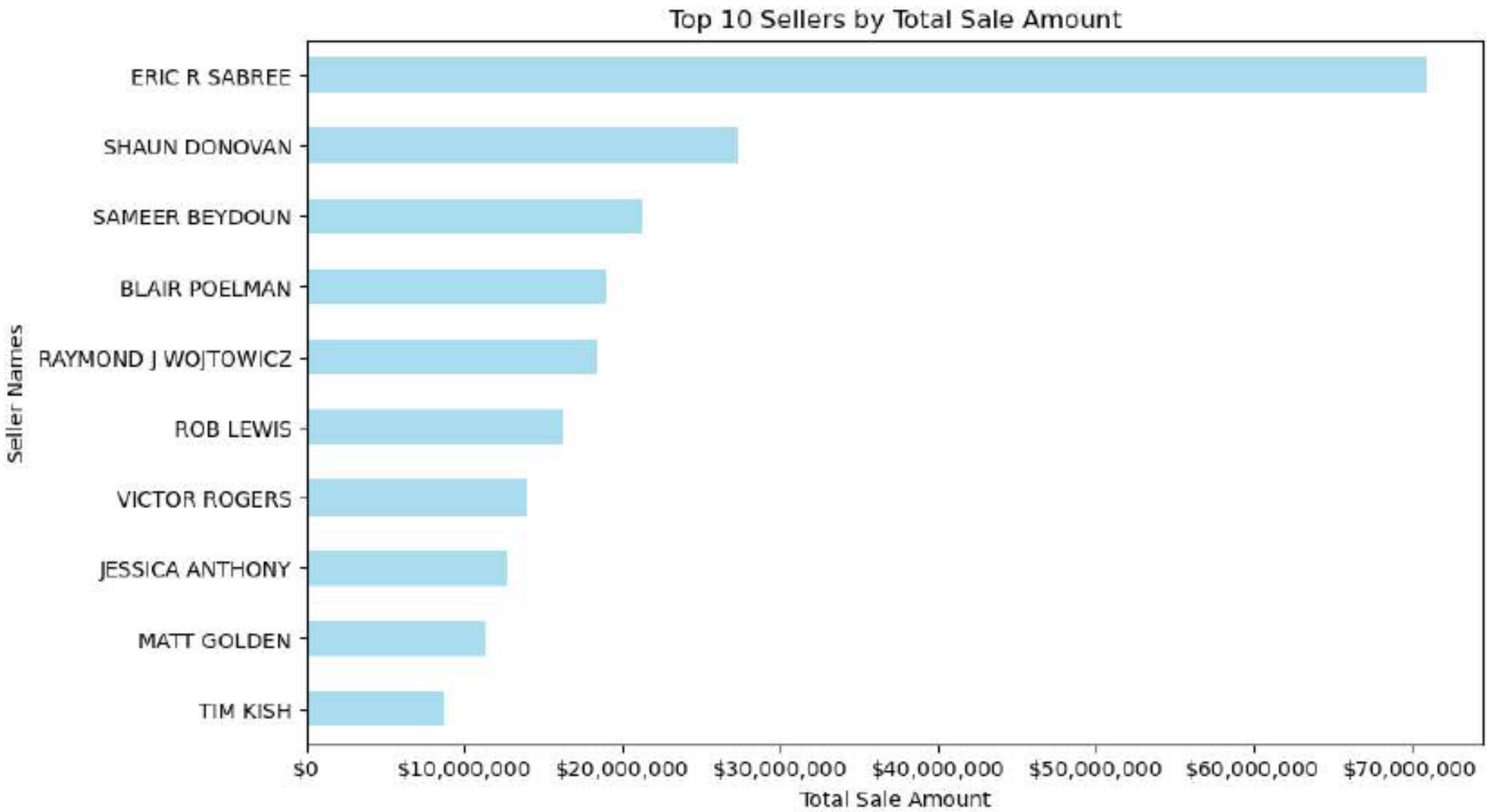
Source: Clapp, Jou, and Lee (2012).

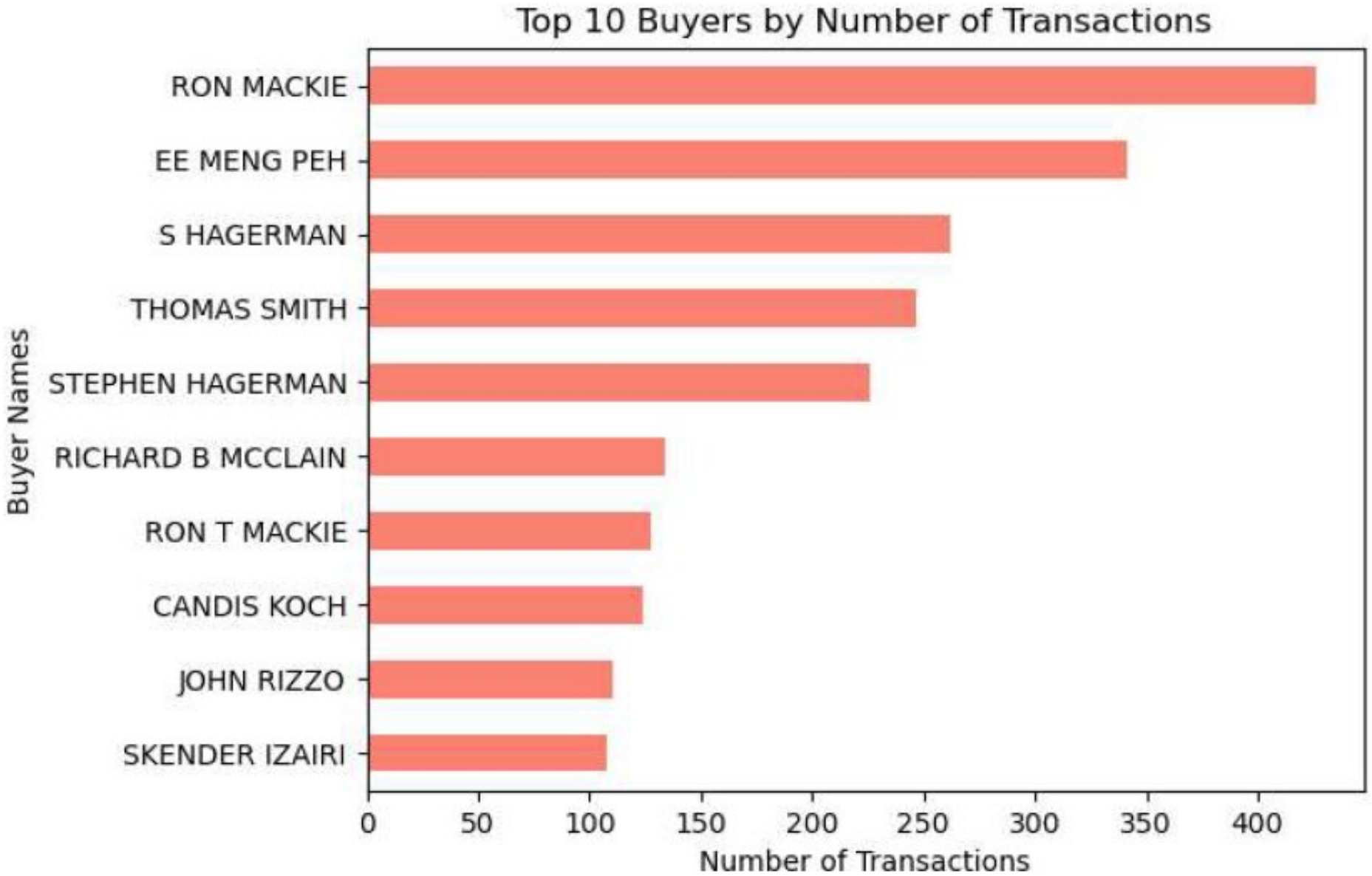
Analysis of Repeated Buyer and Seller Names:

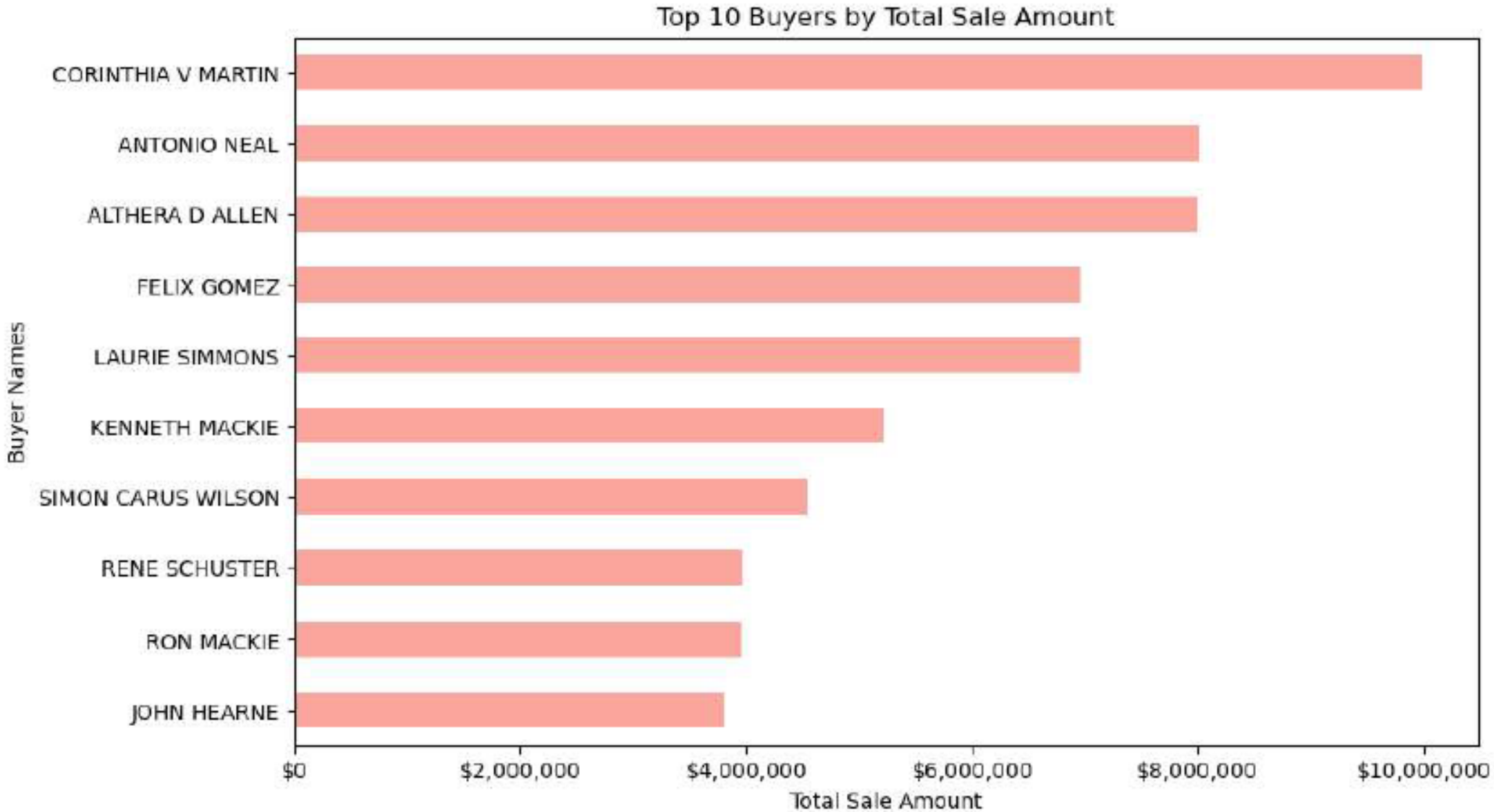
Upon delving deeper into the dataset, some intriguing patterns regarding repeated names emerge:

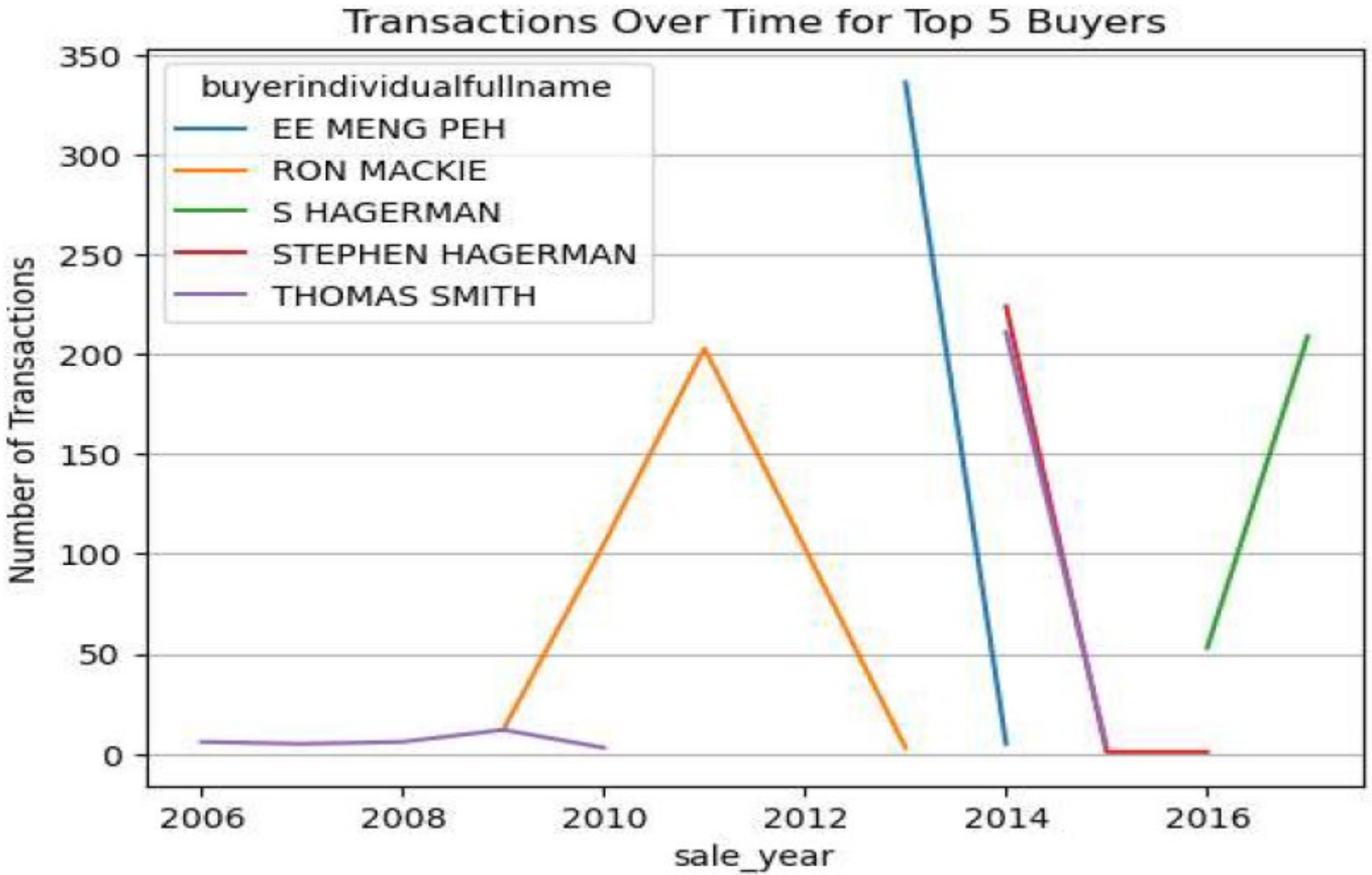
- **Buyers**: Out of the total unique buyers, 46,327 buyers have made more than one property purchase during the study period. This represents a significant portion and suggests that many buyers in the Detroit market during this timeframe were potentially investors, property dealers, or entities with a keen interest in multiple acquisitions.
- **Sellers**: On the seller side, 13,107 unique sellers have been involved in more than one property sale. While this number is smaller compared to repeated buyers, it's still noteworthy. It could indicate that a segment of sellers might be businesses or individuals who frequently trade properties or perhaps manage a portfolio of assets.

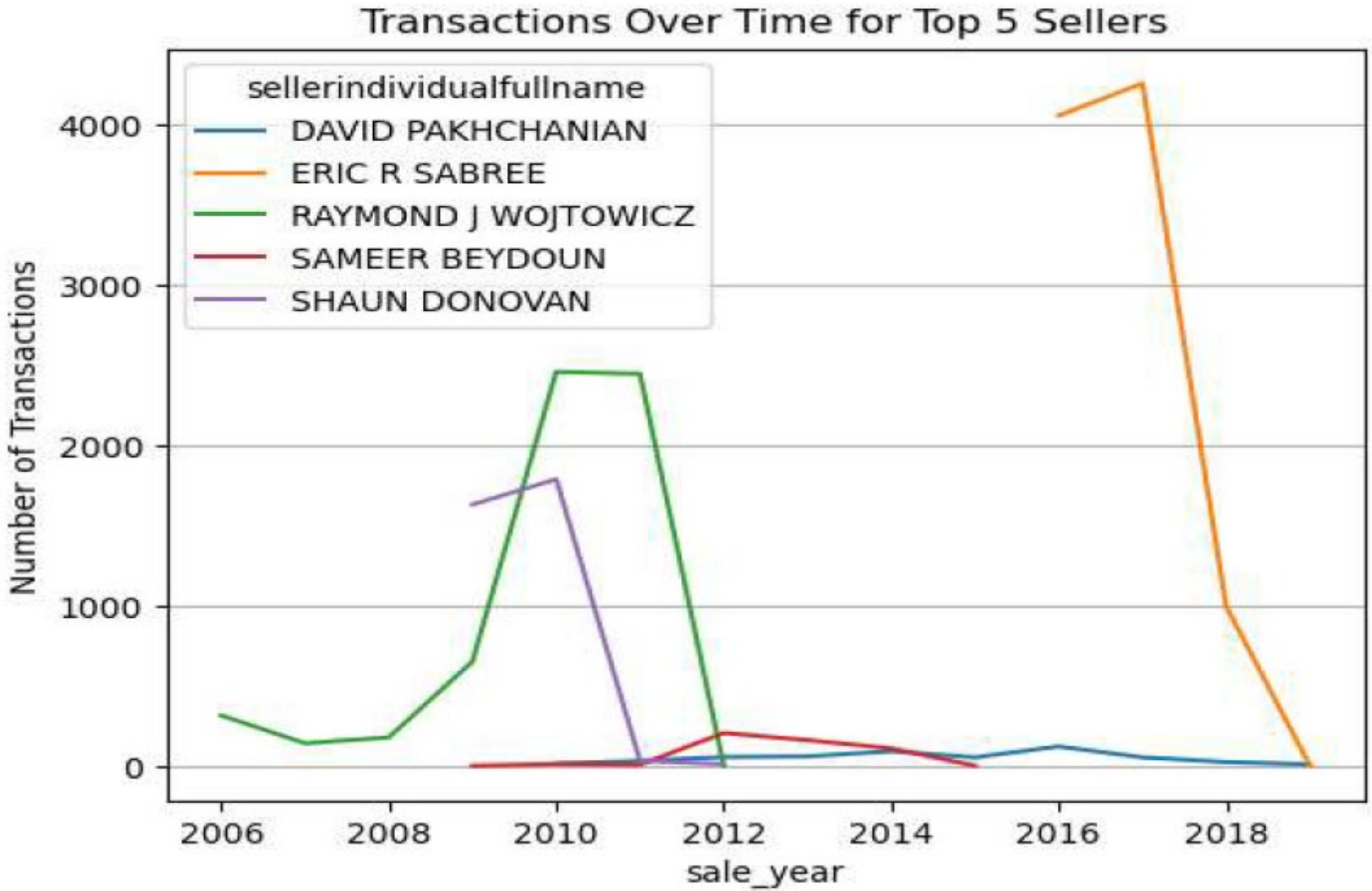

Top 10 Sellers by Number of Transactions
ERIC R SABREE
RAYMOND J WOJTOWICZ
SHAUN DONOVAN
DAVID PAKHCHANIAN
SAMEER BEYDOUN
STEVEN C PRESTON
BLAIR POELMAN
ROB LEWIS
JESSICA ANTHONY
UDI PEREZ
Seller Names
0
2000
4000
6000
8000
Number of Transactions

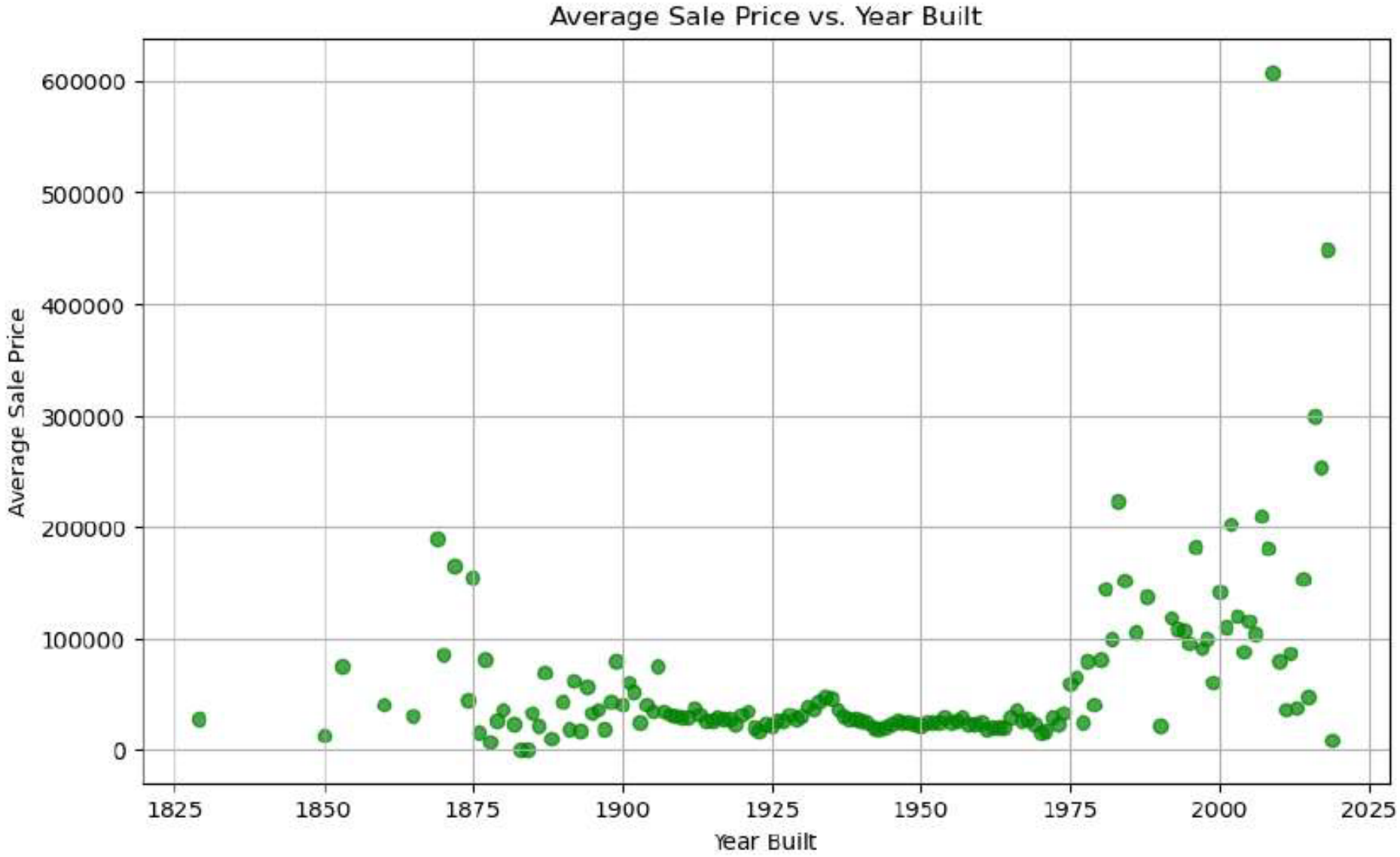

Top 10 Sellers by Total Sale Amount
ERIC R SABREE
SHAUN DONOVAN
SAMEER BEYDOUN
BLAIR POELMAN
RAYMOND J WOJTOWICZ
ROB LEWIS
VICTOR ROGERS
JESSICA ANTHONY
MATT GOLDEN
TIM KISH
Seller Names
$0
$10,000,000
$20,000,000
$30,000,000
$40,000,000
$50,000,000
$60,000,000
$70,000,000
Total Sale Amount


Top 10 Buyers by Number of Transactions
RON MACKIE
EE MENG PEH
S HAGERMAN
THOMAS SMITH
STEPHEN HAGERMAN
RICHARD B MCCLAIN
RON T MACKIE
CANDIS KOCH
JOHN RIZZO
SKENDER IZAIRI
Buyer Names
0
50
100
150
200
250
300
350
400
Number of Transactions


Top 10 Buyers by Total Sale Amount
CORINTHIA V MARTIN
ANTONIO NEAL
ALTHERA D ALLEN
FELIX GOMEZ
LAURIE SIMMONS
KENNETH MACKIE
SIMON CARUS WILSON
RENE SCHUSTER
RON MACKIE
JOHN HEARNE
Buyer Names
$0
$2,000,000
$4,000,000
$6,000,000
$8,000,000
$10,000,000
Total Sale Amount


Transactions Over Time for Top 5 Buyers
buyerindividualfullname
EE MENG PEH
RON MACKIE
S HAGERMAN
STEPHEN HAGERMAN
THOMAS SMITH
Number of Transactions
0
50
100
150
200
250
300
350
2006
2008
2010
2012
2014
2016
sale_year


Transactions Over Time for Top 5 Sellers
sellerindividualfullname
DAVID PAKHCHANIAN
ERIC R SABREE
RAYMOND J WOJTOWICZ
SAMEER BEYDOUN
SHAUN DONOVAN
Number of Transactions
4000
3000
2000
1000
0
2006
2008
2010
2012
2014
2016
2018
sale_year



Source: Author's Calculations.