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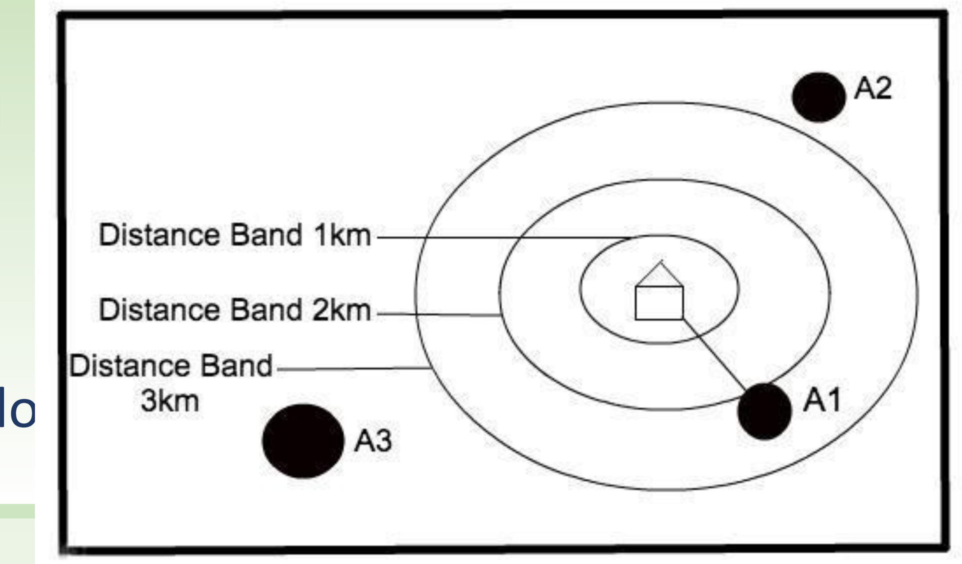
Estimating the Marginal Effect of Pits and Quarries on Rural Residential Property Values in Wellington County, Ontario, Canada: A Hedonic Approach

Alison Grant*, Brady Deaton*, Richard Vyn*, and Ying Cao**

Department of Food, Agricultural Resource Economics, University of Guelph*, Department Epidemiology & Environmental Health, University of Buffalo

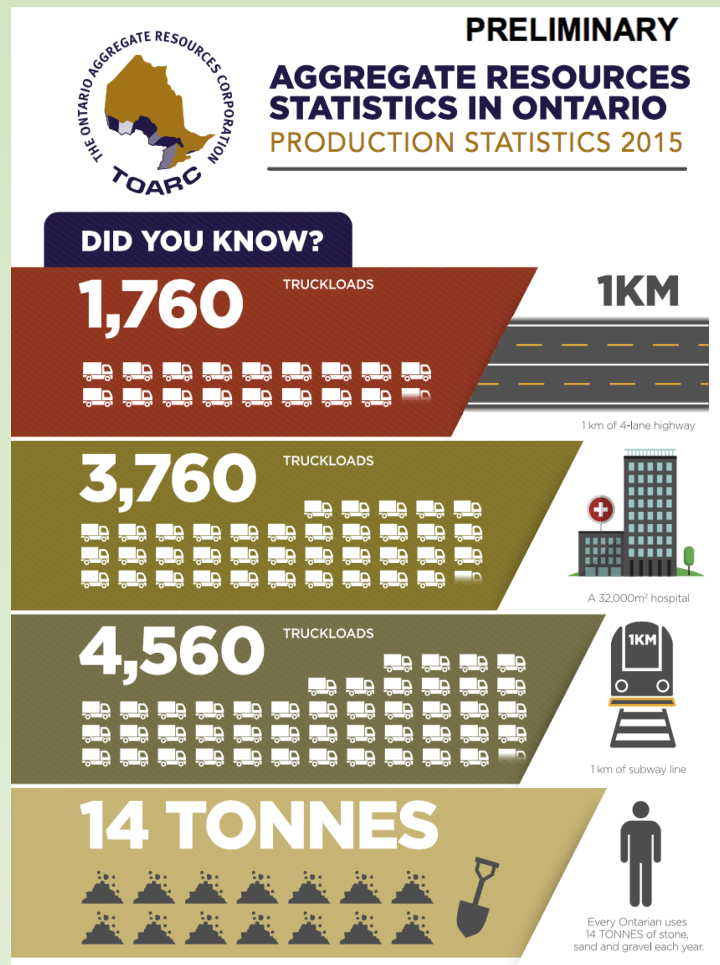


ABSTRACT

"Aggregate" material – i.e., sand, gravel, clay, and bedrock – are extracted from pits and quarries throughout Ontario. Aggregates are the number one resource extracted and used by Ontarians, and approximately $1.2 billion of aggregate material was extracted in Ontario in the last year.

While aggregate is a valued resource, the extraction of aggregate is often identified as a negative externality. Residential concerns include noise and visual disamenities, as well as environmental concerns.

I was able to identify the spatial extent of these effects using various functional forms: e.g., continuous distance measures as well as discrete measures (i.e., within 3 km, etc). A distance bands measure is used to assess the effect of the aggregate sites at different distances from the properties. **I do not find strong evidence that aggregate sites have a negative effect on property values in Wellington County.**



MOTIVATION

Across all analyses on *gravel pits* examined, the findings were quite similar: a large effect of aggregate sites on property values is identified, and at far distances from the sites. Four studies have been reviewed that find gravel pits as an environmental disamenity. All studies reviewed on gravel pits find a statistically significant negative effect of gravel pits on surrounding property values.

Despite the consistent findings in previous studies, there are significant shortcomings. These shortcomings, and the lack of research on this issue for aggregate sites in Ontario, are what this paper aims to address. My study addresses the shortcomings of previous literature in 4 ways.

(1) I confirm that the aggregate site is indeed physically active, and provide a measure of aggregate activity.
(2) Nearby major urban areas and major highways are taken into account.
(3) All aggregate sites are examined – from sand and gravel pits, to bedrock quarries.
(4) A county-level analysis was performed, which pays greater attention to individual sites.
(5) I study this issue in a previously unstudied geographic area.

OBJECTIVES

Two key hypotheses are analyzed and tested:
1. Rural residential properties experience a decline in value within close proximity (three kilometres) to aggregate sites.
2. The effect of proximity to an aggregate site depends on its level of activity.

EMPIRICAL MODEL

$$PRICE_i = \alpha + \beta_1 PROP + \beta_2 LOC + \beta_3 TIME + \beta_4 TOWN + \beta_5 BANDS + \varepsilon_i \quad (4.3)$$

Where:
PRICE = sales data from 2002-2013
PROP = vector of housing attributes, including number of bathrooms, square footage of house, acreage of property, fireplace, pool, etc.
LOC = vector of distances to provincial highway 401, Toronto, and closest urban area
TIME = sale year dummy variables
TOWN = township dummy variables
BANDS = vector of distance bands: 0-0.5km, 0.5-1km, 1-1.5km, 1.5-2km, 2-2.5km, 2.5-3km
α = intercept term
β = estimating coefficients
ε = error term

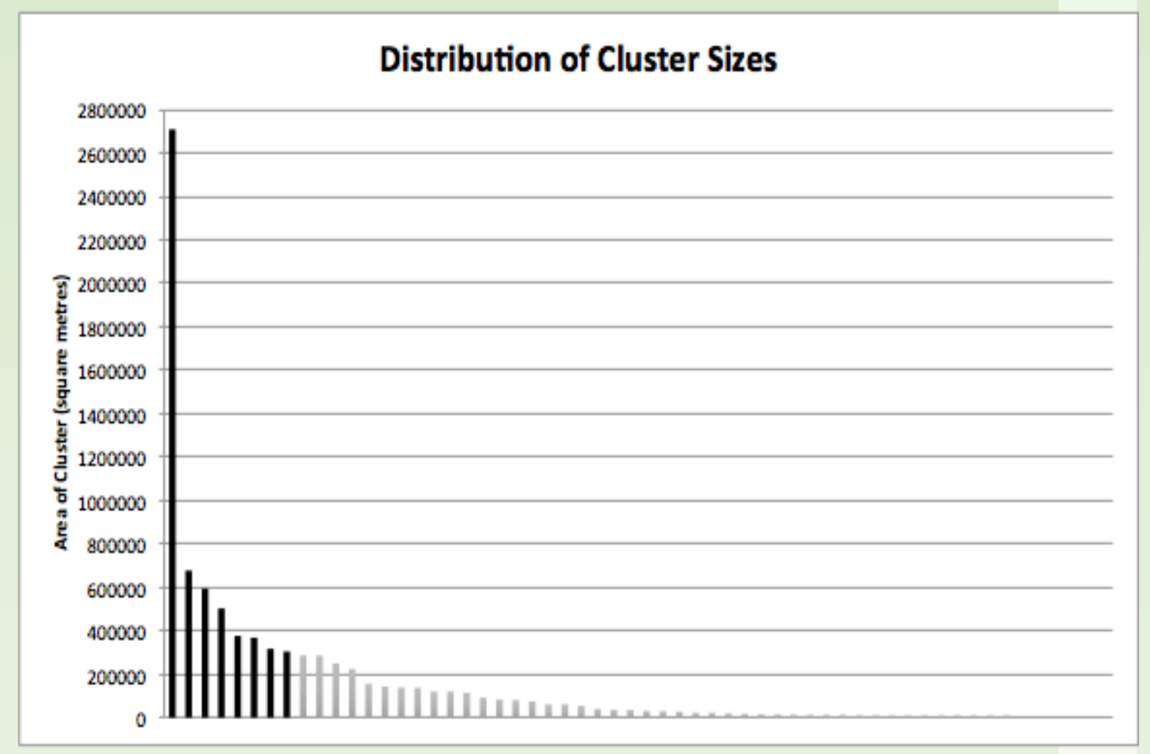
DATA

- Over 9,000 arms-length sales of rural-residential properties in Wellington County in Ontario.
- These property sales occur over a 12 year period: 2002-2013.
- Data on the 107 individual pits and quarries in Wellington County were collected through the 2013 Ministry of Natural Resources (MNR) database on licensed aggregate sites
- Conventional covariates that describe housing and land quality, as well as covariates that describe the aggregate site (e.g., activity, licensed area)
- Spatial attributes that might influence the relationship between the site and the residence (e.g., distance to nearest highway, distance to Toronto).
- Measure of average extraction activity of each aggregate site over the twelve years was obtained through geographic information systems.

CONSTRUCTION OF THE ACTIVITY VARIABLE

Data on all aggregate site licenses provided maximum tonnage allowances for each of the aggregate sites, but this does not give specific insight into the measure of actual extraction activity, only the size of the licensed area.

The Ontario Aggregate Resources Corporation (TOARC) collects tonnage and revenue data from aggregate companies, as the tonnage of aggregates being removed from each site is taxed. Unfortunately, this data is confidential and not publicly available.



- To remedy this, an alternate method to estimate extraction activity was used: geospatial satellite imaging.
- This activity measure identifies the average loose gravel or bedrock area exposed on a pit or quarry over the period of analysis. While using an overlaid map of 2013 registered aggregate sites, I compiled the actual disturbed land areas of those registered pits over the 12-year time period of the MPAC dataset: 2002-2013.
- In many cases, a subset of pits and quarries are in close proximity to each other. As discussed below, I cluster pits and quarries that are abutting each other, allowing me to identify aggregate sites by a cluster of pits and/or quarries (shown in the photo on the top left is a cluster of registered quarries).
- I identify the degree of activity by cluster by adding up all of the areas of the pits abutting each other.
- This method – i.e., exposed area and size – is used as a measure of actual area of activity that is present in Wellington County.
- I focus analysis towards prices of rural residential houses that are located close to *highly active clusters*: pits and quarries in close proximity to each other with a relatively high average area of gravel and bedrock exposed over the time period.
- Obtaining a measure of activity was crucial: of the 58 geographical clusters in Wellington County, 8 of those clusters were considered to have no activity present. The most active cluster was over 2.7 million square metres and the least active (not including zero activity) was only 20 square metres.
- The graph to the right shows that the distribution of average extraction area, or activity, is highly skewed or right-tailed. Most aggregate clusters have smaller average areas, with the highly active clusters being large outliers. The top 8 most active clusters are shown in bold on the graph.
- The top eight geographic clusters of pits and quarries were chosen for comparative analysis in this study, which are only those pits that were above 300,000 square meters were chosen (high outliers), which presents a good sample of the most highly active pits.

RESULTS

The first model uses the entire data set and the second uses only observations around the top 8 most active pits and quarries.

Based on the results, the hypotheses were rejected; significant negative price effects on properties in close proximity to aggregate sites in Wellington County are not found.

These effects across all bands are approximately an increase in 3-4% of the property's value.

	Model 1: Base		Model 2: Activity	
	Coefficient	Robust Std Err	Coefficient	Robust Std Err
Variable				
Property and Location Variables				
ln(Total Area)	0.3112***	0.0087	0.3009***	0.0273
ln(Lot Size)	0.1195***	0.0018	0.0999***	0.0059
ln(Distance to Hwy 401)	-0.0210**	0.0067	0.0340***	0.0045
ln(Distance to Toronto)	-0.1073***	0.0137	-0.0051	0.0742
ln(Distance to Urban)	-0.0300***	0.0042	-0.0200	0.0169
Bathrooms	0.0322***	0.0037	0.0325**	0.0102
Fireplaces	0.0262***	0.0030	0.0204*	0.0088
Pool	0.0468***	0.0083	0.0317	0.0173
Age	-0.0014***	0.0001	-0.0009***	0.0002
Quality	0.1446***	0.0055	0.1963***	0.0157
Basement	0.0463***	0.0037	0.0610***	0.0126
Air	0.0314***	0.0038	0.0168	0.0115
Time Variables				
SY2003	0.0593***	0.0076	0.0865***	0.0194
SY2004	0.1520***	0.0075	0.1364***	0.0259
SY2005	0.2348***	0.0083	0.2085***	0.0326
SY2006	0.2918***	0.0070	0.3100***	0.0223
SY2007	0.3544***	0.0071	0.3462***	0.0250
SY2008	0.3894***	0.0071	0.3802***	0.0243
SY2009	0.3738***	0.0079	0.3823***	0.0212
SY2010	0.4653***	0.0099	0.4613***	0.0365
SY2011	0.4880***	0.0152	0.4875***	0.0346
SY2012	0.5122***	0.0148	0.4913***	0.0684
SY2013	0.5719***	0.0172	0.5375***	0.0329
Township Variables				
Erin	0.3371***	0.0193	0.3848**	0.1398
Wellington North	0.0825***	0.0097	-0.0705	0.1047
Mapleton	0.2222***	0.0129	0.3270*	0.1612
Puslinch	0.3005***	0.0275	0.4307***	0.1306
Eramosa	0.3174***	0.0182	0.3082*	0.1285
Wellington Centre	0.3176***	0.0118	0.2066	0.1067
Aggregate Distance Bands				
0-0.5km	0.0320***	0.0082	0.0210	0.0255
0.5-1km	0.0470***	0.0072	0.0111	0.0251
1-1.5km	0.0484***	0.0074	-0.0081	0.0247
1.5-2km	0.0424***	0.0073	0.0218	0.0281
2-2.5km	0.0411***	0.0078	0.0333	0.0272
2.5-3km	0.0486***	0.0068	-0.0053	0.0264
Constant	9.5345***	0.1060	8.3625***	0.4332
R-squared	0.6260		0.6894	
Number of Sales	9,095		796	

When focusing the model on only the top 8 most active pits in the county, the coefficients either lose strength in the positive effect or flip signs to become negative; however, these results are not statistically significant.

CONCLUSIONS

The main narrative that these results address is the importance of including an aggregate site's activity when analyzing their impacts. The Ministry of Natural Resources main database for licensed aggregate sites include all pits and quarries that are under an active license, however an active license does not necessarily mean that a pit is active in extraction activities. This analysis presents an original model, where no pit identifiers or activity is included in the model, which is then compared with a model that includes a measure of activity. Once activity is accounted for, and once the model focuses on only those pits that are under high extraction activities, the results provide no evidence of aggregate site impacts on rural residential property values. This is confirmed when constraining the model to a 3km radius range of every pit.

The primary models indicated no statistically significant impacts on property values once aggregate activity was accounted for. The hypothesis that property values may increase with increasing distance away from aggregate sites was rejected. The sensitivity analysis was consistent with these results.

CONTACT AND COPYRIGHT

Alison Grant received her MSc in Food, Agricultural and Resource Economics from the University of Guelph and will be starting her PhD in Agricultural Economics at Purdue University in August of 2017. Her contact information is alisongrant2@gmail.com.

This research is based, in part, on data provided by the Municipal Property Assessment Corporation (MPAC). Any findings or recommendations expressed in this paper are those solely of the author, Alison Grant, and not necessarily the views of MPAC.