Defining a Housing Market Integrity Index (MII): A Methodology and Application to Quebec's Housing Market

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Contents

Executive Summary

Money laundering, mortgage fraud, and other illicit activities in the housing market can contribute to housing unaffordability and increase market and mortgage vulnerability to various risks. Criminals worldwide use innovative mechanisms to launder their proceeds of crime both in their home countries and abroad, with estimates suggesting that over half of all proceeds of crime are laundering through real estate.[1] Money laundering, while currently very difficult to measure, could be distorting the Canadian real estate market, with the prospect that effective reduction in money laundering could deflate house prices and the equity Canadians hold in their homes and as security against their mortgages. Maloney, Somerville, and Unger (2019)[2], which formed the Expert Panel on Money Laundering in BC Real Estate, estimated that in 2018 money laundering of both domestic and foreign origin could have made house prices in BC 3.7% to 7.5% higher than they otherwise would have been.

In 2018, CMHC started a research project to develop a methodology to help identify suspicious activity risks in the housing and mortgage market, following discussions with and research of Dr. Brigitte Unger of the University of Utrecht, one of the world's leading experts in money laundering in real estate. This study looks at the capacity of the methodology to identify suspicious real estate transactions using Quebec data, which is more open than other provinces in releasing names of buyers and sellers in real estate transactions. We recognize that privacy and other legislative concerns, as well as data-sharing agreements with relevant government authorities would likely need to be explored and addressed by any organization tasked with implementing this methodology.

The essence of the project is to develop and evaluate data-driven "red flags" based on the emerging literature on money laundering in real estate (FATF (2007)[3], Unger et al. (2010)[4], FINTRAC (2016)[5], Savona and Ricardi (2017)[6], Ferwerda and Kleemans (2019)[7]). The methodology has five steps.

1. First, we start with a list of indicators that could potentially help identify suspicious transactions.
2. Second, we create conditions for each indicator that would flag a transaction as suspicious and convert it to a range between zero and one. Some of these indicators are continuous and some are binary, meaning they take on a value of 1 if true, 0 otherwise.
3. Third, we aggregate the normalized values of all the indicators to calculate our composite "Market Integrity Index" or MII for residential property transactions.

[1] Schneider, Stephen. Money Laundering in Canada: An Analysis of RCMP Cases. Nathanson Center for the Study of Organized Crime and Corruption, York University. 2004. Page 1.
[2] Maloney, Maureen, Tsur Somerville and Brigitte Unger. Combatting Money Laundering in BC Real Estate: Expert Panel on BC Real Estate. 2019.
[3] Financial Action Task Force (FATF). Money laundering & terrorist financing through the real estate sector. 2007.
[4] Unger, Brigitte, Joras Ferwerda, Hans Nelen, Luuk Ritzen and Jaap Trouw. Detecting Criminal Investments in the Dutch Real Estate Sector. 2010.
[5] FINTRAC. Indicators of money laundering in financial transactions related to real estate. 2016.
[6] Savona, Ernesto U. and Michele Riccardi (eds). Assessing the risk of money laundering in Europe. Final Report of Project IARM (www.transcrime.it/iarm). Milano: Transcrime – Università Cattolica del Sacro Cuore. 2017.
[7] Ferwerda, Joras and Edward R. Kleemans. Estimating money laundering risks: An application to business sectors in the Netherlands. Working Paper. 2019.

4. Fourth, we define an initial cut-off value for the MII index and create a list of buyers and transactions for a search of publicly available information that could either raise or lower the sense of risk of money laundering. Given sparse data on verified cases of money laundering, this threshold is currently based more on resources for secondary investigation.
5. Fifth, conduct secondary, corroborating research like that expected as due diligence in financial institutions to validate or dismiss the transactions as suspicious enough to warrant further attention.

Box E1 outlines some technical details on how our red flags are calculated.

Box E1: Normalization of Indicators

We convert each indicator to a range between 0 and 1, 0 being the least suspicious and one being the most. This normalization would allow us to evaluate each indicator equally which would later facilitate creating our composite index. The normalization process gives us three types of indicators.

- The first type is binary, which equals one if a particular condition holds (for example, the buyer lives abroad) and 0 otherwise (i.e., buyer lives in Canada).
- The second type converts a continuous indicator to a range between 0 and 1 by exploiting its percentile ranking (for example, the property is in a very high-valued neighborhood).
- For the third type, we are interested in both the high and low values (for example, the property's price compared to its assessed value). In those cases, we take the mean absolute deviation of the percentile ranking and then multiply by 2 to range between 0 and 1.

Box E2 presents the list of external sources that we consult for secondary analysis. The Notary Contracts in the provincial land registry database to help us find additional qualitative details unavailable in the real estate transactional data. Politically Exposed Persons (PEP) databases compile lists of domestic and foreign persons with political exposure and criminal connection and legal sanctions Provincial Corporate Registries (For example, *Registraire des Enterprises du Québec*) has publicly available information on registered companies, including owner information and date of the establishment, and often helps us find the ultimate beneficial owner (UBO). A more comprehensive database, which also comes with a sanction list, is also available via subscription-based databases and may be subject to the data providers' use restrictions. We also search Canada Legal Institute's (CANLII) database, the International Consortium of Investigative Journalists (ICIJ) database, and other news databases. Please note that some of the aforementioned information can be accessed from publicly available databases and others may need to access under subscriptions and subject to the relevant data provider's terms of use.

We consider three different approaches to selecting cases for conducting secondary research. First, we begin with the case with the highest MII score and proceed down the list as time and other resources allow. Second, we can start with a set of transaction characteristics that we think are most indicative of a pattern of money laundering. For example, a property traded twice within a short time with significant capital gains with no mortgage record. Third, it may be possible to identify buyer-seller networks engaged in repeated transactions facilitated by affiliated mortgage providers and notaries. Note that at this point we cannot identify realtors associated with each transaction.

Box E2: List of external sources for secondary checks * (please note that some of the information can be accessed from publicly available databases and others may need to access under subscriptions and subject to the relevant data provider's terms of use)

1. Notary Contracts accessible via the provincial land registry database
2. Land Registries (provincial)
3. Politically Exposed Persons (PEP) database for sanction / criminal information including various national and international sanction lists
4. Database for Ultimate Beneficial Ownership
5. Federal and Provincial corporate registries (e.g., Registraire des entrerprises du Québec)
6. Canadian Legal Information Institute (CANLII) database
7. International Consortium of Investigative Journalists (ICIJ) database

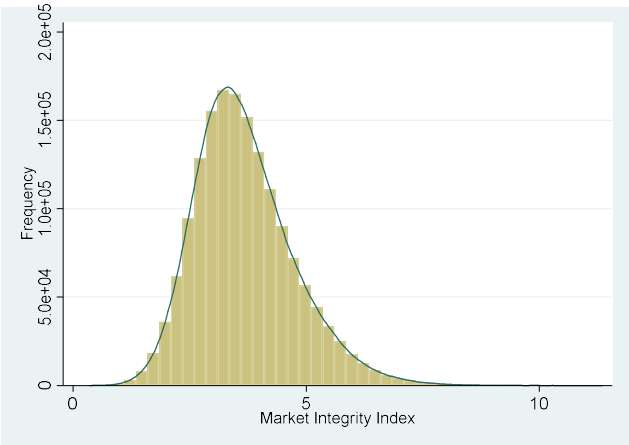
We applied our methodology to Quebec property transaction data accessed via the Quebec land registry database. The Quebec data allows us to estimate 17 of 35 indicators as listed in table E3. Data from 2000 onward includes 2.4 million property transfers involving 1.5 million distinct properties and 1.6 million unique buyers. Following the methodology described above, we estimated each indicator and the sum those indicators to form an initial Market Integrity Index (MII) for Quebec real estate. Without better information on transactions where suspicions are justified, we can't say which indicators do a better job of measuring money laundering and other risks, so we don't yet weigh the indicators according to their correlation with cases where suspicions can be validated.

Table E1: MII Indicators as evaluated with available Quebec Real Estate Transaction data

Property Characteristics	**Transaction Characteristics**
1. Traded multiple times. 2. Traded at least twice within one year. 3. Located in a higher value neighbourhood.	Price is significantly high/low compared to: 1. Average price in the neighbourhood. 2. Assessed value. 3. Previous price of the same property.
Transaction Financing Characteristics	**Buyer Characteristics**
1. Mortgage is provided by a natural person. 2. Mortgage provider is from abroad. 3. No mortgage. 4. Mortgage Provider is not an approved lender for CMHC insurance purposes	1. Provided incomplete address. 2. Is from abroad. 3. Is a Corporation. 4. Owns a large number of properties. 5. Properties owned have a high average value. 6. High number of properties purchased in a year. 7. Multiple purchase in a short time frame (also typical of land assembly).

Figure E1 shows the distribution of our estimated MII. With the maximum score out of 17, the mean MII is 3.67. Figure E1 indicates that almost 94% have MII scores between 2 and 5. We are interested in the right tail of the distribution, and given limited resources, we focused on the top 0.2% of transactions with a score of 7.5 or higher as meriting secondary checks. That list consists of 3,808 buyer/transactions, and we have only begun secondary searches on those cases. We also keep all the buyers scoring between 6 and 7.5 to avoid losing false negatives, and plan to sample those transactions to gain a sense of the concentration of suspicious cases in that group.

Figure E1: Distribution of Market Integrity Index



We also discuss our findings on specific indicators. We start with the three property characteristics:

1. Looking at multiple traded properties, we find that about 11% of properties have four or more transactions since 2000. We recognize that properties traded for the first time early in the sample period are more likely to have multiple trades, so we anticipate the following indicator will be more relevant.
2. The second indicator is whether a property is sold twice or more within 365 days of purchase, and about 6% of properties fall into this category.
3. The third indicator looks at the average property value in a neighbourhood compared to the provincial average price for that property type. Wanting to identify properties in high-end neighbourhoods, we find that the top 10% of neighbourhoods are defined by average neighbourhood property values 40% higher than the provincial average.

We have four indicators related to property transaction financing or mortgages.

1. Roughly 0.5% of all transactions have a natural person as a financier, as opposed to a financial institution of some type.
2. 0.01% of the transactions have financiers from abroad.
3. Roughly 15% of transactions are considered to have been paid in “cash”, in the sense that no mortgage lien was registered within a month of the property transfer closing date.
4. 2.4% of the transactions have mortgage financiers who are not CMHC approved lenders.

We have three indicators related to transaction characteristics. FATF (2007) and Unger et al. (2010) suggest that both high and low prices are suspicious, so we examine transaction prices against three benchmarks:

1. A red flag is raised when prices are in either the lowest or highest decile of the distribution compared to the neighbourhood average. The cut off for the lowest decile in the price distribution is a price 54% below the neighbourhood average, whereas a property with a 43% higher price is the cut off for the top decile.
2. Similarly, relative to the assessed value, a property traded at 38% below the assessed value fall into the lowest decile percentile, whereas a property with a price 19% above is in the top decile, and both trigger a red flag for significant difference from assessed value.
3. Finally, we consider the price growth of the same property. A property with a negative 0.8% annual growth rate falls into the lowest decile. Similarly, a property with annual price growth of 39% and higher are in the highest 10% property price appreciation.

There are seven buyer characteristics. For the last two indicators, our interest is to capture sudden increase in property ownership or transactions. One way to capture this is by looking at the average number of properties bought in a year. The other indicator is to look at the minimum time difference between the two transactions with a flag triggered only at the lower end of the distribution indicating very short periods between the two transactions. Secondary research is important given that there are legitimate reasons for each of these buyer characteristics below.

1. About 0.1% of all buyers do not provide a complete address.
2. Our best, though very imprecise, indicator of a foreign buyer in this data is the presence of a foreign address as the home address of the buyer. Only 1.1% of all the buyers provide a foreign address.
3. 14% of the buyers are not natural persons, with the buyer being a corporation or trust.
4. Buyers having three or more properties are in the 95th percentile and above.
5. Buyers with properties worth $885,000 are in the 90th percentile.
6. Purchases of four or more properties in a year define the top 10% most active buyers.
7. Those who buy another property within six days or less of another transaction fall are among those with the shortest time between buying two properties.

We have compiled a set of 18 additional published indicators of money laundering in real estate which we could not evaluate due to lack of access to data. Development of data sharing Memoranda of Understanding (MOUs) with federal and provincial partners could address these data gaps.

There are some challenges in advancing this work as appropriate privacy, mandate and other legislative considerations need to be carefully considered and appropriate data share agreements would need to be entered into with relevant government partners with AML investigative powers.

The key challenge in extending this work to other provinces is that generally provinces consider the sharing of bulk transactions data as subject to privacy legislation and will not release names of buyers, sellers, and notaries/lawyers, though this information is available to the public on an individual transaction basis. We are fully prepared to share our work on the methodology, as appropriate, for informational and discussion purposes with other federal or provincial agencies with a mandate and interest in exploring our methodology.

I. Introduction

As the prevalence of public corruption, tax evasion, and organized crime is growing worldwide, criminals and fraudsters are increasingly using innovative schemes to launder and hide their criminal proceeds.[8] These schemes often exploit the developed countries' financial and economic systems to obscure illegal connection, as several media reports suggest. For example, the ex-president of Ukraine, Viktor Yanukovich, allegedly siphoned billions of dollars into shell companies established outside Ukraine.[9] [10] The Wachovia Bank in the United States allegedly facilitated a transfer of US$ 378 billion, equivalent to one-third of Mexico's gross national product, for Mexican drug lords in 2010, eventually settling the case in court by paying a US$160 million fine.[11] [12] In December 2019, the Swiss operations of HSBC agreed to pay the US Department of Justice about US$ 192 million for helping Americans to evade taxes.[13] In November 2019, the Australian Transaction Reports and Analysis Centre (AUSTRAC), the government financial crime watchdog, accused Australia's second-largest bank, Westpac Banking, of failing to comply with Anti-money laundering rules in 23 million transactions, some of which involved, e.g., child-sex offenders, leading to the resignations of both the CEO and Chair of the Board of Directors.[14]

Much of the illicit money flows through or is parked in the real estate and housing sector in developed countries including Canada, with estimates that over half of criminal proceeds flow through real estate transactions. The real estate market is attractive to money launderers because it involves large sums of money is often a safe investment with reasonable return, especially in developed countries, and the ultimate beneficial owner (UBO) is relatively easy to hide. A 2018 Globe and Mail report, for example, suggests that drug dealers lend their criminal proceeds through private mortgage providers to Vancouver homebuyers, often from China. The reporters presented 45 court cases to back their story, involving homebuyers filing complaints about the threats they received from lenders. In 2007, the *Journal de Montreal* published an investigative report on top-level politicians from seven West African nations who laundered their alleged corruption proceeds in Quebec's real estate market.

As secrecy is a crucial element in money laundering, launderers often use corporate vehicles or "frontmen" in real estate transactions. Transparency International (2016)[15], for example, examined the 100 most expensive properties in Vancouver, finding that nearly half of these properties had a corporation, a trust, a student, or a homemaker as the registered owner. Whereas for the first two, the ultimate beneficial owner (UBO) remains hidden under corporate secrecy, the other natural owners are

[8] For recent studies, see Saez and Zucman (2019), Bullough (2019), and Bernstein (2018).
[9] Ukraine's Stolen Asset: a-long-hard-slog. The Economist, March 5, 2014.
10 Leask, David. "Scottish shell firms used to launder tens of millions of dollars looted from Ukraine by country's former leaders," The Herald, January 7, 2018.
[11] Vulliamy, Ed. "How a big US bank laundered billions from Mexico's murderous drug gangs," April 3, 2011.
[12] Pascal Fletcher. Wachovia pays $160 million to settle the drug money probe. Reuters, March 17, 2010.
[13] Boland-Rudder, Hamish. HSBC To Pay $192m Penalty For Helping Americans Evade Taxes. ICIJ. December 11, 2019.
[14] CNBC, "Australia's Westpac Banking accused of 23 million money laundering breaches," November 19, 2019.
[15] Transparency International – Canada. No Reason to Hide: Unmasking the Anonymous Owners of Canadian Companies and Trusts. 2016.

apparently representing the unknown UBO or received the property or funds to purchase via an intra-family transfer or gift.

The emergence of a growing number of such cases is alarming. Indeed, Maloney, Somerville, and Unger (2019), the Expert Panel on Money Laundering in BC Real Estate, "...conservatively estimate annual money laundering activity in 2015 ….. in BC at $6.3 billion ($7.4 billion for 2018)." Furthermore, considering the $7.4 billion dollar estimate of 2018, "…... the amount invested in real estate would be between $2.7 and $5.3 million." Injection of such significant amounts of money and the various schemes used to clean it are likely to have distortionary effects on the real estate market:

- First, and most importantly, such real estate investments would increase housing demand, raising home prices. The BC Expert Panel study finds that "...the effect of money laundering is to make house prices in BC 3.7 percent to 7.5 percent higher than they would be in the absence of all money laundering." Similarly, Hundtofte and Rantala (2018) analyze housing market in Miami and find that Geographic Targeting Order (GTO), which requires corporate buyers to report their UBOs, led to a significant drop in the number of corporate buyers and was a factor in a decline in the price of high-end properties in Miami of 4.2%.
- Second, since these homebuyers typically have criminal ties, their investments in the housing market bring unwanted risks.
- Third, as the "Vancouver model" suggests, a large proportion of drug money proceeds enters the underground lending market. A part of this money finds ways to the unregulated mortgage market in BC, it increases the riskiness in both the mortgage and the housing market.
- Fourth, these homebuyers usually prefer high-end properties, thereby increasing demand for such properties. This sends wrong signals to the market which could have the effect of encouraging housing suppliers to build high-end properties more than the domestic economy demands, further aggravating the affordability crisis.
- Fifth, the various schemes used to clean money (e.g., creation of shell companies and trust, creation of false documents, transfer arrangements of illegal funds through underground financial systems) encourage fraudulent practices, increasing such risks in the housing and mortgage markets.

Money laundering, mortgage fraud, and other illicit activities in the housing market have likely contributed to the problem of housing affordability and increased market and mortgage vulnerability to various risks. This project seeks to analyze real estate transaction data to identify potential suspicious transactions by applying a red flag approach based on indicators developed by various experts worldwide. The market monitoring methodology also includes a qualitative research component that investigates a selected highly suspicious transactions and buyers/sellers deeper to check the red-flag approach's effectiveness.

The market monitoring tool has several advantages in combating money laundering.

- First, a red flag approach based on money-laundering schemes and typologies can be a relatively unbiased way to identify suspicious transactions, free of more subjective assessments of those expected to file suspicious transactions reports.
- Second, this method can focus information gathering on higher risk transactions, relative to random audits, out of hundreds of thousands of other legitimate transactions especially when

the launderers attempt to camouflage their activities from individual observers. The methods can also be used to evaluate historical transactions, with the potential to indicate whether money laundering risk is rising or falling over time.

- Third, the MII can pull together a history of transactions over times and places, revealing patterns that would not be observable by individual professionals in the existing AML regime.
- Fourth, systematic use of the MII tools could deter money laundering in real estate by identifying potential suspicious transactions.

This report presents a methodology to conduct this market monitoring. The rest of the report proceeds as follows. Section II presents the methodology of the red flag approach in detail. Section III presents the list of indicators. Section IV offers the method for secondary research. Section V provides a descriptive analysis of the Quebec real estate market. Section VI presents our conclusions. We withhold details of cases out of caution on privacy issues and recognition that this methodology is still in the early stages of development, as noted in the next section.

II. The Red-Flag Methodology

Deducing money laundering from real estate transactions alone is challenging. Without an investigation and a court conviction, there is no way to conclusively determine whether a real estate transaction is laundering the proceeds of crime. However, we can identify certain red flags that in combination help indicate a heightened risk or suspicious transaction. A number of studies (FATF (2007)[16], Unger, et al. (2010)[17], FINTRAC (2016)[18], Savona and Ricardi (2017)[19], Ferwerda and Kleemans (2019)[20]) explain the concepts of flag methodology for real estate transactions.

We develop a red-flag methodology based on this emerging literature and summarize it with the following five steps:

- First, we develop a list of indicators that could help identify suspicious patterns and transactions.
- Second, we formulate each indicator to reflect the degree of suspicion associated with the factor standardize it to a range between zero and one.
- Third, we aggregate by simply summing the normalized values of all the indicators to calculate our composite “Market Integrity Index” or MII for residential property transactions.
- Fourth, we work with the transactions and principals associated with highest MII index values and search publicly available information that could either raise or lower the sense of potential suspicious activity. Given sparse data on verified cases of money laundering, this threshold is currently based more on resources for secondary investigation than on known concentration of verified cases of money laundering or other illegal activity.

[16] Financial Action Task Force (FATF). Money laundering & terrorist financing through the real estate sector. 2007.
[17] Unger, Brigitte, Joras Ferwerda, Hans Nelen, Luuk Ritzen and Jaap Trouw. Detecting Criminal Investments in the Dutch Real Estate Sector. 2010.
[18] FINTRAC. Indicators of money laundering in financial transactions related to real estate. 2016.
[19] Savona, Ernesto U. and Michele Riccardi (eds). Assessing the risk of money laundering in Europe. Final Report of Project IARM (www.transcrime.it/iarm). Milano: Transcrime – Università Cattolica del Sacro Cuore. 2017.
[20] Ferwerda, Joras and Edward R. Kleemans. Estimating money laundering risks: An application to business sectors in the Netherlands. Working Paper. 2019.

- Fifth, we document the cases that we believe rise to the level that could warrant a FINTRAC suspicious transaction report, or a referral to appropriate investigative authorities.

I.a Technical classifications of indicators

An important step in creating the composite index is to "normalize" every indicator to a range between zero and one. Based on this normalization process, we find three types of indicators.

1. Binary Indicators:

The first and the simplest one involves binary outcomes, i.e., whether a particular characteristic is attributable to a property, a transaction or a buyer or not. We create dummy variables for these indicators such that the indicator gets 1 if the attribute is present and 0 otherwise:

$$X_1 = \begin{cases} 1 & if\ the\ characteristic\ is\ attributable\ to\ the\ buyer \\ 0 & otherwise. \end{cases} \quad \ldots\ldots(1)$$

Examples of such indicators include whether the buyer lives abroad or not with a value of 1 if the buyer is not resident in Canada, and 0 if they are.

2. Continuous Indicators

The second and third indicator types involve underlying variables that take more than two values. Examples include properties traded multiple times, and properties sold at extremely high prices. There are two potential approaches. In the first, we could set a threshold (or cut-offs) value for an indicator such that crossing the threshold would raise red flags, setting the value to 1 if the underlying variable crosses the threshold and 0 if it remains within the threshold. There are two problems with this approach: First, without having a set of known money laundering transactions, it is difficult to establish a risk-based threshold value. Second, a small difference in the value of the underlying variable may result into crossing the threshold. In that case, two minimally different observations will receive different scores.

We considered a second approach where we generate a continuous indicator from the underlying variable that reflects a degree of risk. The underlying variable requires conversion to range between 0 and 1 to ensure similarities across all the indicators in question and facilitate constructing the Market Integrity Index. For the purpose of future reference, therefore, we define the underlying variable or indicator as to the one that captures the concept. In contrast, the adjusted indicator is the resultant indicator (that ranges between 0 and 1) generated after converting the underlying indicator.

2.1 Type I Continuous Indicators

The second class of adjusted indicators includes those whose interests lie only on one side of the distribution (high or low values) of the underlying variable. For example, for the number of properties owned by a person, a higher number of properties owned should raise greater suspicion. In such cases, the task is to convert the underlying variable's values such as the number of properties owned, into an indicator that ranges between 0 and 1. Whereas there are a few ways of doing this, we take a simple approach of considering the percentile value of the underlying variable. In cases of the same values, for example buyers owning exactly two properties, we take the lowest percentile of the same number. For that matter, each value in the indicator represents the observation's percentile ranking relative to the

whole distribution in the underlying variable. In brief, we compute the second set of variables in the following way:

$$X_2 = percentile(Y_2) \quad \ldots\ldots\ldots\ldots (2)$$

Where Y_2 is the underlying continuous or multi-valued discrete variable.

2.2 Type II Continuous Indicators

Finally, there are a few indicators where we are interested in both ends (high and low) of the distribution. For these third types, we need a few additional steps. First, after converting to their percentile rankings, we calculate Mean Absolute Deviation (MAD). The MAD of the percentiles, however, ranges between 0 and 0.5.[21] Second, we multiply the MAD with 2 to ensure that the value of the indicator ranges between 0 and 1.[22] In brief, the third set of variables are:

$$X_3 = 2 \times MAD[percentile(Y_3)] \quad \ldots\ldots\ldots\ldots\ldots (3)$$

Where Y_3 is the underlying continuous or multi-valued discrete variable.

III. The Indicators

Before discussing the indicators in detail, there are a few issues to clarify. First, this list has seventeen indicators due to the limits of property transactions data available from the Quebec real estate market and land registries. The number of indicators that can be evaluated depends on the transaction details made available in each jurisdiction. Second, an indicator value of one by itself does not suggest a transaction is suspicious. The methodology requires several indicators to be at or near a value of one to reach range of more suspicious transactions.

We classify the indicators into four distinct groups. These are

i. Property related indicators,

ii. Transaction financing related indicators,

iii. Transaction related indicators and

iv. Buyer related indicators.

Each group of indicators is discussed in the next section.

III.a Property Characteristics

1. Properties traded multiple times

Often money launderers trade a property multiple times within their networks to clean their proceeds of crime and/or create layers to hide the actual beneficial owner. Eventually, we observe a property traded multiple times. Hence, this indicator is:

[21] Since the mean of the percentiles is 0.5 and the percentiles range between 0 and 1, deviation from mean varies between - 0.5 and + 0.5. Taking the absolute value makes it ranges between 0 and 0.5.

[22] Since the MAD ranges between 0 and 0.5, multiplying it with 2 will keep the lower bound to 0 but the upper bound to 1. Hence, multiplication of 2 is required to keep the range of indicator values between 0 and 1.

$$y_1 = Number\ of\ times\ a\ property\ is\ traded.$$

Since a greater number of transactions raises higher suspicion, this is a type II indicator, and we convert it using equation 2 above:

$$x_1 = percentile(Number\ of\ times\ a\ property\ is\ traded).$$

Most properties are traded once or twice over the nearly 20-year period. Due to this over-representation, we would observe significantly different percentile values for properties with the same frequency of transaction. To deal with this, we take the minimum percentile within the same frequency. We discuss this in greater detail below when we apply this for Quebec housing market.

2. Frequently traded Properties

This indicator to capture cases when a property is traded again within a short period. We consider whether there has been more than one transaction of the property within 365 days. We generate a dummy variable to capture this as an indicator:

$$x_2 = \begin{cases} 1 & if\ the\ there\ is\ more\ than\ one\ transaction\ of\ the\ property\ since\ 2000\ in\ 365\ days \\ 0 & otherwise. \end{cases}$$

3. The Property is located in a higher valued neighbourhood

We define a neighbourhood by the Forward Sorting Area (FSA), the first three alphanumeric characters in the postal code. We calculate the value of an average property for a property type (condominiums, single family detached) each year by:

$$z_{jkt} = \frac{\sum_i^{n_{jkt}} Price\ of\ the\ property\ i\ in\ neighborhood\ j\ of\ type\ k\ in\ year\ t}{n_{jkt}}$$

Where z_{jkt} is the mean property value in neighbourhood j of property types k in year t and n_{jkt} is the number of traded properties located in neighbourhood j of property types k in year t. We then calculate the provincial mean value of properties of each property type in year t by:

$$\bar{z}_{kt} = \frac{\sum_i^{n_{kt}} Price\ of\ the\ property\ i\ of\ type\ k\ in\ year\ t}{n_{kt}}$$

We are interested in the mean property value in a neighbourhood relative to the provincial mean, i.e.:

$$y_3 = \frac{z_{jkt}}{\bar{z}_{kt}}.$$

A higher y_3 therefore would imply a higher-valued neighbourhood and properties traded in such neighbourhood would be more suspicious. To convert this to an adjusted indicator, we again apply equation 2:

$$x_3 = percentile(y_3) = percentile(relative\ property\ value\ in\ a\ neighborhood).$$

III.b Transaction Financing Characteristics

4. The mortgage is provided by an individual/natural person

Mortgages provided by natural persons cast doubts since the sources of funds are often unknown. The indicator in this case is simply a dummy variable like equation 1:

$$x_4 = \begin{cases} 1 & if\ the\ mortgage\ provider\ is\ a\ natural\ person \\ 0 & otherwise. \end{cases}$$

5. The mortgage provider is from abroad

When the mortgage provider is from abroad, there is a similar, if not greater, difficulty to establish the source of funds. The indicator is also similar, a dummy variable:

$$x_5 = \begin{cases} 1 & if\ the\ mortgage\ provider\ is\ from\ abroad \\ 0 & otherwise. \end{cases}$$

6. There is no mortgage record

The property transaction without a mortgage record implies that the there is no external financier for the transaction. This in turn means that the buyers have used their own funds, i.e., cash. Since the source of funds is unknown, such cash purchases are suspicious. The indicator here is again type I, a dummy variable:

$$x_6 = \begin{cases} 1 & if\ there\ is\ no\ mortgage\ record \\ 0 & otherwise. \end{cases}$$

7. The Mortgage provider is not approved by CMHC

W*e use the CMHC approved lender list as a convenient proxy for mortgage-offering firms subject to a federal or provincial financial regulator and/or FINTRAC obligations to report suspicious transactions*. In Canada, larger mortgage lenders are "CMHC approved" in accordance with the *National Housing Act* and the *Housing Loan Regulations.* [23]

[23] CMHC, *Becoming an NHA Approved Lender*, December 16, 2020, HB-6 CMHC Ref Doc 06-E. https://assets.cmhc-schl.gc.ca/sites/cmhc/finance-investing/mortgage-loan-insurance/approved-

The criteria of approved versus non-approved lenders bring an additional indicator related to risk management standard in the mortgage industry.

In the mortgage industry, the risk profile for "unregulated lenders" is usually higher. Unregulated lenders include corporations, individuals and other entities that offer mortgages but that are typically subject to neither federal nor provincial mortgage lending rules and guidelines. Unlike banks, trust companies, insurers and credit unions, these lenders do not take deposits and are not subject to federal government mortgage lending rules and oversight. For example, they are not subject to federal rules about the amount of funds they must keep in reserve for credit losses arising from mortgage loans.[24]

Since we already have a separate indicator for a natural person providing a mortgage, we consider only corporations for this indicator. The indicator here is class I, a dummy variable:

$$x_7 = \begin{cases} 1 & if\ the\ lender\ is\ not\ CMHC-approved \\ 0 & otherwise. \end{cases}$$

III.c Transaction Details

Money Laundering usually involves large sums of money. When it involves real estate, it relies on what the market offers and often results in purchasing a property at a significantly high price. The buyer may also sell it to himself through straw men and shell companies. In the process of cleaning it, he may just pay himself amounts that may be significantly different from what the property is actually worth. The indicators look at three benchmarks of the property value:

i. Mean annual property price in a neighbourhood,

ii. The assessed value of the property and

iii. The previous purchase price.

We are interested in both the high and the low prices of the properties relative to the benchmark while making the comparison. In other words, we are interested in whether the price of a property is too high or too low compared to its neighbourhood average, assessed value, or the price at the previous transaction.

8. Significantly different prices in comparison to the neighbourhood average

We first estimate the neighbourhood average for each property type (e.g., condominiums, single family detached) in each year in a very similar way to the indicator 3 above using the following formula:

lenders/form-13-e-becoming-an-nha-approved-lender-application-en.pdf?rev=04de3482-fd85-428c-9487-5c0396992dcd

[24] CMHC, *Residential Mortgage Industry Report*, September 2020, p. 34.

$$z_{jkt} = \frac{\sum_{i}^{n_{jkt}} Price\ of\ the\ property\ i\ in\ neighborhood\ j\ of\ type\ k\ in\ year\ t}{n_{jkt}}$$

Where z_{jkt} is the mean property value in neighbourhood j of property types k in year t and n_{jkt} is the number of traded properties located in neighbourhood j of property types k in year t. We then take the ratio between the price of the property and this neighbourhood average of the same property type in the same year:

$$y_8 = \frac{z_{ijkt}}{z_{jkt}}$$

Where z_{ijkt} is the price of the property i which is located in neighbourhood j, is of property type k and is traded in year t.
As mentioned above, both the high and low values of this ratio are suspect here. Hence, this indicator is of class III and we convert this using equation 3:

$$x_8 = 2 \times MAD[percentile(y_8)].$$

9. The purchase price relative to assessed value
The assessed value of the property is the second benchmark against which we wish to compare the purchase price. The municipalities estimate property value of each property time to time for property tax assessment purposes. We therefore estimate our indicator first as:

$$y_9 = \frac{z_{ijkt}}{a_{ijkt}}$$

Where z_{ijkt} is the price of the property i and a_{ijkt} is the assessed value of the property i with the subscripts j, k and t denote neighbourhood, property type and years respectively. Again, our interest lies on both the high and low values (i.e., it is a class III indicator) and therefore, we convert it using equation 3:

$$x_9 = 2 \times MAD[percentile(y_9)].$$

10. The growth in property price
Our third benchmark is the price at the previous transaction of the property. There are two options: the ratio between the two prices and a price growth. An important factor in consideration here is that the time difference between the two transactions vary significantly. More important, a greater price difference can be positively associated with a greater time difference between the two transactions just because there is more time for the price to rise. Hence, it is important to adjust the price in a meaningful way. We therefore consider an adjusted price growth within a particular time interval, in our case, 365 days:

$$y_{10} = \frac{(z_{1i} - z_{0i})}{z_{0i}} \times \frac{365}{T}$$

Where y_{10} is the annualized price growth, z_{1i} is the current price, z_{0i} is the previous price and T is the number of days between the two transactions. Since both the high price growth and low price growth (usually negative) are important, this is class III indicator and we convert it using equation 3:

$$x_{10} = 2 \times MAD[percentile(y_{10})].$$

There is one caveat: there could be property improvements between the two transactions, which may elevate the price more than usual. To rule out such possibilities, we could take two approaches. First, we may combine this indicator with the price-to-assessed value ratio, the previous indicator. Our construction of MII covers it when we aggregate all the indicators. Second, during our secondary research, we verify whether the price growth is due to some home improvements by looking at the changes in the assessed value. We calculate the growth rate in the price-to-assessed value ratio for this purpose. Then, we would capture the effect of any home improvement in the assessed value, and tracking this ratio would also help us rule out such possibilities.

III.d Buyer Characteristics

11. The buyer provided incomplete address in transaction record

One of the red flag indicators listed in FINTRAC (2016) is when a buyer tries to avoid actual physical address by using, for example, a PO Box. Based on the idea, we check whether the buyer has an incomplete address in the transaction record. The indicator is:

$$x_{11} = \begin{cases} 1 & if\ the\ buyer\ does\ not\ provide\ a\ complete\ address \\ 0 & otherwise. \end{cases}$$

12. The buyer is from abroad

If a buyer is from abroad, the source of funds used to purchase the property is more difficult to verify. Indeed, the affluent foreign buyer could be a corrupt politician or public official of a foreign country, a foreign person evading taxes, an international drug/arms dealer, a human trafficker or a terrorist. Furthermore, as the recent Panama Paper leaks suggest, both the Canadian and foreign businesspeople or politicians may purchase properties in Canada using offshore shell companies.[25] Hence, one way to raise red flags is merely combining two indicators: whether the buyer is from abroad and whether the buyer is a corporation (our next indicator). Since it is just a yes/no variable, this is of class I, and we calculate this by:

$$x_{12} = \begin{cases} 1 & if\ the\ buyer\ is\ from\ abroad \\ 0 & otherwise. \end{cases}$$

Again, this indicator does not say that all foreign buyers are suspicious, only that literature suggests there is a relatively greater risk associated with transactions by a buyer who is a foreign resident due to greater difficulty in verifying the source of funds.

13. The buyer is a corporation or a trust

As mentioned above, a corporation buying a property often raises suspicion about the owner. In many jurisdictions, it is difficult to know the Ultimate Beneficial Owner (UBO) of the company, and criminals

[25] See International Consortium of Investigative Journalists' (ICIJ) website, https://www.icij.org/, for details on Panama Papers and other leaks.

can use this vehicle to hide their identity. This can be done through the use of trusts or numbered companies. Given that, our indicator is:

$$x_{13} = \begin{cases} 1 & if\ the\ buyer\ is\ a\ corporation\ or\ trust \\ 0 & otherwise. \end{cases}$$

14. The total value of the properties owned by the buyer

Money laundering usually involve large sums of money and hence, it is important to track the total value of the properties owned by the buyer (Unger et al. (2010)). But many individuals and companies have legitimate investments in real estate markets too and this indicator will flag these investors. It is, therefore, important to analyze this indicator in combination with other indicators. Given that, we assign higher score for buyers who own more in real estate. The underlying indicator is:

$$y_{14} = Total\ value\ of\ properties\ owned\ by\ the\ buyer\ .$$

We are able to compute this from the property transaction data by

$$y_{14} = Total\ value\ of\ properties\ bought - \ Total\ value\ of\ properties\ sold.$$

An important point to note here is that this value could be negative when the value of the sold property exceeds that of purchased property. This would be common for construction companies who sell new homes and condos. If that is the case, the buyer would not be considered suspicious since we are only interested in the high values of this indicator.

Since this is a class II indicator, we therefore convert it using equation 2:

$$x_{14} = percentile(y_{14}) = percentile(Total\ value\ of\ properties\ owned\ by\ the\ buyer\ since\ 2000).$$

15. The number of properties owned by the buyer

Like the total value of the property, a buyer owning a large number of properties can also raise suspicion. Whereas this is positively and strongly correlated with the total value of the property, number of properties captures a different aspect: how many times the buyer has spent large sums of money. The higher the number of properties, the higher the degree of suspicion. Hence, our underlying indicator is:

$$y_{15} = Number\ of\ properties\ purchased\ by\ the\ buyer\ since\ 2000.$$

Since this is a class II indicator, we convert it using equation 2:

$$x_{15} = percentile(y_{15}) = percentile(Number\ of\ properties\ purchased\ by\ the\ buyer\ since\ 2000).$$

16. The average number of properties purchased by the buyer in a year

One indicator suggested by Unger et al. (2010) looks at whether the buyer has built the real estate portfolio within a short span of time. One way to do this is by calculating the number of properties the buyer purchased, on average, in a year. This is obtained by:

$$y_{16} = \frac{Number\ of\ properties}{Number\ of\ days\ to\ build\ the\ full\ portfolio} \times 365.$$

The higher the number of properties purchased in a year, the greater the suspicion. Hence, this is a class II indicator which we convert by equation 2:

$$x_{16} = percentile(y_{16}) = percentile\left(\frac{Number\ of\ properties}{Number\ of\ days\ to\ build\ the\ full\ portfolio} \times 365\right).$$

17. The minimum number of days between two purchases

Whereas the previous measure looks at the mean number of properties, it ignores bursts of quick back-to-back purchases. To capture this, we consider the number of days between two purchases of all transactions of a buyer and consider the minimum difference between two transactions as an indicator. The indicator is:

$$y_{17} = The\ minimum\ number\ of\ days\ between\ two\ purchases\ by\ a\ buyer.$$

The lower the minimum number of days between the two purchases, the greater the suspicion. Since the degree of suspicion is negatively correlated with the minimum number of days between the purchases, we reverse the percentile ranking by considering the negative value of the y_{17}, i.e.:

$$x_{17} = percentile[(-\ y_{17})]$$
$$= percentile[(-The\ minimum\ number\ of\ days\ between\ two\ purchases\ of\ a\ buyer)].$$

We have compiled a set of 18 additional published indicators of money laundering in real estate which we have not yet been able to evaluate, mainly due to lack of access to the required data. Development of data sharing MOUs with federal and provincial partners could help address these data gaps to make this analysis more robust.

Indicators that could not be estimated due to incomplete data:

1. Financier is a non-business party.
2. Financier has unregistered shareholders.
3. Financing has an unusual amount compared to appraised value (WOZ)
4. Financing has a creditor and a debtor being the same subject.
5. Owner is a person with antecedents (documented criminal behaviour)
6. Owner is a straw man.
7. Owner is a company with an unclear Ultimate Beneficial Owner
8. Owner is a company with a particular exploitation.
9. Owner is a company just established.
10. Owner is a company that closes shortly after the transaction.

11. Owner is a company without employees.
12. Owner is a 'world citizen' (unknown by the Tax Administration)
13. Real estate object is in a very bad neighbourhood
14. Property has been mortgaged multiple times.
15. Property has been renovated multiple times.
16. Renovation expenditure is unusual compared to price of the property.
17. Client buys back a property that he or she recently sold.
18. Direct sale or purchase without using a real estate broker or sales agent.

Market Integrity Index (MII)

Once each indicator has been normalized to a score between 0 and 1, we simply sum all the indicators to compute the Market Integrity Index:

$$Market\ Integrity\ Index\ (MII) = \sum_{i}^{17} x_i,$$

where x_i are the individual, converted indicators discussed above.

This is clearly a simplification since without verified cases of suspicious activity we don't know which of these indicators are more highly correlated with suspicious activity. A next step here is to develop a list of transactions that would be considered suspicious, and then statistically determine which indicators are most highly correlated with the suspicious activity.

After computing the MII for each buyer, we sort the buyers in terms of their MII score. We then simply worked through the list starting from the highest and conduct second round of checks based on the external, publicly available sources on the internet.

IV. Secondary Analysis based on external public sources

The buyer list created by the primary quantitative analysis consists of buyers with high MII and, therefore, we consider them as suspicious while recognizing the high probability of false positives - a high score that nevertheless seems to be an entirely innocent transaction. By design, a buyer or transaction gets a high MII if characteristics and activities satisfy multiple red-flag conditions. For example, a Canadian living in the United States may have purchased a few luxury properties in Canada over the years, sometimes financed by his own funds (cash) and foreign banks in other cases. Perhaps it is common for developers to purchase land in cash, take an equity line of credit on the purchased land from several possibly unregulated providers, and undertake a project under a new company (often a numbered company). Each of these transaction characteristics could lead to high MII indicating a higher risk the transaction may be illicit, but certainly does not amount to evidence that it is illicit.

We need to screen these cases out through a secondary research. We therefore look for presence and details of these high-MII buyers in externally available sources. Box 1 presents the list of external sources that we consult for this secondary analysis.

Box 1: List of external sources for secondary checks * (please note that some of the information can be accessed from publicly available databases and others may need to access under subscriptions and subject to the relevant data provider's terms of use)

1. Notary Contracts in Quebec's land registry database (*Registre foncier du Québec*)
2. Politically Exposed Persons (PEP) database for sanction / criminal information including various national and international sanction lists
3. Database for Ultimate Beneficial Ownership
4. Federal and Provincial corporate registries (e.g., *Registraire des entreprises du Québec*)
5. Canadian Legal Information Institute (CANLII) database
6. International Consortium of Investigative Journalists (ICIJ) database

Notary Contracts in the Quebec land registry database: provides Quebec property characteristics data. Features also include an online searchable database where one can look at a few additional property transaction details, including the amount of HST paid, the interest rate on the mortgage, other contractual information, etc.

Politically Exposed Persons (PEP) databases for sanctions/criminal information: PEP databases list persons with political exposure and criminal background. These lists are created mostly based on news articles and court case files and allow one to check, for example, whether a person has a political seat or political connections, has experienced a sanction, or even a criminal background. Even if it says 'political,' it includes other individuals with a criminal history too.

Database for Ultimate Beneficial Ownership: When a corporation is identified, if we can identify the UBO, we can check whether the owner has a criminal history through the PEP and related databases.

Federal and provincial corporate registries: Whereas the UBO databases created by the private organizations require subscription and are often expensive, the federal and provincial enterprise databases provide corporate details for free. The *Registraire des entreprises du Québec*, for example, contains ownership information, be that a natural or a legal person, the date of the establishment of the company, the nature of the company, the sector of the company, whether a merger or acquisition of the company has taken place, date of such an event, etc. We search in these databases to find the UBO and then conduct a separate web search to check their connection to a crime.

Canadian Legal Information Institute (CANLII) database: CANLII is an online database of all the Canadian court cases. The online portal allows one to search by the name of a person and provide details of cases in which a person's name appears. Therefore, it is possible to ascertain whether the buyer has ever been convicted in Canada. The case details also illuminate the nature of the crime involved.

International Consortium of Investigative Journalists (ICIJ) database: The ICIJ shook the money laundering business with its series of publications using the Panama Paper and other leaks' information. The Consortium continues to publish investigative reports worldwide through its journalist network as new data leaks emerge. Some of the individuals appearing in this database are alleged to be corrupt politicians, businesspeople, and international criminals who use corporate vehicles to hide their identity and use their income for various purposes (for example, buying a property). The ICIJ website allows quick searches by name and is a good publicly available source for PEP checks.

IV.a Approaches to conducting secondary research

How should one initiate secondary research? First, we must acknowledge that the secondary analysis needs to be done on a buyer, not the full or part of the property transaction dataset. We are mainly interested in the person, not the property or the transaction. The interest in property and transaction is only part of our interest in the buyer and the seller. Hence, the starting point here is the shortlist of the buyers we have created from the MII.

Approach 1: The most straightforward approach is to start with number one (highest score) on the shortlist and then go down the list. After selecting a person or a company, we can conduct a full search of the person on each of the relevant databases listed above. We then look at the search results and decide whether the buyer has a questionable income source or has a criminal record.

Approach 2: Another approach is to start with a combination of buyer and transaction characteristics. Several indicators in this regard would be a good starting point. Here are a few possibilities:

- A buyer who purchases several properties without a mortgage record (which usually means a cash purchase) within a short period of time calls for further examination to look at other indicators.
- Numbered companies are also considered suspicious buyers, despite the fact there are legitimate reasons to set up numbered companies. Whereas it is customary for a construction company to create a new company for each construction project, there are cases where a numbered company is purchasing a condominium.
- Significant high prices are also suspicious, especially when there are multiple transactions of the same property within a short period. A high price difference and short time difference suggest a greater possibility of no structural improvement and raise a strong suspicion of tax evasion, money laundering, or both.
- Combinations of any or all of the above, which is more likely for buyers with the highest MII scores, are the most promising candidates for secondary research efforts.

Approach 3: Follow the network. For example, there may be buyer-seller networks that are engaged in repeated transactions conducted by professional money laundering organizations (See FATF, 2018). By examining collections of data rather than individual transactions alone it may be possible to detect networks of service providers engaged in illicit activity.

IV.b Typical Secondary research

The secondary search begins with looking at the Notary Contract. Often, the Notary Contract reveals qualitative information that helps clear false positives or strengthens suspicious cases. Notary Contracts include information on ownership, parcel details, the price and taxes paid, mortgage amounts and providers. We start by confirming a few facts, for example, the name and address of the buyer and seller. Sometimes, the Notary Contract provides a full form of the name that may reveal a relationship between the buyer and the seller. We also check whether the transaction involves full or part of the property, explaining a sudden drop in the property price. The tax information is vital in computing avoidance in HST/QST payments. Finally, the mortgage information let us confirm mortgage amounts and mortgage lenders and see the mortgage rate. A higher mortgage rate, for example, reveals the riskiness of the investment perceived by the mortgage lender.

If the buyer is a corporation, we start at *Registraire des entreprises du Québec*. We look for a few details. First, we see whether there is any information on the UBO. Some of our searches reveal that the owner of a numbered company is another numbered company, which, although legal, is a common money laundering practice and raises our suspicion.26 We continue our research on those companies to identify the UBO. We have also found cases showing the corporation's establishment date is shortly before the property purchase date. We examine whether the buyer and seller entities are established within a short time of each other.

We also search at the CANLII by the buyer's name. Whereas it generally does not matter whether the buyer is a corporation, we explore both by the corporation's name and the UBO if the buyer is a corporation. It is important to stress that a name showing up at CANLII does not necessarily imply a red flag by itself. A buyer may be the plaintiff may not be a convict, or even if convict, the buyer may have faced the charge for a case unrelated to a crime (for example, a dispute related to rent payments).

We record our findings and build case studies on the researched buyer. A case study consists of two parts. First, we outline why this buyer emerges as a suspicious buyer. Essentially, we explain the red flags we obtain from our MII analysis. Second, we describe our findings from the secondary research with links to the information sources.

V. Results of Quebec Market Analysis

As noted, we applied the above methodology to Quebec property transaction data including 2.4 million transactions since the year 2000, involving 1.5 million properties and 1.6 million buyers. We provide a descriptive analysis below using the Quebec data.

V.a Market Integrity Index

With the maximum possible score of 17, the mean MII of 3.67 sets one threshold based on an assumption that the majority of real estate transactions are not associated with money laundering. Table 1 presents the distribution of the MII score, rounded to the nearest integer. We find that 94% of the buyers have an MII of 5 or lower. We are interested at the upper end of the distribution and

[26] Transparency International (2019) reports several cases where numbered companies are used for money laundering purposes.

consider the top 0.2% (3,297 buyers with a score of 8 or higher) as our buyers of interest. These buyers have been involved as buyers or sellers in 7% of all transactions valued at $46B between 2000 and 2018.

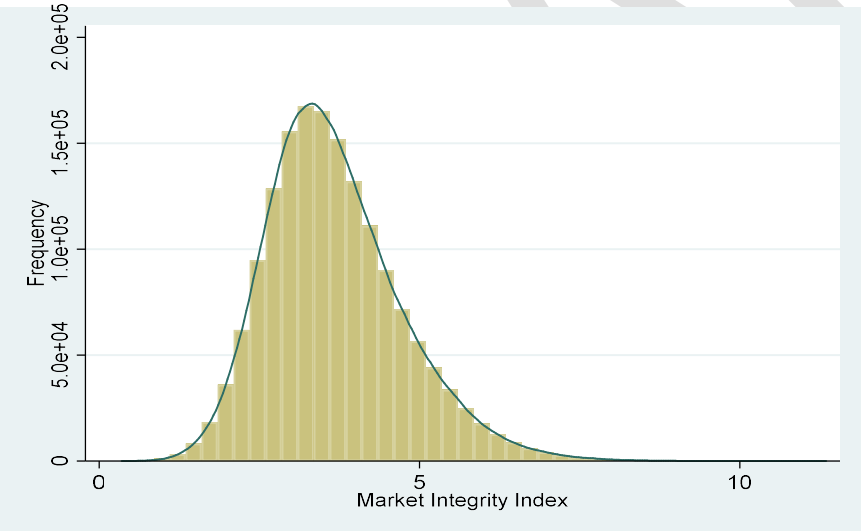
Table 1: Distribution of the market integrity Index (Buyers)

MII Score	Frequency	Percent
0	12	0
1	8,593	0.53
2	173,594	10.76
3	594,007	36.83
4	515,570	31.97
5	226,825	14.07
6	73,023	4.53
7	17,198	1.07
8	3,297	0.2
9	459	0.03
10	45	0
11	7	0
Total	1,612,630	100

Source: JLR, CMHC calculations

Note that buyers with scores of 8 or higher are not necessarily involved in money laundering. Our hypothesis is that they are more likely to be involved in money laundering activity, but it is impossible to conclusively demonstrate given the limits of data and the lack of a verified set of actual money laundering cases. The distribution of the Buyer MII score is presented in Figure 1.

Figure 1: Distribution of Market Integrity Index



Source: JLR, transactions from 2000 to 2018, CMHC calculations

V.b Property Characteristics

1. Multiple-traded properties

As Table 1 suggests, the mean number of transactions experienced by an average property since 2000 is 2.07 with standard deviation 1.14. Table 2 presents the distribution of the frequency of transactions of

each property. Most properties were sold only once or twice between 2000 and 2018 with 37% of properties with one transaction, and 34% of properties sold twice.

Table 2: Distribution of the number of transactions of properties between 2000 and 2018

Frequency	No. of Properties	Percent	Cumulative %	Adj. Indicator Value
1	890,317	37.1	37.1	0.00
2	805,632	33.6	70.7	0.37
3	445,710	18.6	89.2	0.71
4	180,884	7.5	96.8	0.89
5	56,865	2.4	99.1	0.97
6+	21,002	0.9	100.0	0.99
Total	2,400,410	100		

Source: JLR, CMHC calculations

Our interest lies in the properties traded, including the 56,865 (2.4% of all) properties sold five times, and especially the 21,002 (0.87%) properties traded six or more times. We want high scores for these types of properties. Hence, taking the percentile results into the adjusted score, as exhibited in the last column. Accordingly, any property traded, for example, five times get a score of 0.97, and properties sold for more than five times get 0.99.

2. Frequently traded Properties #Flipping

We define frequently traded properties as those exchanged hands at least twice within 365 days. We find that 3.5% of all properties have at least two transactions within 365 days. An important point here is that there are properties with one transaction in its entire history, and the issue of being traded within a year does not arise for these properties, recognizing we have a limited observation period following recent transactions. If we ignore these properties (transacted once), we find that 5.6% of all the properties (with transactions more than once) are frequently traded properties. On average, the day difference between two observed transactions of a property is 1,775 days (or almost five years).

3. The Property is located in a higher valued neighbourhood

We are interested in the properties located in neighbourhoods where house prices are significantly high compared to the year's provincial average. Table 3 presents the five sample percentiles that explain the distribution of the average neighbourhood property price. We observe that the median neighbourhood has a mean price of 54% of the provincial average. This price is low due to the significant presence of the Montreal CMA. Despite such overvaluation of provincial means, it is interesting that neighbourhoods at the 90th percentile are 40% above the provincial average. Figure 2 shows the mapping from the underlying variable to the adjusted indicator.

Table 3: Distribution of neighbourhood means in comparison to provincial mean

Percentile	Total Prop. Val.	Adjusted Indic. Val.
p10	0.22	0.1
p25	0.35	0.25
p50	0.54	0.5
p75	0.87	0.75
p90	1.40	0.9

Source: JLR, CMHC calculations

We also look at changes in the neighbourhood mean prices over time. Figure 3 illustrates changes in mean prices and their distribution. We observe two things. First, the prices are increasing over time. Second, and probably more important, the distribution gets more dispersed in recent years.

Figure 2: Indicator mapping from ratio between neighbourhood mean and provincial mean

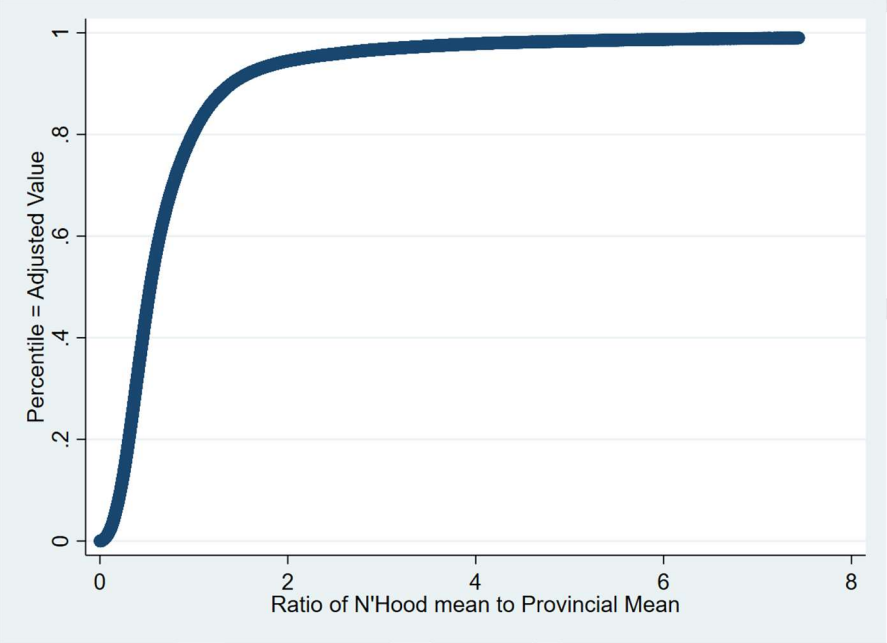
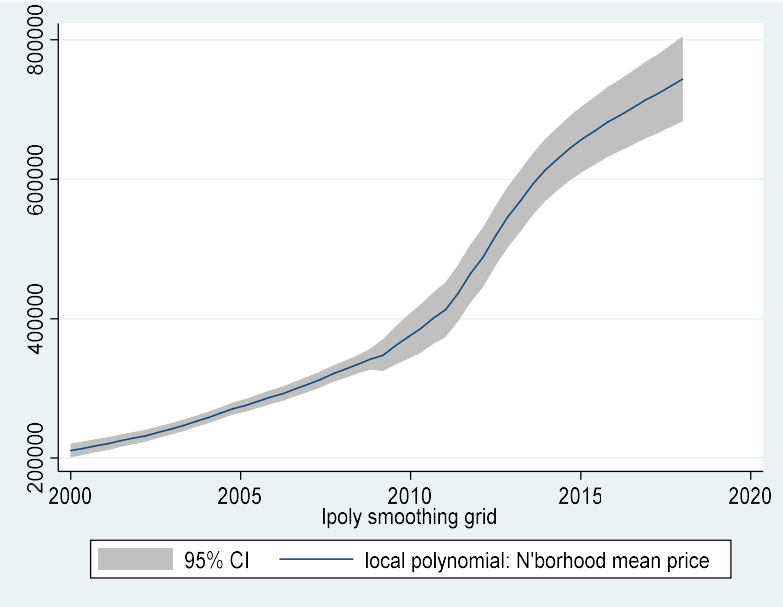


Figure 3: Changes in the neighbourhood mean over time

Price in $



V.c Transaction Financing Characteristics

Mortgage finance data is only available since 2014, allowing us to match mortgage transactions with associated property transactions. Table 4 provides the summary statistics of these indicators.

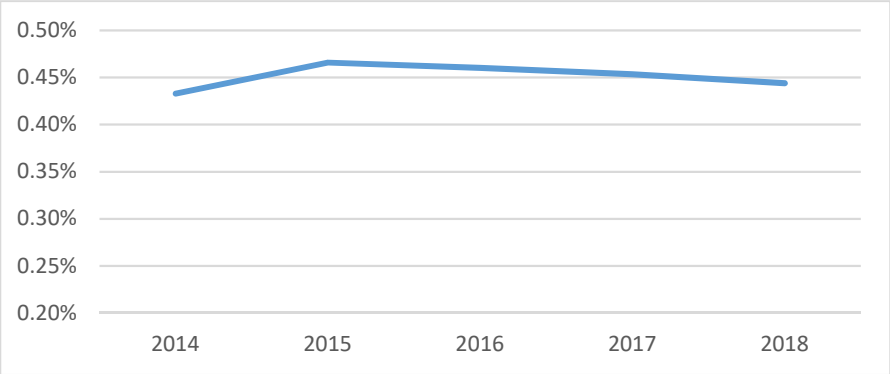
Table 4: Summary statistics of indicators on transaction financing

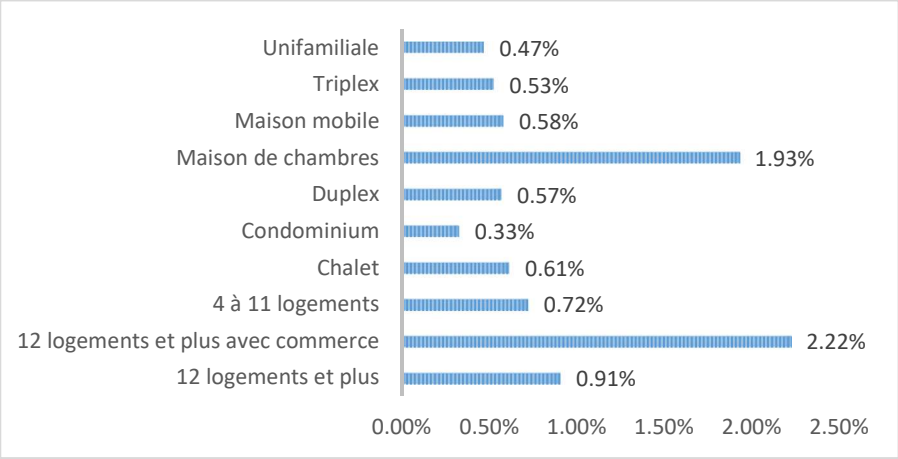
Variable	Mean	Std. Dev.	Total Obs
Mortgage provider is a natural person	0.45%	6.70%	594,225
Mortgage provider is a foreigner	0.01%	1.16%	594,225
There is no mortgage record	15.33%	36.03%	594,225
The mortgage lender is not approved by CMHC	2.43%	15.39%	594,225

4. The mortgage is provided by a natural person

Table 4 indicates that natural persons comprise only 0.5% of all the transactions. Figure 4 also indicates that this is stable over time. When we look at the variations across property types, we find that some commercial property types get more financed by natural persons than other property types. For example, 2.2% of the transactions involving properties with 12+ units (which are mostly rental properties) and almost 2% of “maison de chambres” have an individual financier, both significantly higher than mean, 0.5%.

Figure 4: Percentage of mortgages lent by natural persons, by years and property types

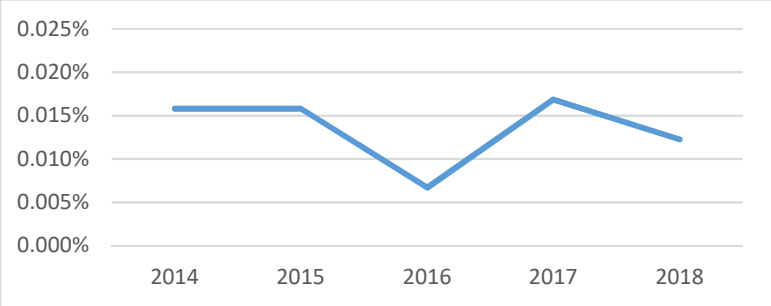




5. The mortgage provider is from abroad detail on foreign sourced mortgage

Foreign financing represents an extremely small proportion of transaction financing (only 0.01%), which is not surprising given increased challenges of recovering funds in case of default. Figure 5 also shows that chalet (cottage) and properties with more than 12 units (12 logements et plus) get a larger proportion of mortgages funded by a provider from abroad. About 0.07% of chalets and 0.05% of properties with more than 12 units (12 logements et plus) receive mortgage funding from abroad and these are significantly higher than the mean (0.01%).

Figure 5: Percentage of the foreign mortgage lenders, by year and property types

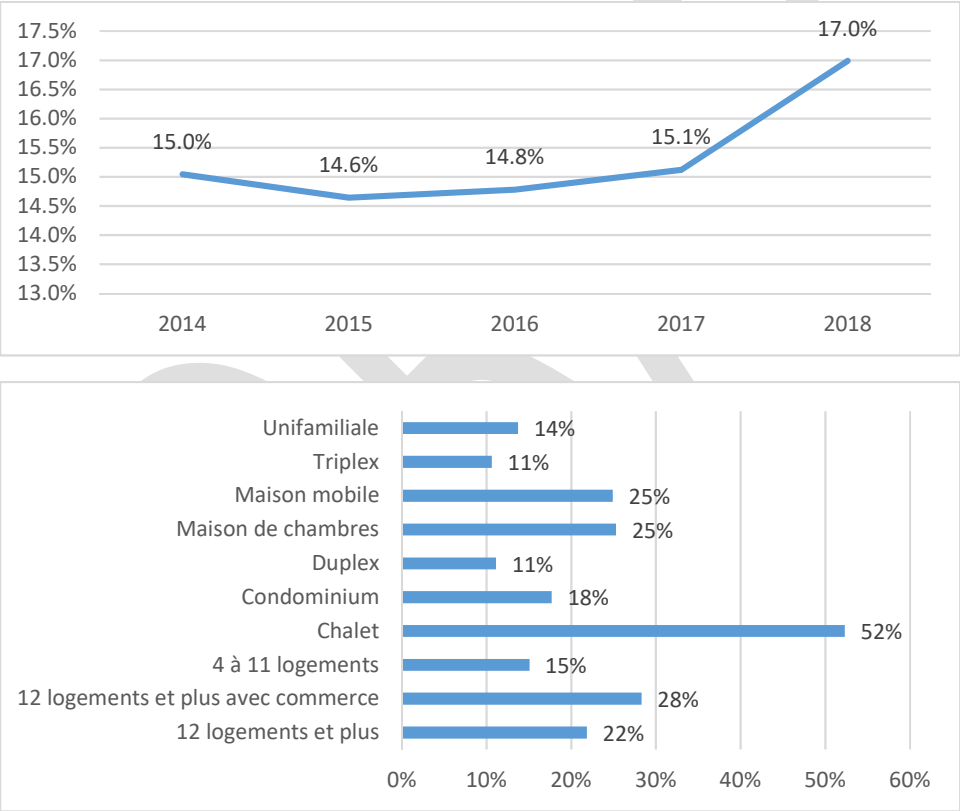


6. There is no mortgage record

Table 4 shows that 15% of property transactions have no associated mortgage record. While this could reflect things like downsizing with proceeds from the sale of another property, no mortgage may also mean that the buyer may have borrowed the money from an informal network with no mortgage lien recorded. Figure 6 depicts that cash transactions are increasing over time, with a notable jump in 2018. Coincidentally, Vancouver and Toronto introduced foreign buyer taxes in 2017 and 2018 respectively, so it is possible that foreign buyer tax in those cities made the Quebec and especially the Montreal real estate market more attractive to foreign buyers, buyers who more likely buy properties without using their own funds to purchase properties.

The two most traded property types, single-family homes, and condominiums, are close to the mean. However, all the commercial property types are above 25%. Properties with more than 12 units, typically rental properties, have no mortgage records for 22% of transactions.

Figure 6: Transactions with no mortgage record, by year and property type

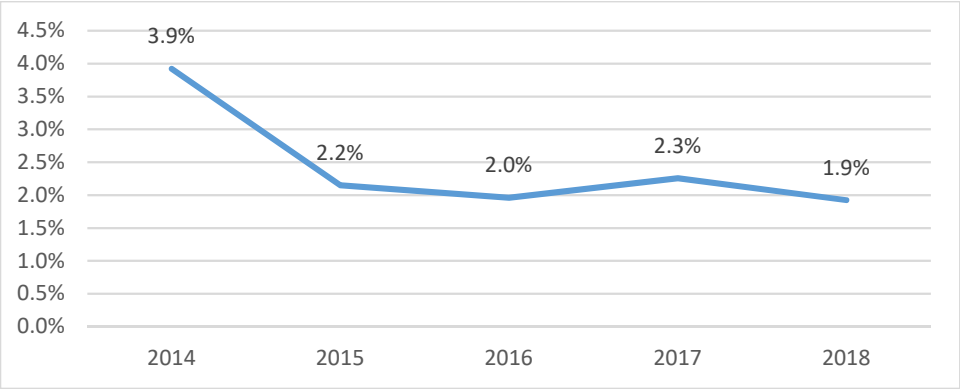


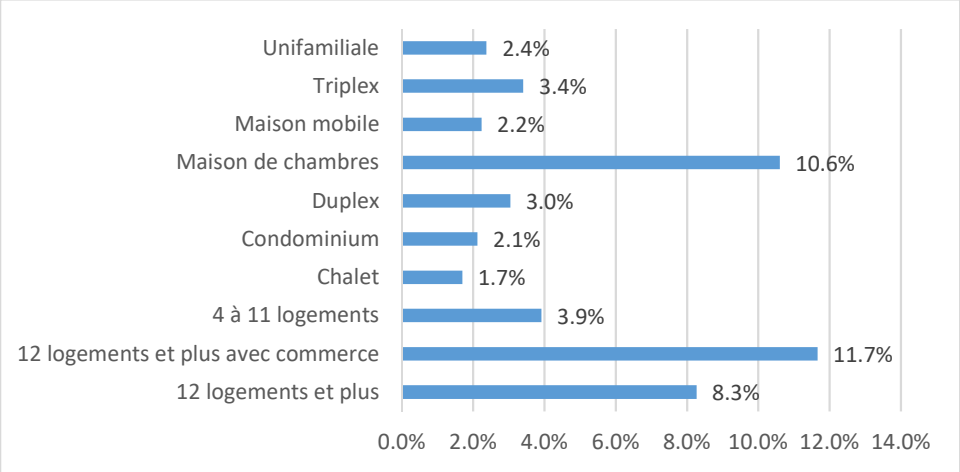
7. The mortgage provider is not a CMHC approved lender

Table 4 indicates that 2.4% of the transactions have financiers not approved by CMHC. Figure 7 shows that percentage of mortgage providers not approved by CMHC has fallen from a high of 3.9% in 2014, noting that this mortgage data is only available since 2014. Considering the property types, we again

observe that the commercial properties are more likely to receive finance from a lender not approved by CMHC. Single-family homes and condominiums are 2.4% and 2.1%, respectively, and are not too different from the mean.

Figure 7: Percentage of transactions with mortgages by unapproved lenders, by years and property type





V.d Transaction Details

FATF (2007)[27] and Unger et al. (2010)[28] suggest that both high and low price of the property are suspicious. Therefore, we look at both ends relative to three benchmarks.

8. The purchase price in comparison to the neighbourhood mean

We compute the neighbourhood means for each year and each property type. This indicator is distribution-based, and we present five different percentiles: 10, 25, 50, 75, and 90 in table 5. We find

[27] Financial Action Task Force (FATF). Money laundering & terrorist financing through the real estate sector. 2007. Page 36 – 37.
[28] Unger, Brigitte, Joras Ferwerda, Hans Nelen, Luuk Ritzen and Jaap Trouw. Detecting Criminal Investments in the Dutch Real Estate Sector. 2010. Page 48 – 52.

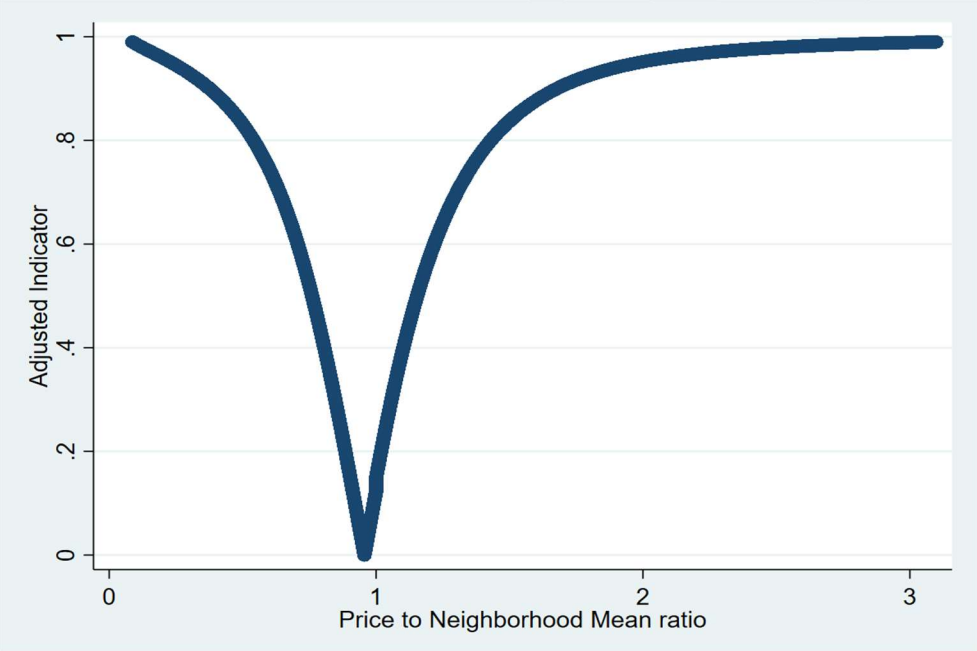
that the property at the median is 4% lower than the neighbourhood average. At one end, the properties at the 10th percentile are 54% of the neighbourhood mean. At the other end, the properties at the 90th percentile are 43% higher than the neighbourhood mean.

Table 5: Distribution of price to neighbourhood mean for single-family homes and condominiums in 2018

Percentile	Price/N'Hood Mean	Adjusted Indicator Value
p10	0.54	0.8
p25	0.76	0.5
p50	0.96	0.0
p75	1.15	0.5
p90	1.43	0.8

To convert these values into the adjusted indicator, we calculate the mean absolute deviation and multiply that with two. Noting that the mean of all percentiles is 0.5 and following our formula given by equation 3, we get 0.8 for properties at the 90th percentile and the 10th percentile. In other words, a property traded at 43% above (or 46% below) the neighbourhood mean gets a 0.8 score. These are forty-percentile distant from the mean. Figure 8 depicts this conversion.

Figure 8: Indicator values for the price-to-neighbourhood-mean ratio



9. The purchase price relative to assessed value

We analyze the price to assessed value ratios in a similar way. There are two points to keep in mind. First, the assessed value of most, but not all, of the properties in Quebec are available. Second, most properties are assessed every three years. Given that, we find that the mean of the property price to assessed value ratio is 0.81. In other words, the property price, on average, is 19% below the assessed

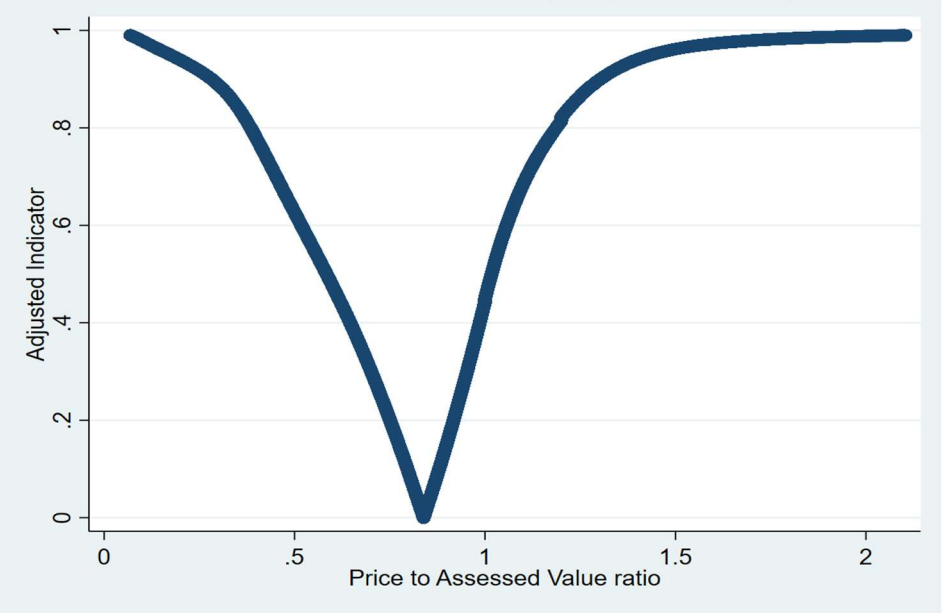
value. We present the five different percentiles: 10, 25, 50, 75, and 90 in Table 6 for 2018. The properties around the median are 17% below the assessed value. Finally, the properties at the 10th percentile are 38% of the assessed value, whereas those at the 90th percentile are 19% above the assessed value.

The conversion to the adjusted indicator works in the same way. Table 6 provides a few examples. The properties at the 90th percentile (price/assessed value = 1.19) and 10th percentile (price/assessed value = 0.38) receive a score of 0.8. Figure 9 presents the mapping from the price to assessed value ratio (underlying variable) to the adjusted indicator. Since the mapping uses mean absolute deviation of the distribution, we get an inverted V-curve.

Table 6: Distribution of price to assessed value ratios in 2018

Percentile	Price/Assessed Value	Adjusted Indicator Value
p10	0.38	0.8
p25	0.58	0.5
p50	0.83	0.0
p75	1.02	0.5
p90	1.19	0.8

Figure 9: The mapping from price to assessed value ratio to the corresponding adjusted indicator



10. The growth in property price

We use the previous transaction price as the third benchmark and calculate the growth in the property's price. A few points to keep in mind: the price growth is only available for properties with more than one transaction, and second, there is no price growth for the first transaction. The number of transactions for which we could compute the price growth between 2000 and 2018 is 898,703. The mean price growth calculated from these transactions turns out to be very high: 228%. There are a few reasons for

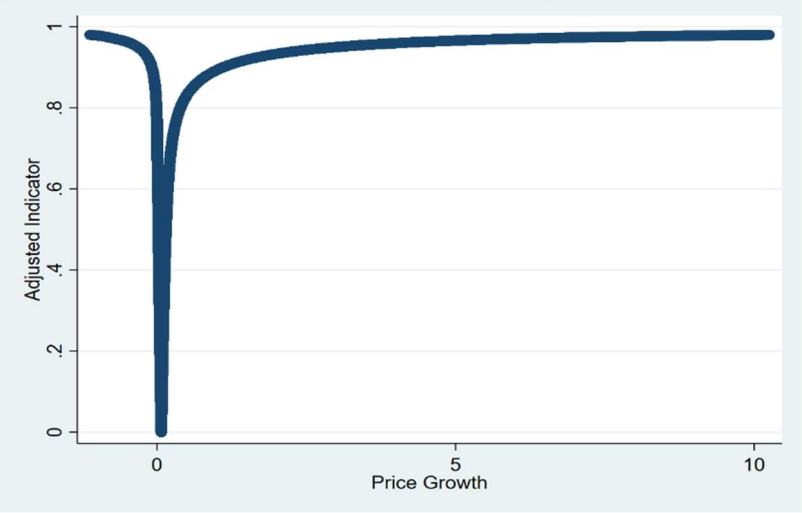
this. First, as mentioned earlier, there could be a significant improvement in the property (e.g., a vacant land improved with a building). Second, some properties change hands at even prices $0 or $1 (or similar nominal prices). These happen when the actual owner dies, the property experiences a foreclosure, the owner experience a divorce, etc. Whereas the data provider tries to rule these out by providing a qualifier for economically considerable transactions, quite a few of such transactions remain. We rule them out only through secondary research, especially when we look at the Notary Contract.

A better measure in this regard is the median and the other percentile values. We, therefore, focus again on the five percentiles for the year 2018 in table 7. We find that the median price growth of a property is 7.2% in Quebec in 2018. The 10th percentile of the price growth is a negative 0.8%, whereas, at the other extreme, the properties experiencing 39% price growth are at the 90th percentile. As before, the adjusted indicator value of the properties at the 10th and 90th percentile gets a score of 0.8, whereas the median price growth receives a score of 0. Figure 10 illustrates the mapping from the price growth to the adjusted indicator. The long tail to the right indicates existence of quite a few outliers.

Table 7: Distribution of price growth in 2018

Percentile	Price Growth	Adjusted Indicator Value
p10	-0.8%	0.8
p25	2.6%	0.5
p50	7.2%	0.0
p75	15%	0.5
p90	39.2%	0.8

Figure 10: The mapping from price growth to the corresponding adjusted indicator



V.e Buyer Characteristics

There are three dummy variable indicators in this set to represent the buyer characteristics.

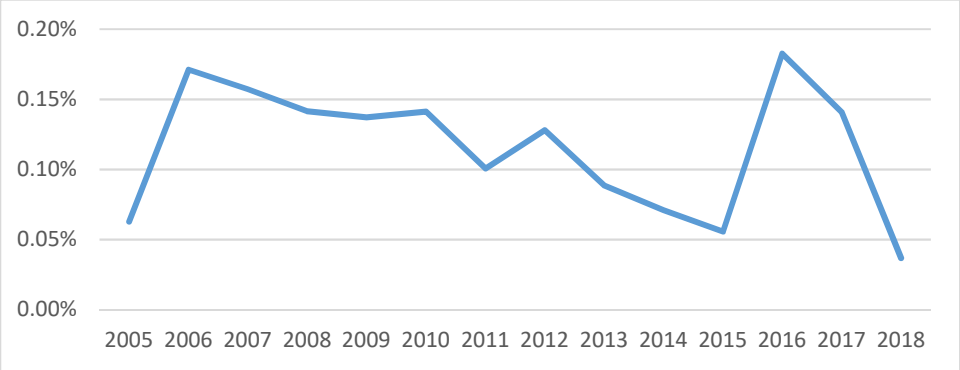
Table 8: Three indicators on Buyer characteristics

Variable	Mean	Std. Dev.	Obs
Buyer provides Incomplete Address	0.1%	3.4%	1,288,310
Buyer lives abroad	1.1%	10.4%	1,288,243
Buyer is a Corporation or Trust	14.3%	35.0%	1,612,630

11. The buyer provided incomplete address in transaction record

A large proportion of the buyers' addresses are missing between 2000 and 2004, possibly due to the address recording system. We therefore look at addresses only from 2005 and onwards. We find that about 0.1% of buyers do not provide a complete address with at least one component of the address (street name, number, city, postal code) is missing. Figure 11 shows that this varies between 0.04% and 0.18%.

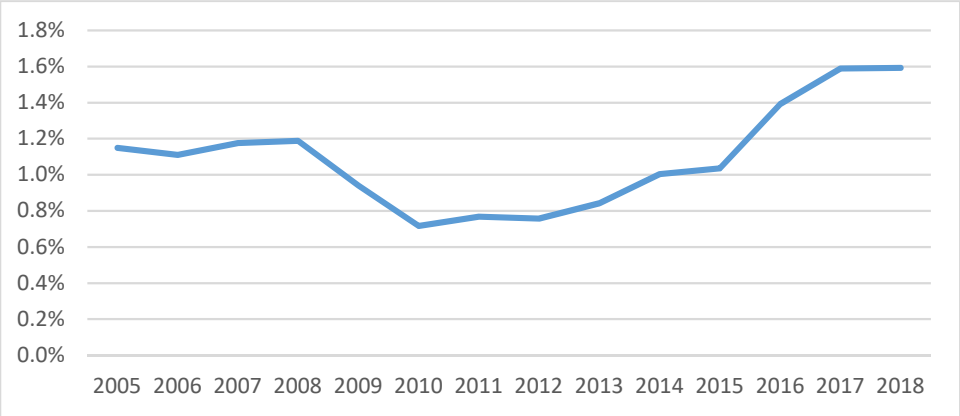
Figure 11: Percentage of buyers providing incomplete addresses, over time and by property types

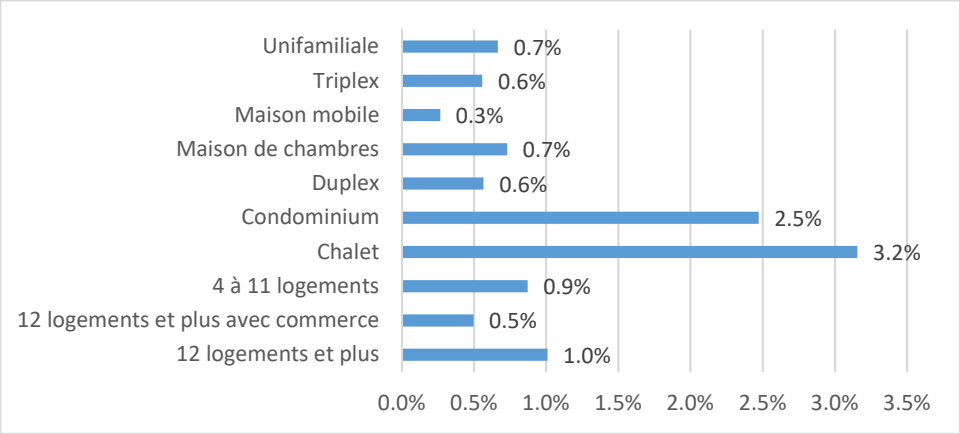


12. The buyer is from abroad

The Quebec land registry data does not include an explicit indicator of the citizenship status of the buyer, so for now we assume a foreign home address indicates a foreign buyer, though this is clearly problematic. We find only 1.1% of all the buyers indicated foreign home address. This percentage has been rising since 2010: whereas 0.7% of buyers were from abroad in 2010, it is 1.6% in 2018, as shown in Figure 12. Among property types, we find that 3.2% of chalets and 2.5% of condominiums are foreigner-owned by this proxy definition.

Figure 12: Changes in the percentage of foreign buyers, by years and property type

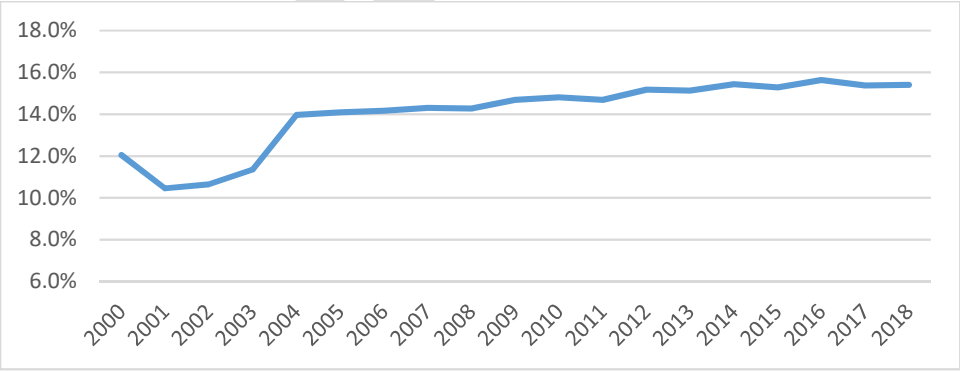


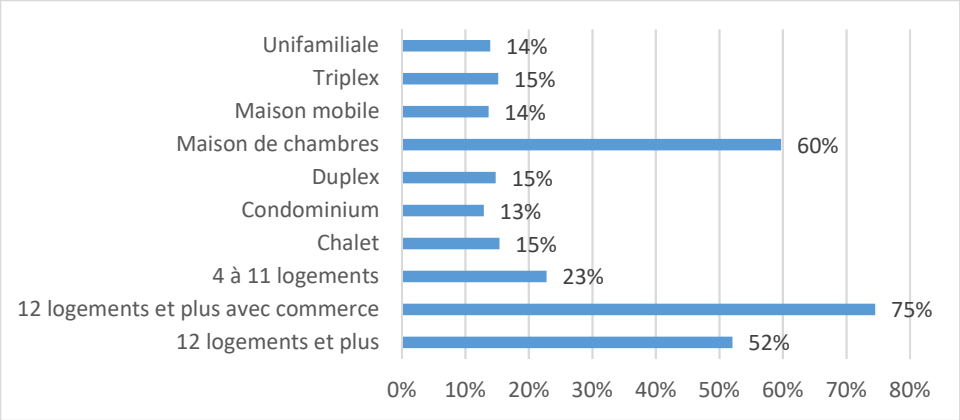


13. The buyer is a corporation or a trust

Corporations or trusts purchased 14.3% of all properties sold between 2000 and 2018. Figure 13 shows this proportion rose from just above 10% to over 15 percent since 2001. The lower panel of Figure 13 shows that the corporations and trusts activity is concentrated in commercial properties, though corporations and trusts account for 14% of all single-family homes purchases and 13% of condominiums.

Figure 13: Percentage of purchases by corporations or trusts, by years and property type





14. Total value of the property owned by the buyer

Our interest is in the buyers who amassed a large number of properties. We first look at the total value of the property bought and sold, which may be negative or positive. A negative value implies that the total value of properties sold surpassed the total value purchased, which is a possibility, especially for the construction companies and speculators. We look only at the high values (i.e., it is a class II indicator).

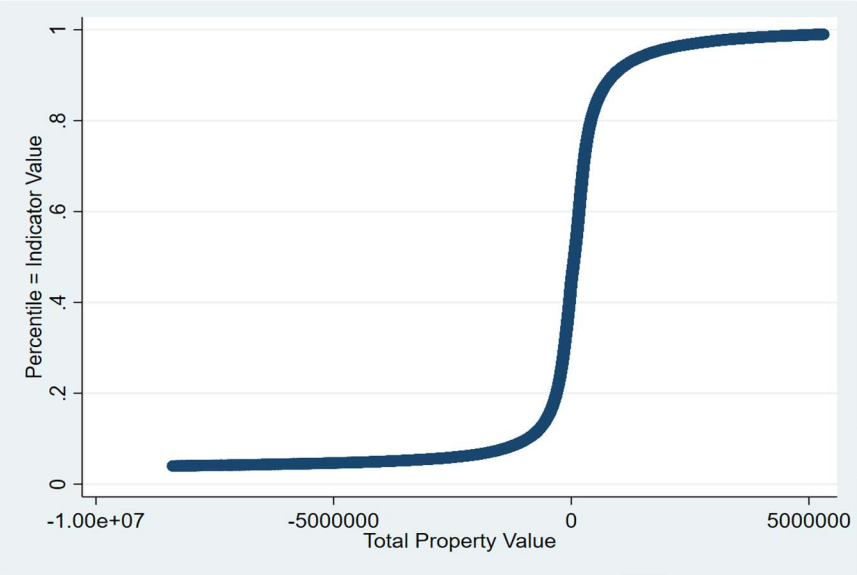
Without adjusting for inflation over the sample period, an average purchase transaction in Quebec was $172,790, whereas the median, as shown in Table 9, was considerably lower at $64,620.29. Table 9 also presents the four other percentile values of the total value of the property. At one extreme, we observe a buyer with a negative net transaction value of $923,621 at the bottom decile or tenth percentile, whereas a buyer with a net positive purchase of $884,778 is at the 90th percentile. Figure 14 shows how the percentile distribution of total property value is converted into the adjusted indicator value.

Table 9: Distribution of the total value of the property

Percentile	Total Prop. Val.	Adjusted Indic. Val.
p10	- 923,261	0.1
p25	- 213,929	0.25
p50	64,620	0.5
p75	319,375	0.75
p90	884,778	0.9

[29] This is a bit underestimated since property prices generally increase overtime and should be adjusted to reflect this general price inflation to be comparable over the nearly 20 year time span of the data.

Figure 14: Mapping of the total property value of the buyer to the adjusted indicator



15. The number of properties owned by the buyer

Though positively correlated with the value of all the property owned, the number of properties purchased indicates how active the buyer is in the market. Table 10 presents the distribution. The number of properties owned by an average buyer is 1.3, with 87% of buyers buying one property, whereas 7% bought two properties. At the extreme, 23,679 buyers bought six or more properties accounting for about 1.45% of all the properties. For our adjusted indicator, the percentile rank is the indicator value. For example, buyers buying five properties get a score of 0.98, whereas buyers with six or more get a score of more than 0.99.

Table 10: Distribution of the number of properties owned by buyers

No. of Properties	Frequency	Percent	Cumulative %	Adj. Indic. Value
1	1,408,601	87.4	87.4	0.00
2	118,594	7.3	94.7	0.87
3	35,987	2.2	96.9	0.95
4	16,543	1.0	98.0	0.97
5	9,226	0.6	98.5	0.98
6 & 6+	23,679	1.5	100.0	0.99

Whereas the property's total value and the number of properties owned capture essential dimensions, it is also crucial to look at how quickly a buyer has accumulated these properties. We use two indicators to get to this.

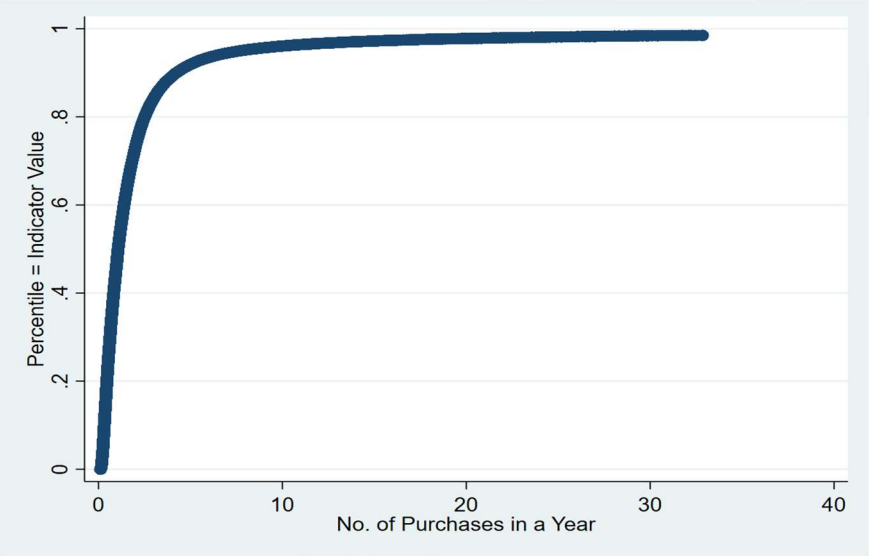
16. The average number of properties purchased by the buyer in a year

We first examine the number of properties purchased in a year. The median number of properties (p50 to imply 50th percentile) purchased by a buyer in a year is 1.07, as presented in Table 11. At one extreme (10th percentile), a buyer buys 0.32 properties in a year. At the other extreme, buyers at the 90th percentile have purchased 4.24 properties in a year. Since we are interested only in high values, this is a class II indicator, and the percentile ranks are the adjusted indicator values. For example, a buyer who has purchased 2.12 properties is in the 75th percentile and gets a score of 0.75. Figure 15 provides the mapping from the annual number of purchases to the adjusted indicator.

Table 11: Distribution of the number of purchases in a year by a buyer

Percentile	Total Prop. Val.	Adjusted Indic. Val.
p10	0.32	0.1
p25	0.53	0.25
p50	1.07	0.5
p75	2.12	0.75
p90	4.24	0.9

Figure 15: Mapping from the annual number of purchases to adjusted indicators



17. Number of days between two purchases

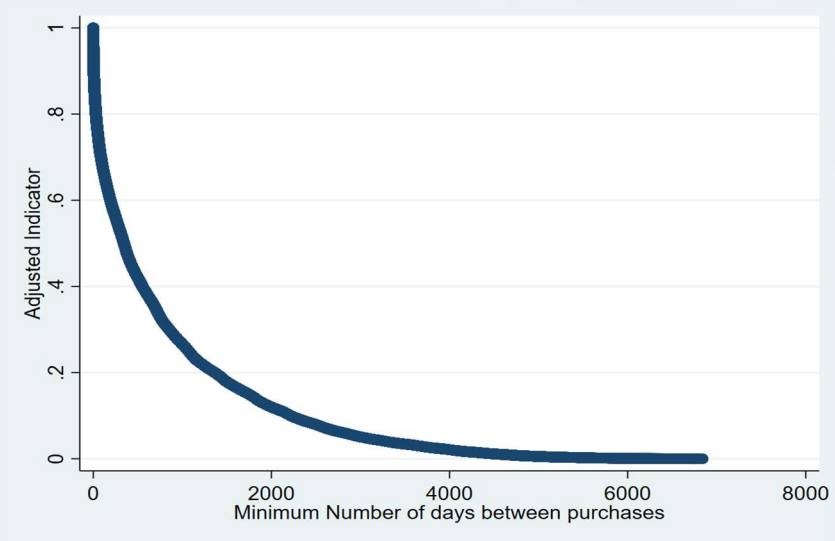
The second indicator looks at the time difference between two properties purchased by the buyer. Whereas the previous indicator looks at all the purchases of the buyer and takes an average value, this indicator looks at whether the buyer has been excessively involved in purchasing properties. The minimum number of days between two purchases captures precisely that. We have 407,211 buyers who have made at least two purchases, and the mean difference between the purchases is 772 days or a little over two years.

Table 12 presents the distribution of the minimum number of days between purchases. The median number of days between two purchases is 344 days. We first need to recognize that our interest here lies in lower values of the minimum number of days. Hence, whereas a buyer, who has spent 2,217 days between two purchases, is in the 90th percentile, we want to know who is at the other end. We see that the person who is at the 10th percentile purchases another property within six days. Therefore, we reverse this such that the buyer at the 10th percentile gets 0.9 and vice versa. Figure 16 presents this mapping from the number of days between purchases to adjusted indicator values.

Table 12: Distribution of the minimum number of days between two purchases

Percentile	Total Prop. Val.	Adjusted Indic. Val.
P90	2217	0.1
P75	1070	0.25
p50	344	0.5
P25	53	0.75
P10	6	0.9

Figure 16: The mapping from the minimum number of days between purchases and the adjusted indicator



VI. Conclusion

The impetus to pursue this Market Integrity Index methodology for real estate derives from the 2015 mandate given to the federal minister responsible for CMHC to present an action plan to counter

mortgage fraud, combined with subsequent indications of money laundering through real estate in the Vancouver area.

This report presents a methodology for using data analytic to identify elevated risk of suspicious activities that might represent fraud or money laundering in the real estate market. We apply this methodology to the Quebec data and provide a descriptive analysis to illustrate how these indicators help identify possible illicit activity.

This report is preliminary. Access to more robust data poses significant challenges including:

- Some of our indictors use imperfect proxies
- Some indicators can't be evaluated at all due to data gaps
- We don't have a set of proven or likely cases of fraud or money laundering to test out which indicators are stronger indicators of illicit activity.

The methodology applied here will continue to evolve as we gain access to additional data, and as new types of suspicious activities emerge, and data technique to these activities emerge.

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