Real Estate Property Investment and Hedging as a Canadian Investor

By

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A Research Project Submitted to
Saint Mary's University, Halifax, Nova Scotia
in Partial Fulfillment of the Requirements for
the Degree of Master of Finance

August, 2017, Halifax, Nova Scotia

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Date: August 28th, 2017

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Abstract

Many large investors are contesting high management fees on alternative assets by managing investments in-house, and investing in real assets. As a large investor, CPPIB can afford to do so as they enjoy long time horizons and little capital rationing concerns. This means that they can invest directly in many real assets across shores, which aids in diversification and gives cause to not hedge currencies. However, for short-term horizon or capital rationing restricted investors, these opportunities may not be as lucrative. This paper explores real estate investment opportunities for Canadian investors – including sensitivity analysis on the exponential housing price increases witnessed in Toronto and Vancouver. It features insight into the real estate opportunities between residential and commercial, domestic and offshore, and finally hedging strategies of a Canadian residential real estate property investment.

August 28th, 2017

Acknowledgements

This Major Research Paper would not have be been possible without the guidance and support from faculty at the Sobey School of Business at Saint Mary's University, as well as that from family and friends. In particular, I would like to thank Dr. J. Colin Dodds for his patience and willingness in teaching, challenging, and thus progressing my intellect and abilities. To my family: Thank you for the unwavering support and love felt from across the country. Regardless of the time difference, you always answered the phone and shared your light. Special thanks to Amy Deeb for getting me out of countless rabbit holes, and reassurance throughout this journey. Finally, thank you to Ilija Galic for always agreeing to help me study, and encouragement to reach this goal.

I could not have come this far without any of you. Thank you.

Emily Deeb

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Chapter 1: Introduction

A latest investing fad is retro: investing in real assets in lieu of financial securities. Due to the costs in management fees of alternative investments, investment groups have sought to manage investments in-house. This includes developing a diversified portfolio in private equity, where they control the underlying assets.

To opt for direct investment in real assets, many of the benefits of investing in securities are lost. These benefits include, but are not limited to, lower capital requirements and liquidity. This creates a loss in investment freedom, and makes direct investment abilities secluded to a few. However, if the condition of diversification of assets is relaxed, individual investors of the middle to upper class may find lucrative opportunities in smaller scale real assets. This begs the question whether the returns afforded on a larger scale can be exploited on a smaller scale.

Specifically to real estate, where a large firm may invest in properties globally, some individual investors can invest in a single property as a rental investment.

Due to the lack of diversification of a single investment property, investors may then seek to hedge their direct investment in a real estate property.

Common hedging practices of real assets are specific to an element of the investment: interest rate risk, currency risk, or price change. Interest rate risk can be hedged through swaps: a financial security. Currency, or foreign exchange risk can be hedged through the Foreign Exchange (FOREX): another financial security. Hedging against price changes are more complicated, as not all assets have a linked financial security to trade on a market. In these cases, investors seek assets on a market that perform with a correlation that is more-or-less perfectly positive or negative with their asset.

An example of a perfect hedge would be where an investor is long in an asset by X dollars, and shorts the same asset by X dollars, where the purchase and selling price in each asset is the same. This way, all gains by the long position are expended on the short position, or all losses on the long position are covered by the short position. Net payoff is 0, and the investor is only exposed to the costs of investing.

To long real estate without the use of financial securities, an investor would directly purchase a property. To short real estate, an investor cannot sell the title of a property that they do not own, so financial securities must be employed.

This paper will explore and compare investment opportunities in residential and commercial real estate in through direct investment compared to financial securities, on a local and global scale. Then, hedging strategies of direct investment of residential real estate will be explored.

Chapter 2: Literature Review

Since the American housing crash in 2009, investors have been speculating on the soundness of the Canadian housing market, specifically in Toronto and Vancouver. Some have gone to the extent of expressing intent or admitted existing positions in which they hold investments that will profit from a downturn in the Canadian residential housing market.

Many large investment firms have substituted investment in financial securities for real assets in infrastructure, particularly real estate. With such investment changes and bearish outlook on the Canadian market, a hedged position of the exposure to Canadian real estate may be desired.

In contrast, not all investors find it necessary to hedge their foreign exchange risk exposures, as they are well diversified across many currencies and asset classes. An example of this is the Canadian Pension Plan Investment Board (CPPIB). In its 2017 Annual Report (CPPIB, 2017), they transparently outline their reasons for not hedging each individual investment with exposure to currency risks:

1. Hedging against foreign currency exposures with additional home currency exposure results in a "double-counting" of their investors' exposure to the domestic economy

2. They hedge against domestic currency with foreign investments, and they do not need to hedge the upside of domestic currency

3. It is very expensive to hedge the currencies of developing countries, if a hedging opportunity is available at all

4. By investing in a diversified basket of currencies, there is a natural hedge

Other reasons to not hedge against foreign exchange risk include:

1. If you have transplants or offices across the countries in which you invest, you can use those expertise to reinvest a majority of the cash inflows and not subject the funds to the costly exchange market

2. Investors or shareholders can, on their own, diversify currency risk and do not need to be integrated in each individual investment opportunity

3. Even with clear hedging investment opportunity, the costs associated with participating in the counter-investment may be greater than the predicted downside risk

4. If the purchase of the international property is a secondary residence for the investor or predecessors, the valuation of the property is inconsequential as there is the presumption that the investment will be held for a long time; the investment can be held through a recessionary and trough period

Many of the reasons to not hedge are specific to firms with large capital that make diversification possible. Without this ability, an investor could face negative returns

simply from currency exchange costs. Bradley Krom, Associate Director of Research at WisdomTree, collaborated data on "Major Market Currency Performance vs. U.S. Dollar", and released data on "Annualized Cost to Hedge" (Krom, 2015). It was found that arbitrary profits from investing in a country with a higher rate of return are unachievable due to the cost of currency exchange. The example provided is an investor exchanging their USD into Brazilian reals, invest in a Brazilian bank account, earn an annualized interest rate of 12.75% - significantly higher than that offered by American banks. After some time, the investor divests from the Brazilian bank account, converts the balance back into USD, and enjoy the arbitrage returns from investing offshore. However, these profits are depleted once the cost to hedge the foreign exchange of Brazilian reals to USD, reported as 12.76% annually, are taken into consideration.

This report assumes that investors are either well diversified, or have other reasons to not consider currency risk. Therefore, Chapter 6 will focus on hedging a position in a property in Canada, so that hedging foreign exchange is not required.

Ultimate areas of research from these existing bases of investment choices are the performance differences in Canadian residential and commercial sector, performance differences in International real estate ventures, performance differences in Canadian real estate properties and securities, and hedging options for investments in real estate properties.

Existing sources have cited proprietary data to conclude performance measures, so the subsequent three chapters will attempt to mimic and confirm existing outlooks on real estate assets with publicly available data. The succeeding chapter will then analyze hedging opportunities.

Chapter 3: Canadian Residential vs. Commercial Real Estate Investment

Teranet and National Bank of Canada (Teranet and National Bank of Canada, 2017) release a composite of housing price indices in 11 major Canadian cities, the Composite 11 Index (C11). It is a weighted average of the 11 major cities, weighted by their sales pair count. Another composite was artificially created for nine major Canadian cities: all those in C11 with the exception of Toronto and Vancouver being exempt. This was to provide ongoing sensitivity analysis of the housing market with the consideration for abnormal market growth in these two cities, due to foreign direct investment.

Statistics Canada offers data from their Canadian Socio-Economic Information Management System (CANSIM) tables regarding Consumer Price Indices, with the ability to specifically select certain areas of price changes. For example, Commercial Rents Services Price Index (CRSPI) (Statistics Canada, 2017, Table 332-0012), Commercial Construction Sales Price Index (Statistics Canada, 2017, Table 327-0043), and Consumer Price Index (CPI) (Statistics Canada, 2017, Table 326-0020) which includes housing price indices such as a residential rent price index, residential owned accommodations' expenses price index, and residential utilities price index are available to be specifically selected, isolated from other factors, and measured on a quarterly, if not monthly, basis for over more than the past decade. Note that the base year or currency does not affect rate of change, so that measure will be applied most frequently in comparing price indices.

With the above-mentioned factors, namely the distinction between commercial and residential factors, an investor already is presented with choices of investing. This list is not exhaustive, as there are still REITs, ETFs, and non-real-estate avenues to consider across many countries.

Figure 3.1 is a comparison of residential against commercial price changes, the change in rent price indices as measured by "CRSPI" for commercial and "Rent" for residential unveils that commercial rents are more volatile than residential rents.

Figure 3.1 - Comparison of Commercial and Residential Rents in Canada, 2013-2017
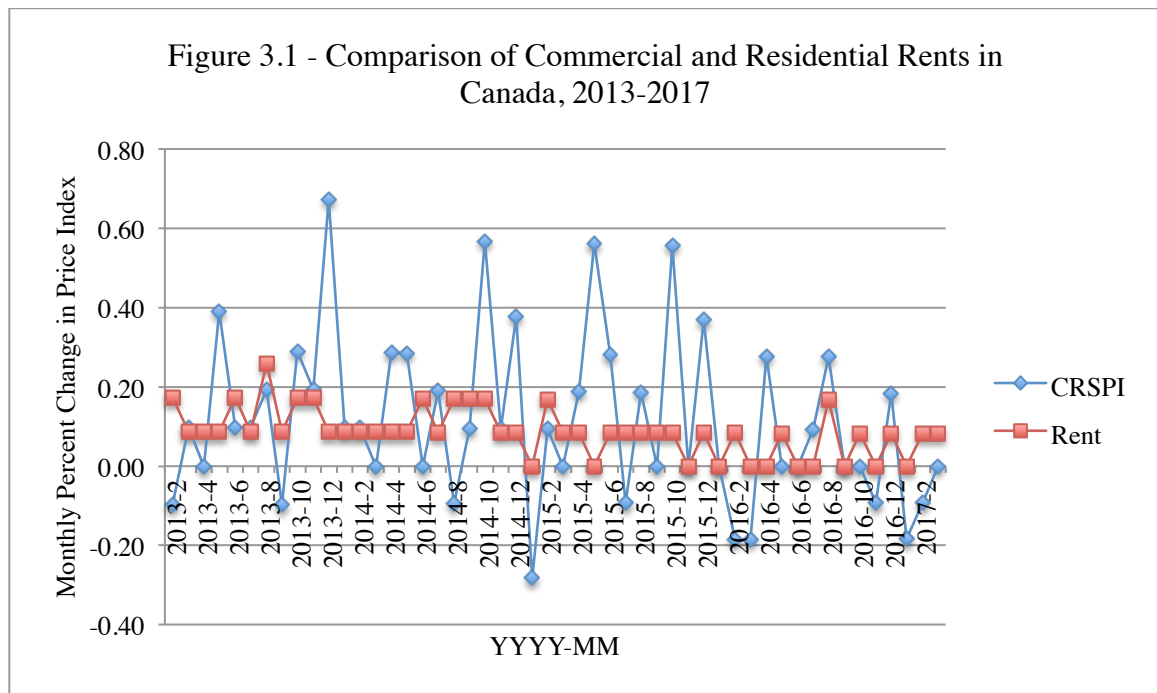
These data do not indicate investment returns, as there is no adjustment for the size of value of rent in relation to the price of the investment. For example, if the amount of rent per square-foot in a commercial building is greater than residential, for the same building

size and purchase price, the return on the commercial building would be greater. Without these data, only the volatility of commercial rent can be implied.

These data do not include subsidized dwellings. As of April 20th, 2017, Ontario enacted rent control that limits the annual percentage increase is rent to existing tenants. Now, rent increases cannot exceed the minimum value between the rate of inflation, and 2.5%. British Columbia is another province will capped rent increase percentages. With extraordinarily housing price increases, the Bank of Canada increasing the interest rate, and therefore mortgage expenses increase, this threatens landlords' returns.

It would be unrealistic to assume that a commercial and residential building of the same size would sell on the market for the same price. This is because residential real estate, even if used as a rental space, is priced by comparable residential homes recently sold. In contrast, a commercial real estate building is priced by the expected income it will generate, discounted to present value. Typically, this results in commercial properties being more expensive per square-foot than residential. Correspondingly, a larger volatility suggests larger expected returns, which follows the assumption of greater initial capital requirements. It can also be rationalized that commercial rental spaces are more risky, as the risk of default is higher for a company than for a person, because there is less liability risk for a company to declare bankruptcy than a person (Apevalova & Radygin, 2010).

The demand of residential rental units is not parallel to that of the demand of commercial rental units. The demand for residential rentals increases as the economy peaks into a recessionary period, due to the expenses of owning a house with a mortgage becomes unaffordable. That is, the demand of residential rental units is negatively correlated with, and a leading indicator of GDP. The demand for commercial rental units, on the other hand, is positively correlated with the economy, as businesses open and expand during expansionary economic periods. Through this logic, the demand for commercial rental units and its construction increases at a lagged, but positive rate with GDP. Table 3.1 shows that there is a more statistically significant relationship between Canada GDP (Statistics Canada, 2017, Table 380-0066) and Canadian Commercial Construction Investment (Statistics Canada, 2017, Table 026-0016).

Table 3.1 – Select Regression Data of Canadian Commercial Construction Investment with Canadian GDP, 2014-2017

Lags (Quarters)	Correlation Coefficient	Slope	Pr(>|t|)
2	-0.03	-0.00	0.94
1	**0.50**	**0.05**	**0.12**
0	0.13	0.01	0.68
-1	-0.34	-0.04	0.31
-2	-0.11	-0.01	0.76

As predicted, the most statistically significant relationship is a positively correlated, lagged by one-quarter regression of Canadian Commercial Construction Investment onto Canada GDP – highlighted in bold. This is especially relevant for investors with existing portfolios to consider: the added speculation or hedging exposures that a residential or

commercial real estate investment would provide. More information on interpretation of these statistics is explored in Chapter 6.

A higher volatility in rent price indices also implies a higher volatility in purchase price as well. This is a major contributor to real estate being a long-term investment: not only does it take time to complete a sale or transaction, but due to the volatility, the returns due to appreciation in the asset are obtainable over the long-term. This can be corroborated through cost-benefit analysis of an average residential investment with a monthly, quarterly, semi-annually, annually, and four year maturity. See Table 3.2.

Table 3.2 – Average Returns on Canadian Residential Real Estate Investment, January 2013 to June 2017

	4-Year	Annual	Semi-Annual	Quarterly	Monthly
Avg Return	151.02%	29.62%	12.72%	4.72%	-0.44%
Annualized Average Return	33.56%	29.62%	25.45%	18.88%	-5.33%
Standard Deviation		15.48%	12.92%	8.33%	0.02%

This table is produced by starting from the average house price in January 2013, as reported by CBC (Evans, 2013), and added to each month from the tabulated monthly change in house prices as reported by Teranet (Teranet and National Bank of Canada, 2017). The monthly change in housing pricing is the first source of monthly income from residential real estate investment. Then, the average monthly home-ownership expenses are subtracted. These data are drawn from Statistics Canada (Statistics Canada, 2017, Table 203-0003) and increased at the rate dictated by Statistics Canada (Statistics Canada, 2017, Table 326-0020). Next, the average monthly rent as reported from Statistics

Canada (Statistics Canada, 2017, Table 203-0003) is added, and grown each month at the rate dictated by Statistics Canada (Statistics Canada, 2017, Table 326-0020). Finally, the average monthly utilities as dictated by Statistics Canada (Statistics Canada, 2017, Table 203-0003) are subtracted, and increased at the rate dictated by Statistics Canada (Statistics Canada, 2017, Table 326-0020).

For the reported monthly returns, no appreciation in the value of the house is considered, making the source of income being only from rent, and return being rent discounted by cost of ownership and utilities divided by the initial investment estimated to be 20% of the cost of the home. Costs for purchasing and selling the home are included in the average monthly expenditure of owning the home, which is unrealistic as it implies the assumption of lower total transactions costs for a shorter time horizon. Therefore, the returns for the smaller time horizons are inflated and would be even lower in reality, or, the larger time horizons would have higher returns in comparison. For all other investment time horizons, the appreciation of property is included as the price of the home at the given date discounted by the price of the home reported the applicable time horizon prior. The standard deviation of the 4-Year investment period is unavailable as the data were only considered for a 4-Year period as to prevent taking any lagging effects from the most recent financial crisis. This also highlights that the standard deviation cannot be compared appropriately across time intervals as each horizon had a different number of data considerations available. Even with the aforementioned modesty in the

longer-term horizon returns compared to the shorter-term, the accumulation of building appreciation is the main source of returns in residential real estate investment.

A major consideration is the overwhelming increase in real estate prices experienced in Toronto and Vancouver over the past several years, as reported in the media. This poses a conflict, as it could be unreasonable to assume an average investment property to appreciate to the same extent as witnessed in these two specific areas. Also, with these two areas being the most impacted by their respective provinces' rent caps, removing them will further provide more reasonable future investment expectations. In a sensitivity analysis where these two locales are removed from the growth rate of housing prices, ownership costs, rent incomes, and utilities, a large difference in returns are witnessed. See Table 3.3.

Table 3.3 – Average Returns on Non-Toronto nor Vancouver Canadian Real Estate Investment, January 2013 to June 2017

	4-Year	Annual	Semi-Annual	Quarterly	Monthly
Avg Return	19.95%	5.49%	2.39%	0.62%	-0.48%
Annualized Average Return	4.43%	5.49%	4.78%	2.47%	-5.82%
Standard Deviation		11.63%	16.83%	10.16%	0.01%

The same inaccurate implication that the costs of purchasing the residence is greater the longer you hold the asset exists, implies that the 4-Year annualized average return is likely not truly less than that of the Annual nor Semi-Annual time horizon. However, from the non-annualized reported average returns, it is clear that the long-term appreciation of the asset is a main source of return from such investment.

An apparent risk that presents itself is that home ownership costs, e.g., with variable

mortgage rates, can fluctuate more freely than rent, which is normally fixed for a 12-

month rental contract. See Figure 3.2.

Figure 3.2 - Comparison of Canadian Monthly Home Ownership Expenses Growth and Rent Income Growth, 2013-2017
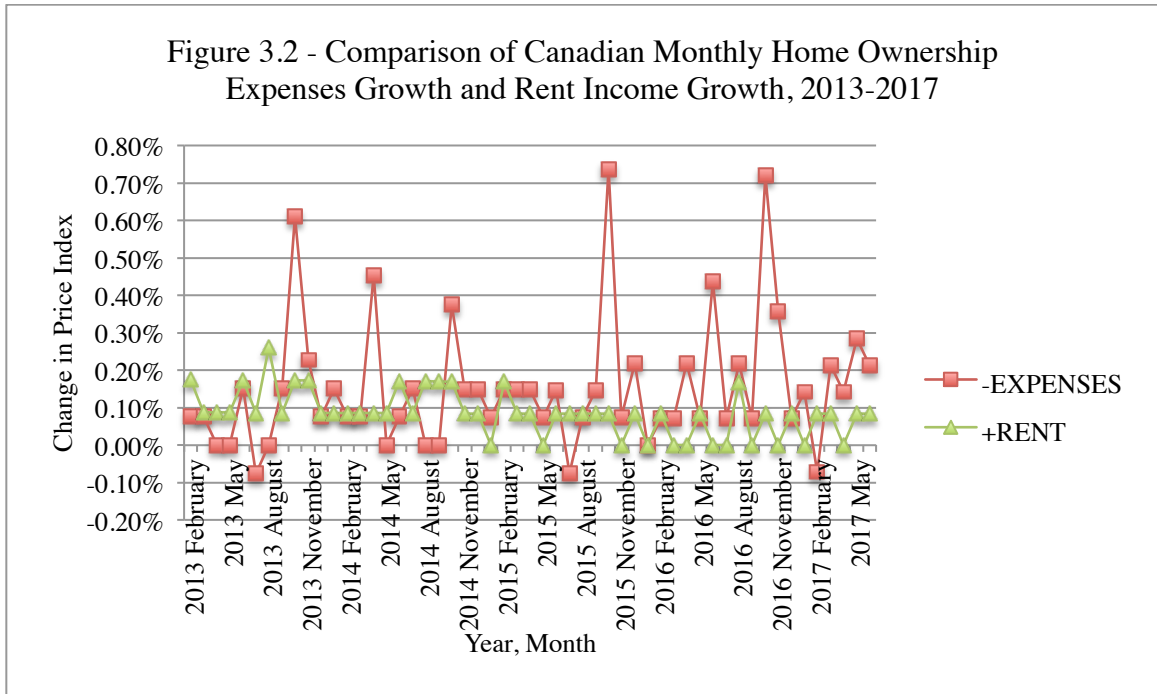
This risk puts more emphasis on the appreciation of the property being the main source of

returns.

Chapter 4: Canada vs. International Real Estate Investment

Continuing with investing in residential real estate, the growth of the housing price index
is different in each country. Global Property Guide Research (Global Property Guide,
2017) offers quarterly data across countries. Looking at the different growth rates in
popular developed and emerging economies, it is apparent that Canadian investors would
be wise to consider offshore investment. See Figure 4.1.

Figure 4.1 - Comparison of Quarterly Change in HPI Growth Across
Select Countries, (a) 2003-2017, (b) 2016-2017
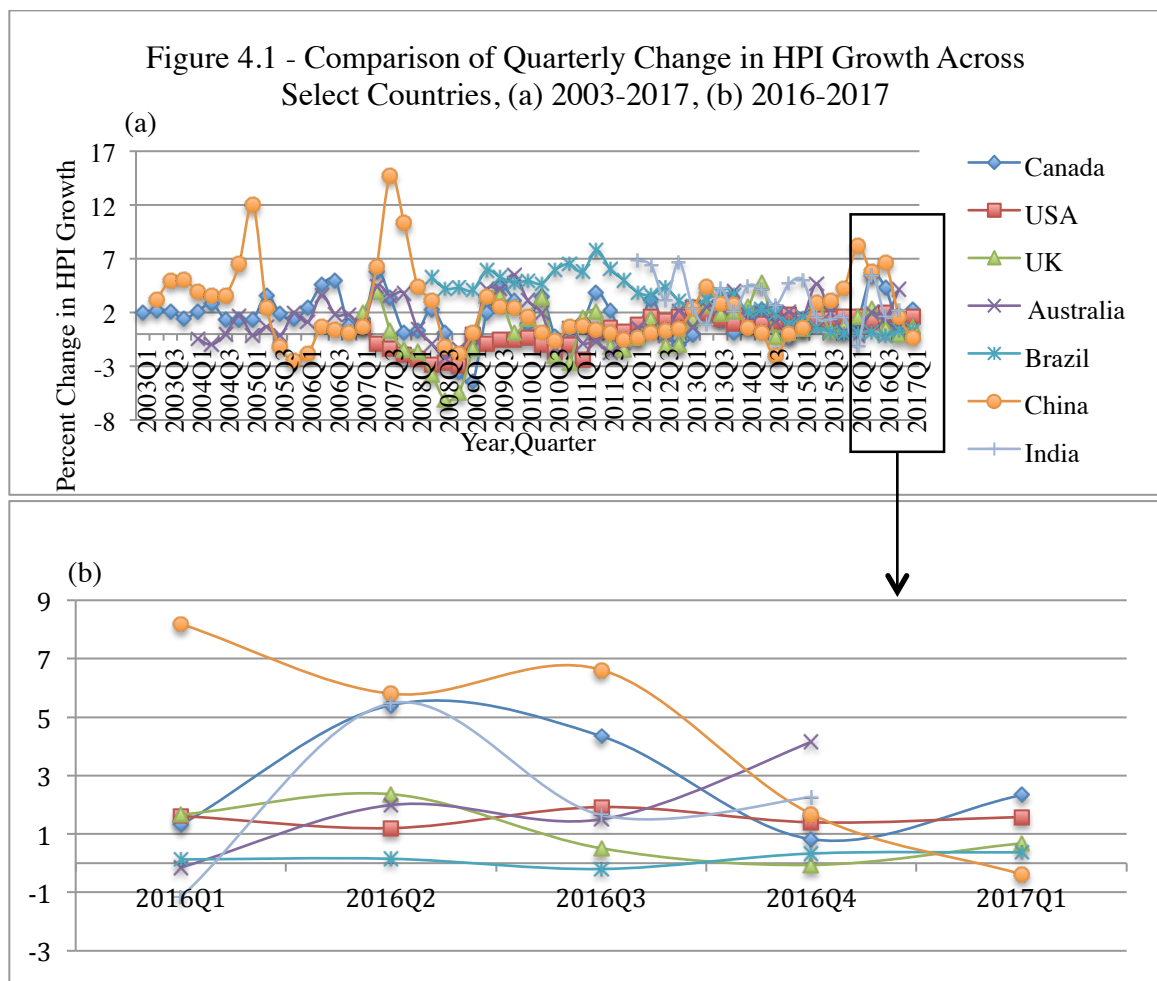
However, investment across borders can pose a multitude of additional risks, especially if
investment is restrained to one or another – possibly due to capital rationing – rather than

offering diversification. As discussed in Chapter 2, currency risk poses a threat to these returns as the prices are in the respective national currency. Therefore, an undiversified investor should consider foreign exchange risk and costs to hedge such risks. Table 4.1 is gathered from the same data as Figure 4.1.

Table 4.1 – Average Quarterly Growth in Housing Price Indices Across Select Countries

	Canada 2003-2017	USA 2007-2017	UK 2007-2017	Australia 2004-2016	Brazil 2008-2017	China 2003-2017	India 2012-2016
Geometric Avg (Quarterly, %)	1.62	0.22	0.43	1.31	3.29	2.32	3.30
St. Dev (Quarterly, %)	1.90	1.53	2.39	1.86	2.21	3.43	2.15
Growth/Risk	0.85	0.15	0.18	0.70	1.49	0.68	1.53
Correlation with Canada	1.00	0.15	0.57	0.36	-0.13	0.26	-0.12

The growth in HPI represents the appreciation in residential real estate, which was previously determined to be the main driver of returns in such investments. Reporting the geometric average follows the assumption that the investment is held for the full time period in which the data are captured. Ranking the countries from highest growth per unit of risk (measured by standard deviation), in order from best investment opportunity to least: India, Brazil, Canada, Australia, China, U.K., and U.S.A. Not only do emerging countries pose a great investment opportunity from a return-to-risk perspective, but if invested in conjunction with other Canadian residential real estate investments, there are also great diversification benefits, most evidently depicted by the hedging opportunity represented by the negative correlations to Canada in India and Brazil's housing data.

Looking more closely at Brazil and India, and using data retrieved from Fundação Instituto de Pesquisas Econômicas (FIPE) (Fundação Instituto de Pesquisas Econômicas, 2017) and the Reserve Bank of India (RBI) (Reserve Bank of India, 2017) for each country, respectively, and returning to the Teranet data for Canada, a similar sensitivity analysis can be applied to measure the different growths if Toronto and Vancouver were withdrawn from the Canadian housing market index. Figure 4.2 is presented using the full composite index of 11 cities for Canada.

Figure 4.2 - Quarterly Growth of HPI in Canada, Brazil, and India, 2009-2017
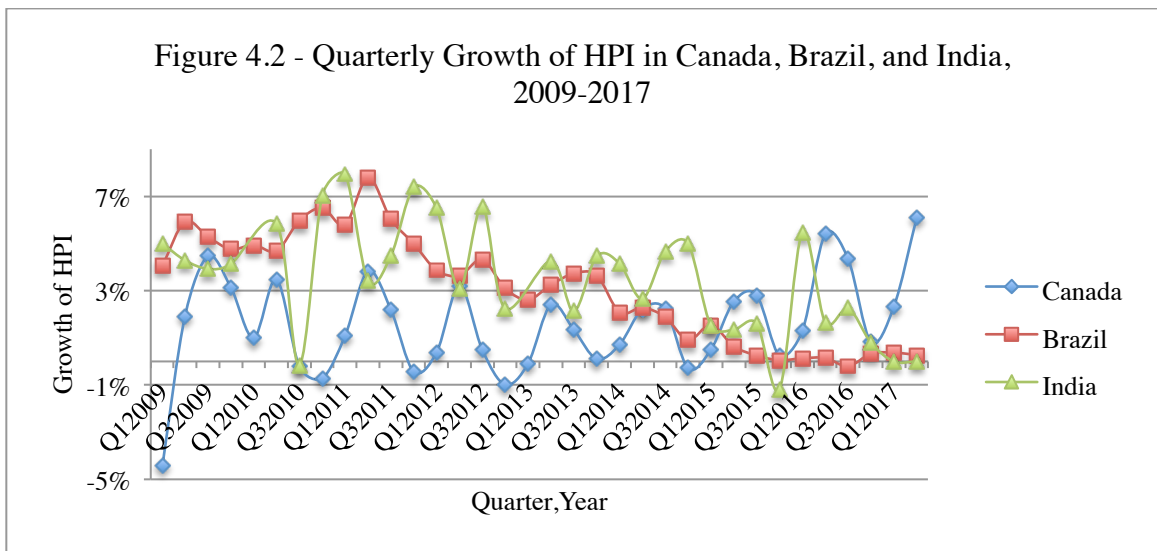
In contrast, Figure 4.3 presents data using a nine-city-composite index for Canada.

Figure 4.3 - Quarterly Growth of HPI in select cities in Canada, Brazil, and India, 2009-2014
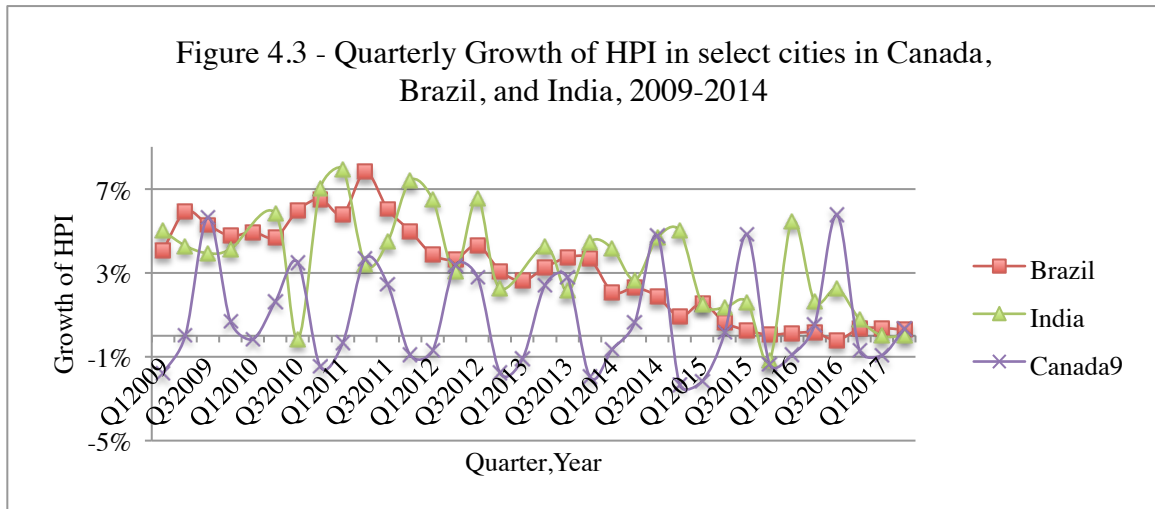
It would appear that India and Brazil have been in a declining trend since recovering from the financial crisis, whereas Canada's HPI seems to follow a mean-reverting trend. However, one could argue that the emerging countries are safer as, even though their growth rates are declining, they have not been negative – dissimilar to Canada. Therefore, for short-term investments, there is an argument in favour of Brazil and India as the possible outcomes of depreciation of the investment, from a historical perspective, are non-existent. It is also important to note that, if not for the spikes in Toronto and Vancouver's housing market in recent history, the current growth of housing prices in Canada would be close to the same as those in Brazil and India.

Returning to commercial real estate investments, FIPE offers commercial sale price indices for a selection of major cities, and Statistics Canada provides price indices of non-residential building construction (Statistics Canada, 2017, Table 327-0043), which will serve as a measure of appreciation of commercial real estate sales. With that, a mindful thought/consideration would be that even with appreciation in (new) construction sales,

there might be an overall depreciation in average commercial real estate sales, as it would include older buildings. Nonetheless, a comparison of these two economies' indices shows the difference in investment opportunities. See Figure 4.4.

Figure 4.4 - Quarterly Growth in Commercial Real Estate Price Index for Canada and Brazil, 2012-2017
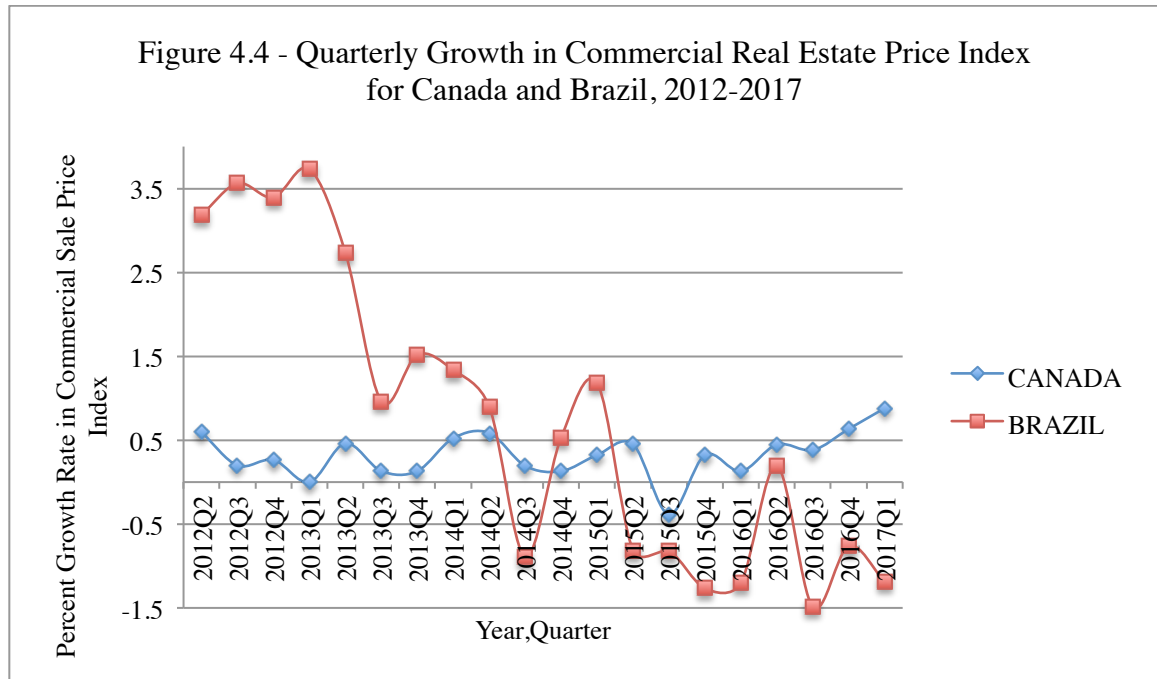
It is apparent that if an investor is looking to invest in Brazil in a real asset that offers a more lucrative investment opportunity than in Canada, commercial real estate is not the asset to be sought. This holds assuming that, like residential real estate, the major driver of returns stems from appreciation of the building rather than from the rent.

The choice to invest in residential or commercial in either Brazil or Canada can be analyzed. See Figures 4.5 and Table 4.2 for Brazil, and Figure 4.6 and Table 4.3 for Canada.

Figure 4.5 - Monthly Growth of Residential ("res") and Commercial ("comm") Price Indices in Brazil, 2013-2017
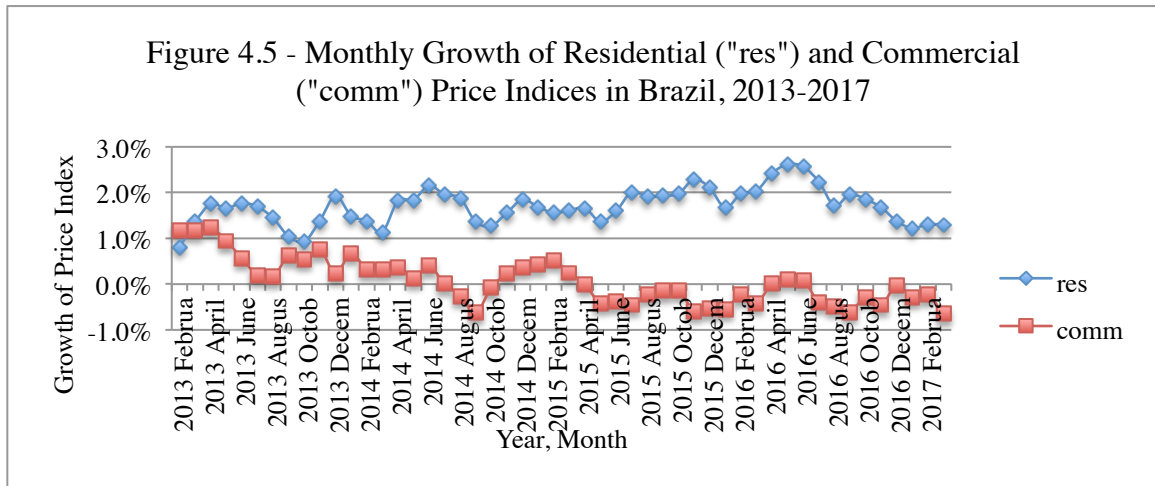
Table 4.2 – Average Monthly Growth of Real Estate Price Indices in Brazil, February 2013-2017

	Residential	Commercial
Geometric Avg (%)	1.70	0.07
St. Dev (%)	0.39	0.50
Growth/Risk	4.32	0.13
Correlation	-0.32	

For Brazil, it is evident that investment in the residential sector has a history of being a more lucrative investment, as well as less volatile.

Figure 4.6 - Monthly Growth of Residential ("res($)") and Commercial ("comm") Price Indices in Canada, 2012-2017
(a) Full Composite
(b) Composite of 9 Cities
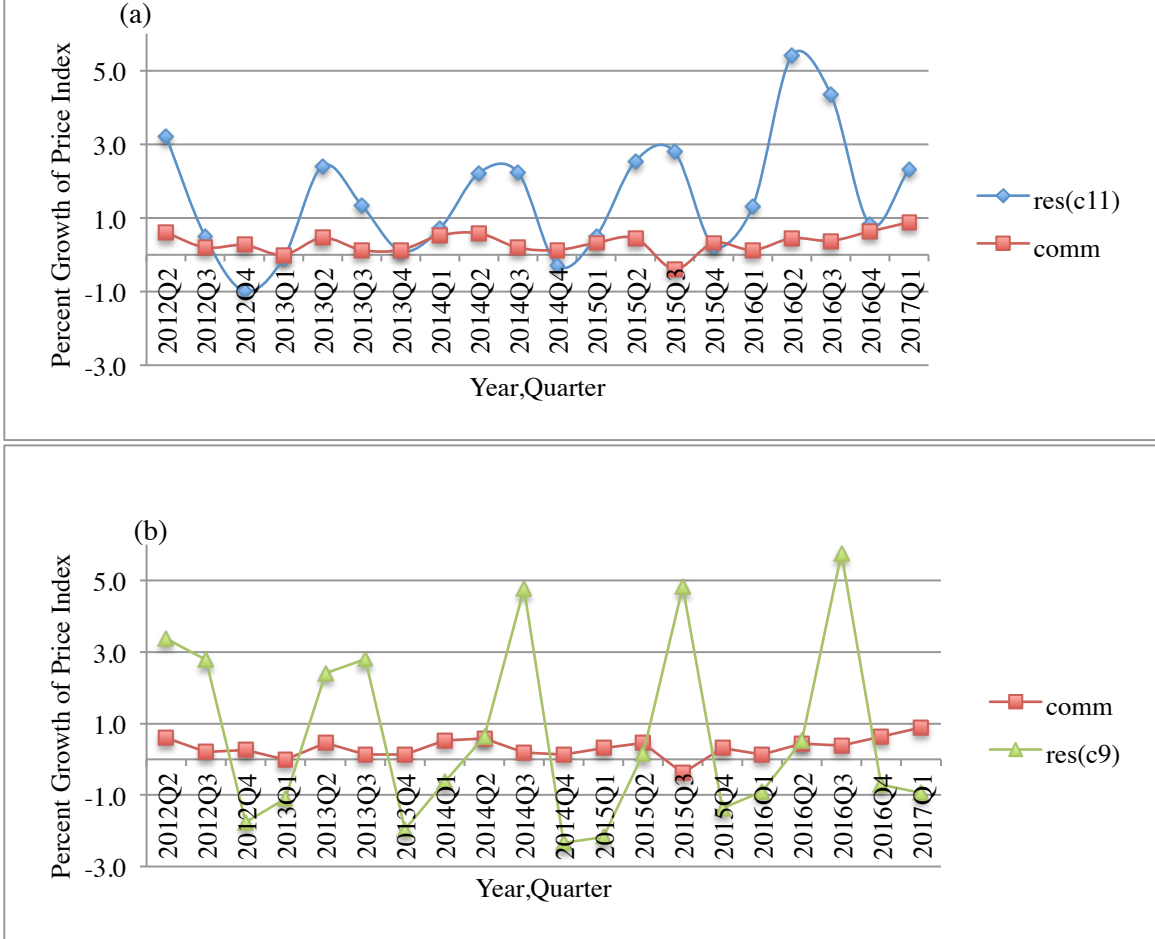
Table 4.3 – Average Quarterly Growth of Real Estate Price Indices in Canada, 2012-2017

	Residential (C11)	Commercial	Residential (C9)
Geometric Avg (%)	1.57	0.32	0.67
St. Dev (%)	1.62	0.28	2.57
Growth/Risk	0.97	1.16	0.26
Correlation	0.25		-0.18

Similarly, with respect to Canadian investment opportunities, the residential real estate sector has historically provided more lucrative appreciation, but with higher volatility. Per unit of volatility, however, the commercial sector offers higher historical growth. Even when taken in regards of a sensitivity analysis, where Toronto and Vancouver are not included in the residential index, the same results apply.

Chapter 5: Canadian Real Estate Investment Assets

To invest in real estate, an investor does not have to directly purchase a building. There are many types of securities with real estate as the underlying asset. Popular securities include REITs, REIT ETFs, and indexes. For REITs and REIT ETFs, 100% of the asset is exposure to the real estate sector. With other ETFs or indexes, real estate is some fraction. Strictly public securities will be considered in comparing investment in physical property, as their data are more available.

The first security added to the comparison is a public equity REIT traded on the TSX. True North Commercial REIT, denoted by TNT as per its ticker TNT.TO. This is REIT owns and acquires Canadian commercial real estate properties. The company was founded in 2012 and has maintained its primary objective to be "generating sustainable cash distributions on a tax-efficient basis" (True North REIT, 2017). This asset does not charge distinctive management fees. The second security is a public equity REIT ETF, also traded on the TSX. Trading under the ticker ZRE.TO, BMO Equal Weight REITs Index ETF has the objective of "High Income Equity" and consists of Canadian REITs, a 0.55% maximum annual management fee, and 0.61% annual management expense ratio (BMO, 2017). The third asset used in a comparison analysis is another public equity REIT ETF, trading on the TSX under XRE.TO. iShares S&P/TSX Capped REIT Index ETF by Blackrock consists of Canadian REITs of the residential, retail, office, and industrial sectors. Its cost structure is identical to ZRE in that its management fee is

0.55%, and management expense ratio (MER) is 0.61% (Blackrock, 2017). Many of the

holdings in XRE are those in ZRE, but the weights of the portfolio are different. This

would justify that their performances are similar. XRE aims to replicate the performance

of the S&P/TSX Capped REIT Index, net of expenses, whereas ZRE aims to replicate the

performance of Solactive Equal Weight Canada REIT index, net of expenses. The final

index used in comparison is an S&P/TSX Composite Index, trading on the TSX as

GSPTSX, and will be considered the market portfolio. This stock does not have

management fees, and therefore no management expense ratio. See Figure 5.1 for

monthly price movements of the five assets, where Gross House Income includes house

price appreciate witnessed in the full Canadian composite Index. See Figure 5.2 for

monthly price movements of the five assets, where Gross House Income is calculated

through exclusion of Toronto and Vancouver in the HPI. See Table 5.1 for both measures

of Gross House Income.

Figure 5.1 - Comparison of Monthly Price Changes in Five Canadian Real Estate Investment Assets, (a) 2013-2017, (b) 2016-2017
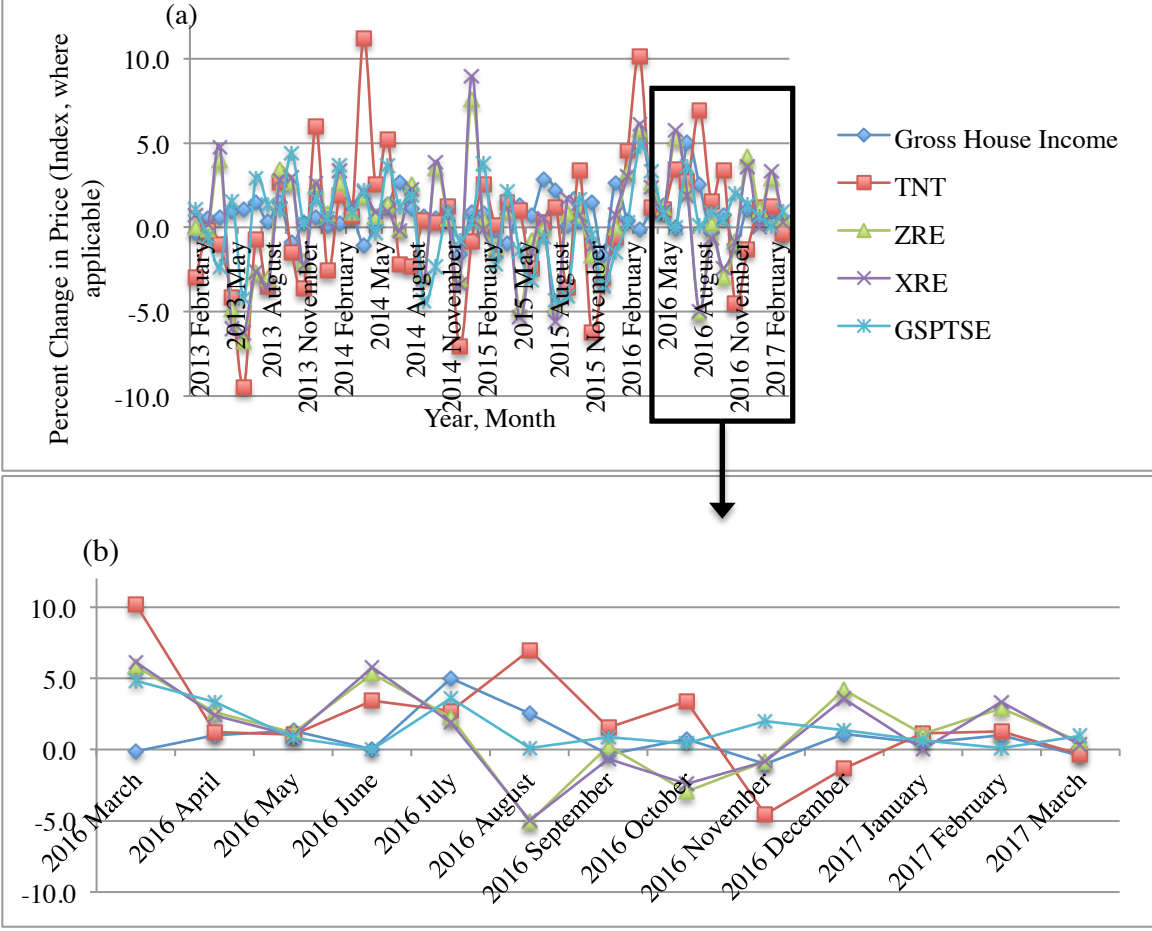
Figure 5.2 - Comparison of Monthly Price Changes in Five Adjusted Canadian Real Estate Investment Assets, (a) 2013-2017, (b) 2016-2017
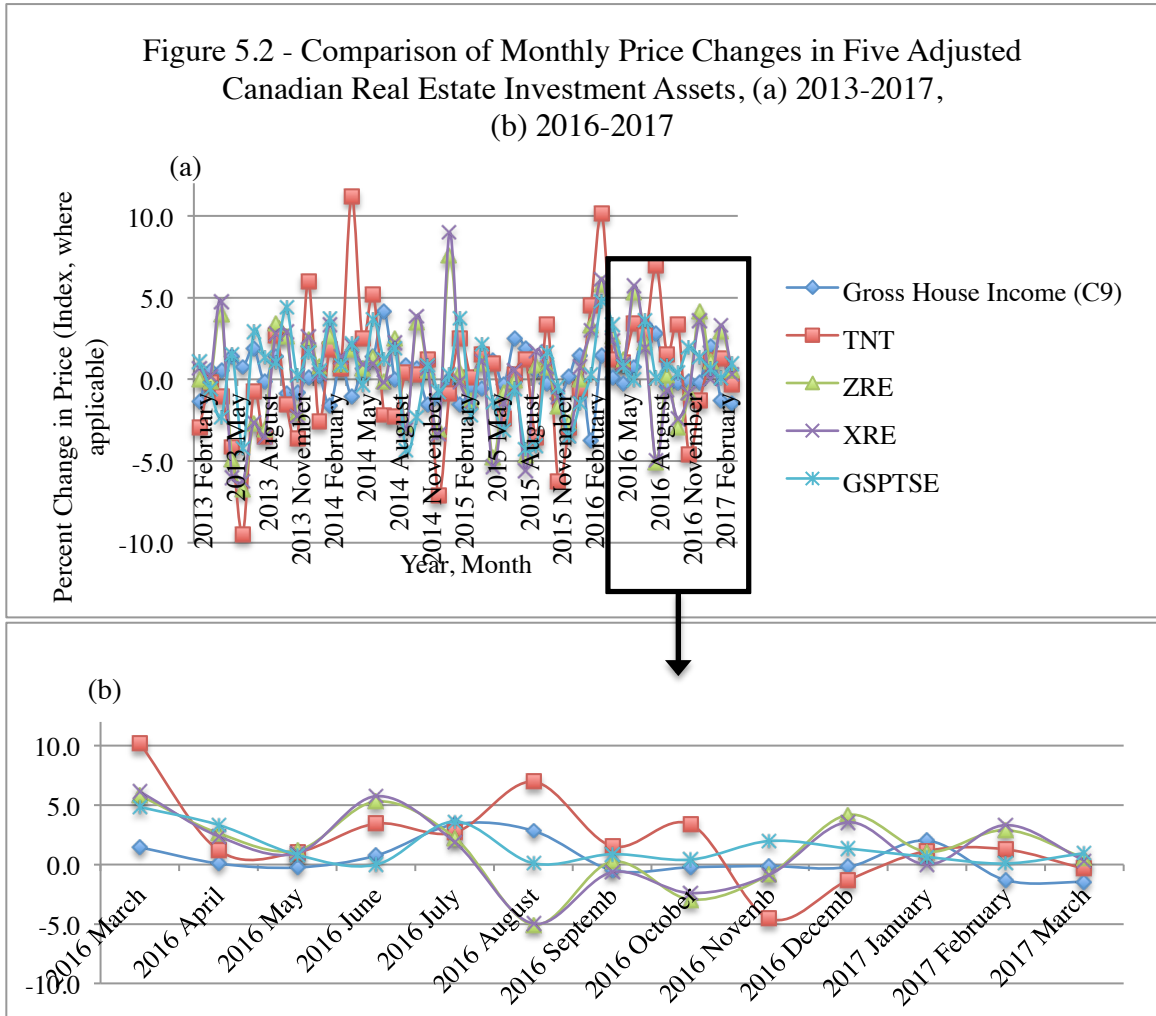
Table 5.1 – Comparison of Average Monthly Returns on Select Canadian Real Estate Assets and Market Portfolio, February 2013-2017

	Gross House Income (C11)	Gross House Income (C9)	TNT	ZRE	XRE	GSPTSE
Geometric Avg (%)	0.66	0.26	0.24	0.30	0.27	0.38
St. Dev (%)	1.19	1.43	3.88	2.99	3.22	2.30
Growth/Risk	0.56	0.18	0.06	0.10	0.08	0.17

Although the index for owning a house as per the Composite 11 is a gross income, factoring only HPI and rent price index, it is exuberantly larger than that of the market portfolio, GSPTSE. However, when Toronto and Vancouver are removed, the gross

income from owning the house does not beat the market in returns, and has a negligibly better growth-to-risk ratio. Given that this is a gross rate, and the transaction costs alone are greater for purchasing a physical property than the presented public market index, the recommended investment would be – in some, if not most cases – the market portfolio. This follows the same logic for the REIT ETFs where inclusion of their associated fees would create a larger spread of returns to the market portfolio. With an already unfavourable growth per unit of risk, the market portfolio outperforms the REIT and REIT ETFs. This can be attributed to both a higher growth as well as a lesser volatility, as the diversification benefits achieved by the market portfolio for investment across many industries.

Table 5.2 – Correlation Matrix of Select Canadian Real Estate Assets and Market Portfolio, February 2013-2017 Data

	Gross House Income	Gross House Income (C9)	TNT	ZRE	XRE	GSPTSE
Gross House Income	1.00	0.63	0.09	-0.07	-0.07	0.01
Gross House Income (C9)	0.63	1.00	0.07	-0.18	-0.19	-0.08
TNT	0.09	0.07	1.00	0.40	0.38	0.40
ZRE	-0.07	-0.18	0.40	1.00	0.99	0.41
XRE	-0.07	-0.19	0.38	0.99	1.00	0.38
GSPTSE	0.01	-0.08	0.40	0.41	0.38	1.00

Table 5.2 shows the correlation between each of the assets. It is worth noting that the correlation between the market portfolio and the gross income from investing in a physical property turns negative once Toronto and Vancouver are disassociated in the index. Also, the Canadian REIT and REIT ETFs do not mirror direct Canadian real estate investments, and therefore are not good material to use for a direct hedge. This is in

contrast to the two REIT ETFs with nearly perfectly positive correlation, so perfectly

opposing investment positions in each asset would constitute a successful hedging

strategy. Further analysis will be conducted in the proceeding chapter.

Although the price per share of the assets are not perfectly, if at all, divisible by $1000, it

is common practice to simulate an investment strategy using a round number. If $1000

were invested in each of the assets at the end of January 2013, the position would have

grown as presented in Table 5.3.

Table 5.3 – Growth of $1000 Investment in Select Canadian Real Estate Assets and
Market Portfolio, January 2013-March 2017

	Gross House Income	TNT	ZRE	XRE	GSPTSE	Gross House Income (C9)
2017 March	1,391.18	1,124.68	1,159.09	1,144.30	1,209.38	1,180.22
Return ($)	391.18	124.68	159.09	144.30	209.38	180.22
Return (%)	39.12%	12.47%	15.91%	14.43%	20.94%	18.02%
Average ($)	1,170.07	938.60	1,018.45	1,022.85	1,104.25	1,103.09
St. Dev ($)	121.38	102.31	72.90	72.00	74.87	77.19
Return ($)/Risk	3.22	1.22	2.18	2.00	2.80	2.33

This method of analysis is only applicable to the specific scenario of investing for the

exact time period, but also offers a different perspective than the analysis of month-over-

month growth rates. Investing in a physical residential real estate asset only

outperformed the market portfolio when the exuberant growths witnessed in Toronto and

Vancouver are included. The Gross House Income outperforms the market portfolio by

18.18%. The fee for an individual investor to independently invest in GSPTSE consists

of a transaction fee, which can vary between investment platforms, are usually a flat dollar fee, and can be assumed to be no greater than $10 per transaction. Including investing and divesting, this represents a 2% fee for our example (modest) portfolio. Typically an investor would have more than $1000 in equity, so this percentage fee is over-exaggerated which in turn makes the returns modest. Even so, expenses in investing and divesting in a physical asset would have to be less than 16% to maintain a positive alpha, which is unrealistic given realtor fees, maintenance fees, and resources needed to find renters. With this consideration, the market portfolio outperformed net returns. Tax considerations are not considered as they vary widely between investors.

As follows with the fees behind the given assets, both ZRE and XRE have management fees associated with their REIT status. With both securities having a MER of 0.61%, the expenses are less than an investor would have to pay if directly invested in the real asset. However, even with a lower management expense than direct investment, their fees further delinquent their performance compared to the market portfolio. Also, their lower volatility in price movements is not contradictory to the analysis using growth rates, as the lower dollar deviation reported is indicative of a larger drop in price in the beginning of the investment period. In fact, the REIT ETFs are more volatile than the market portfolio as indicated by its strong, positive momentum to reduce the gap between it and the market portfolio. See Figure 5.3.

Figure 5.3 - Monthly Growth of Simulated Portfolio in ZRE, XRE, and GSPTSE
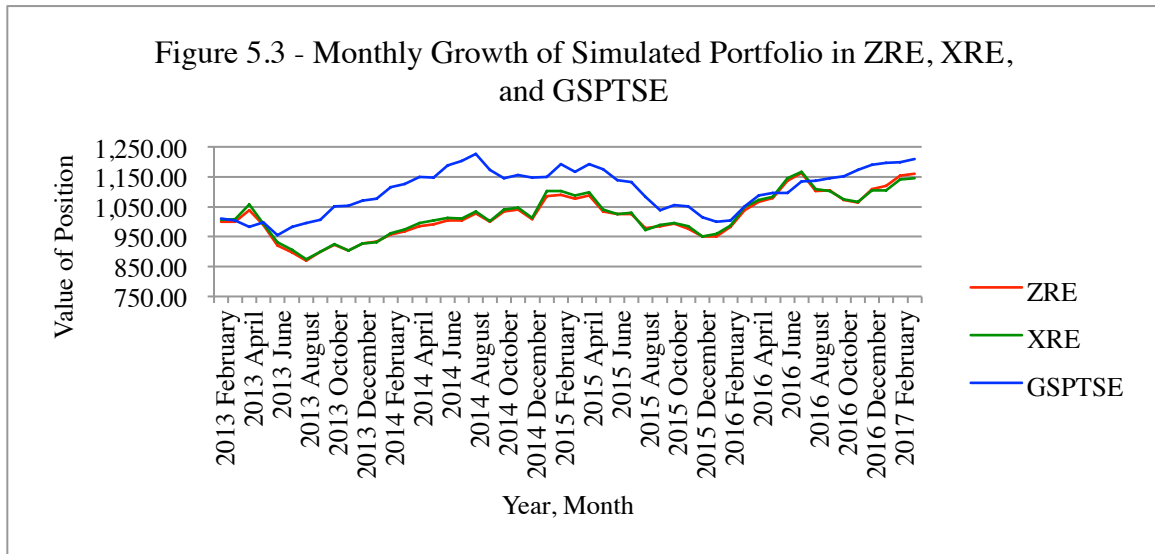
Therefore, the increase in risk aversion of an investor would have increasing utility investing in the market portfolio. That is to say that a more risk neutral or risk loving investor would have greater utility with the speculative choice of investing in a REIT ETF. Depending on the investor's risk aversion, a REIT may add significant value to an existing portfolio.

Unsurprisingly, adding real estate to a portfolio of other assets is beneficial, as it offers diversification. This can be demonstrated by simulating a multifaceted composite index ETF without the real estate component to its makeup. Taking the iShares Core S&P/TSX Capped Composite Index, traded under the ticker XIC.TO, tabulating its distribution across its holdings, and reconstructing the ETF with the weight in the real estate sector appropriately redistributed to the remaining underlying assets. This process was done using Excel, and the Excel Add-In "Solver" to efficiently iterate the circular-reference caused by the additional exposure to the initial ETF for every matching negative exposure

to the real estate securities due to the exposure within the ETF. Essentially, with initial exposure as 100% in XIC.TO, -2.91% investments were required to offset the real estate exposure, netting 97.01% of wealth invested. To compare the portfolios properly, the initial level of wealth must be the same: 100%. When the additional 2.91% was invested in XIC.TO, -0.08% investments were required to offset the resulting real estate exposure. Finally, when the 0.08% of wealth was invested in XIC.TO, the resulting exposure to real estate was immaterial. This regenerated portfolio resulted in a mirrored position as to a 103% exposure to XIC.TO, and shorting three percent in 19 real estate securities. Using Portfolio Visualizer, an online back-test portfolio asset allocation simulator by Silicon Cloud Technologies LLC, a side-by-side comparison of the ETF's performance can be analyzed. See Figure 5.4.

Figure 5.4 – (a) Breakdown of Assets in Portfolio 1,
            (b) Breakdown of Assets in Portfolio 2,
            (c) Performance Measures of Each Portfolio Simulated From January 2012 to
                June 2017

(a)

Portfolio 1

Ticker	Name	Allocation
XIC.TO	iShares Core S&P/TSX Capd Comp Index ETF	100.00%

(b)

Portfolio 2

Ticker	Name	Allocation
XIC.TO	iShares Core S&P/TSX Capd Comp Index ETF	103.00%
REIU.TO	Riocan Real Est Inv Tr	-0.39%
BPY-UN.TO	BROOKFIELD PROPERTY PARTNERS LP	-0.31%
HR-UN.TO	H&R; REIT	-0.30%
CARU.TO	Canadian Apartment Properties REIT	-0.23%
SRU-UN.TO	Smrt Rel Esti Un	-0.18%
AP-UN.TO	Allied Properties REIT	-0.17%
REFU.TO	Canadian Real Estate Investment Trust	-0.17%
FCR.TO	First Capital Realty	-0.14%
FSV	FirstService Corporation	-0.13%
GRT-UN.TO	Granite Real Est	-0.12%
CUFU.TO	Cominar REIT Units	-0.12%
CIGI.TO	Colliers International Group Inc	-0.11%
D-UN.TO	Dream Office Real Estate Investment Trust	-0.18%
AX-U.TO	ARTIS REAL ESTATE TRUST UNITS	-0.11%
BEIU.TO	Boardwalk Equities Inc	-0.09%
AAR-U.TO	Pure Industrial Real Estate Trust	-0.08%
TCN.TO	Tricon Capital Group Inc.	-0.06%
CRR-UN.TO	Crombie Real Estate Investment Trust	-0.06%
AIF.TO	Altus Group Income Fund	-0.05%

(c)

Portfolio Returns

#	Initial Balance	Final Balance	CAGR	Stdev	Best Year	Worst Year	Max. Drawdown	Sharpe Ratio	Sortino Ratio	US Mkt Correlation
1	$1,000	$1,110 ⓘ	5.62% ⓘ	7.93%	21.00%	-8.83%	-10.34% ⓘ	0.70	1.14	0.77
2	$1,000	$1,107 ⓘ	5.45% ⓘ	8.01%	21.15%	-9.06%	-10.60% ⓘ	0.67	1.09	0.76

As demonstrated, the portfolio with real estate exposure, Portfolio 1, did better than an identical portfolio without the diversification real estate provides, Portfolio 2, over the five and a half year period.

Chapter 6: Hedging a Canadian Residential Real Estate Property Investment

To perfectly hedge an existing real estate position would be best performed by investing the same size of position in the exact opposite performance of the asset, or more simply, to short sell the same asset. Therefore the difficulties associated with hedging a position are similar to those if you wanted to speculatively invest in a bearish form.

With respect to exposure to a residential real estate asset, a direct bearish position of the Canadian real estate market would be to sell a residential real estate that you do not own. This construct is not possible – yet – so alternative possibilities that rationally would provide the same exposure include shorting real estate ETFs, shorting REITs, shorting REIT ETFs, shorting Canadian mortgage insurance firms, shorting mortgage-backed securities (MBS) on the TSX, or shorting private residential real estate instruments. Recall in Chapter 5 that, contrary to predispositions, the real estate ETF and both REIT ETFs did not have a strong, positive relationship with HPI. A potential reason for this is that the securities could experience lagged effects. Another potential reason for this is that REITs increase in value based on demand of rental spaces, not just rise in housing value. With these disparities, it follows that real estate ETFs and REIT ETFs may not be adequate investments to hedge the Canadian housing sector.

Even more-so indirect methods to pursue in hedging real estate would include investing or shorting non-real estate instruments that are negatively correlated or positively

correlated, respectively, close to unity. Rational possibilities would include shorting the Canadian dollar, shorting Canadian banks with long positions in the real estate sector, or establishing a long exposure to bonds. Ideally, the time to maturity should be the same as that of the real estate property investment. However, it would be acceptable to have a bond with a maturity that extends past the time of the real estate investment given that the bond is a liquid asset; can be sold on the market quickly for fair value.

Only an analysis of instruments publically available will be evaluated, as there is too limited of information available on private instruments. Note that not all investors will have access to shorting assets on the TSX, but the assumption will be held that no such limitation exists.

Therefore, available investment sectors that are putatively able to be used to hedge are Canadian mortgage insurance firms, Canadian banks, the Canadian dollar, and Canadian bonds.

The first step in an analysis of securities to be used to hedge Canadian residential housing prices is to find an asset, or portfolio of assets with almost perfect correlation, either positively or negatively. Representative securities to test such relationship with the devised list of sectors, and expected relationships of HPI with each of factors are as presented in Table 6.1.

Table 6.1 – Hypothesized Relationship of Select Canadian Assets with Canadian HPI

Variable	Relationship with HPI	Reasoning
Genworth MI Canada, Inc MIC.TO Mortgage Insurance Company	Positive (Lagged)	If HPI decreases: Personal equity in house goes to 0, more people default, insurance companies would have to pay more thus decreasing their value. If HPI increases: Higher housing prices – assuming percent down-payment and debt levels are constant if not increasing – implies higher sized loans, which implies higher premium payments on insurance, increasing insurance company's value.
Royal Bank of Canada RY.TO Bank	Positive (Lagged)	If HPI decreases: Outstanding mortgage loans on asset side of balance sheet would decreases, thus decreasing their value. If HPI increases: Higher housing prices – assuming percent down-payment and debt levels are constant if not increasing – implies higher sized loans, which implies larger interest payments on mortgage loans, increasing bank's value.
Foreign Exchange (Canadian Dollar/ American Dollar) CADUSD Currency	Positive (Leading Indicator)	If CAD appreciates: Signal that inflation is increasing, prices are rising – including housing prices If CAD depreciations: Signal that inflation is decreasing, prices are not rising – including housing prices
Various Bond Yields	Negative	If bond yields increase: Interest rates increase, mortgage expense increases, housing prices decrease If bond yield decrease: Interest rates decrease, mortgage expense decreases, housing prices increase

The correlation coefficients of each of the assets with Canadian HPI are presented in

Table 6.2.

Table 6.2 – Correlation Coefficient of Select Canadian Assets with Canadian HPI,
         July 2012-June 2017

Asset	Correlation Coefficient
MIC	-0.19
RY	-0.01
CADUSD	-0.12
Government of Canada 30 Year Bond	-0.18
Government of Canada 10 Year Bond	-0.17
Government of Canada Marketable Bonds Average yield of 3-5 year maturities	-0.21
Government of Canada Benchmark Bonds Average yield of 3 year maturities	-0.23
Government of Canada Benchmark Bonds Average yield of 5 year maturities	-0.20

As predicted, the various government bond yields have a negative correlation with HPI.

MIC, RY, and CADUSD are negative when compared month-to-month, but this

relationship should be insignificant. The correlation coefficients, estimated regression

slopes, and probability of the relationship being found from chance of each of the assets

with Canadian HPI with various lags are presented in Table 6.3.

Table 6.3 – Select Regression Data of Select Canadian Assets with Canadian HPI, July 2012-June 2017

Asset	Lag (Months)	Correlation Coefficient	Slope	Pr(>|t|)
MIC	4	0.00	-0.00	0.99
	3	-0.02	-0.00	0.88
	2	-0.04	-0.01	0.77
	1	0.04	0.01	0.74
	0	-0.19	-0.03	0.15
	-1	0.02	0.00	0.91
	-2	-0.17	-0.02	0.19
	-3	**0.32**	**0.04**	**0.02**
	-4	0.06	0.01	0.67
RY	4	0.06	0.02	0.64
	3	0.04	0.01	0.76
	2	0.02	0.01	0.91
	1	0.01	0.00	0.94
	0	-0.01	-0.00	0.92
	-1	-0.14	-0.05	0.27
	-2	**-0.16**	**-0.05**	**0.23**
	-3	0.16	0.05	0.25
	-4	0.10	0.03	0.45
CADUSD	4	-0.24	-0.11	0.08
	3	0.10	0.05	0.48
	2	-0.09	-0.04	0.52
	1	0.15	0.07	0.27
	0	-0.12	-0.06	0.36
	-1	0.05	0.02	0.72
	-2	-0.13	-0.06	0.34
	-3	**0.32**	**0.16**	**0.01**
	-4	0.17	0.08	0.21
Government of Canada 30 Year Bond	4	-0.01	-0.00	0.93
	3	**0.30**	**0.06**	**0.02**
	2	0.01	0.00	0.96
	1	0.06	0.01	0.66
	0	-0.18	-0.04	0.16
	-1	-0.14	-0.03	0.30
	-2	-0.10	-0.02	0.43
	-3	0.21	0.04	0.12
	-4	0.05	0.01	0.71

Government of Canada 10 Year Bond	4	-0.04	-0.01	0.72
	3	**0.35**	**0.04**	**0.01**
	2	-0.05	-0.01	0.72
	1	0.05	0.01	0.70
	0	-0.17	-0.02	0.18
	-1	-0.09	-0.01	0.48
	-2	-0.12	-0.01	0.37
	-3	0.29	0.03	0.03
	-4	0.07	0.01	0.59
Government of Canada Marketable Bonds Average yield of 3-5 year maturities	4	-0.07	-0.21	0.62
	3	-0.07	-0.22	0.60
	2	-0.15	-0.47	0.25
	1	-0.14	-0.43	0.29
	0	-0.21	-0.67	0.10
	-1	-0.18	-0.55	0.18
	-2	-0.17	-0.53	0.20
	-3	-0.17	-0.51	0.22
	-4	**-0.25**	**-0.75**	**0.07**
Government of Canada Benchmark Bonds Average yield of 3 year maturities	4	-0.09	-0.35	0.51
	3	-0.09	-0.34	0.51
	2	-0.17	-0.64	0.20
	1	-0.14	-0.53	0.29
	0	-0.23	-0.88	0.08
	-1	-0.21	-0.81	0.10
	-2	-0.18	-0.67	0.19
	-3	-0.16	-0.60	0.24
	-4	**-0.25**	**-0.94**	**0.06**
Government of Canada Benchmark Bonds Average yield of 5 year maturities	4	-0.09	-0.27	0.50
	3	-0.08	-0.24	0.55
	2	-0.16	-0.47	0.23
	1	-0.15	-0.43	0.27
	0	-0.20	-0.60	0.12
	-1	-0.18	-0.54	0.16
	-2	-0.17	-0.51	0.19
	-3	-0.14	-0.41	0.30
	-4	**-0.23**	**-0.67**	**0.08**

In Table 6.3, the Lag (Months) represents the number of months of that the independent variable's data are lagged to Canadian HPI. For example, a one-month lag of MIC would entail change of Canadian HPI experienced in July 2012 is compared with change in MIC.TO price in August 2012, and so on.

The Correlation Coefficient is calculated as by Equation 6.1.

$$\rho_{A,B} = \frac{COV(A,B)}{\sigma_A \sigma_B} = \frac{\left. \sum_{i=1}^{n}(A_i - \bar{A})(B_i - \bar{B}) \right/ n-1}{\sigma_A \sigma_B} \qquad 6.1$$

The Slope is determined by Equation 6.2.

$$\hat{\beta}_B = \widehat{\rho_{A,B}} \cdot \frac{\widehat{\sigma_A}}{\widehat{\sigma_B}} = \frac{\left. \sum_{i=1}^{n}(A_i - \bar{A})(B_i - \bar{B}) \right/ n-1}{\widehat{\sigma_B}^2} \qquad 6.2$$

The Pr(>|t|) is determined at a 5% confidence level, assumes that the variable follows a t-distribution, and represents the probability that the presented relationship of the dependent variable with Canadian HPI is found due to chance, i.e., the smaller the value, the more confidence that the relationship would be found again. Highlighted in bold is the most statistically significant relationship, and that correlation coefficient will be used going forward to test hedging strategies.

As rationalized in Table 6.2, Table 6.3 indicates that MIC and CADUSD have a significantly positive correlation with HPI, CADUSD is a significant leading indicator of HPI, and the 3 to 5 year term government bonds are significantly negatively correlated wit HPI. Contrary to predictions, MIC, RY, and 3 to 5 year term government bonds emerge as significant leading indicators of HPI, RY has a significant negative correlation with HPI, and the government long-term bonds of 10 and 30-year maturities are significantly positively correlated and significantly lagged with HPI.

To calculate the dollar amount to invest in the hedging asset, the minimum variance hedge ratio (MVHR) – Equation 6.3 – will be multiplied by the dollar value of the home.

$$MVHR = \rho_{A,B} \cdot \frac{\sigma_A}{\sigma_B} \qquad 6.3$$

The MVHR is the calculated slope given by regression analysis of Equation 6.2, therefore those values will be used in creating a hedged position. That is, for a $100,000 investment in a residential real estate property in Canada, the corresponding dollar value to hedge the position in each of the assets would be calculated as in Table 6.4 under *$100K.

Table 6.4 – Hedging Results of Investing $100,000 in Canadian Residential Real Estate, and According Minimum Variance Hedge in Selected Assets, July 2012-June 2017

Asset	Lag (Months)	Slope = MVHR	*$100K	Growth	Profit (Loss) on Hedge	Profit (Loss) on House Invt	Total
MIC	4	0.00	18	40	22	33,513	33,535
	3	0.00	281	625	344	32,830	33,174
	2	-0.01	546	1,320	774	33,685	34,459
	1	0.01	603	1,677	(1,074)	35,916	34,842
	0	-0.03	2,536	6,492	3,956	35,294	39,250
	-1	0.00	216	468	(252)	33,224	32,972
	-2	-0.02	2,419	5,809	3,389	34,026	37,415
	-3	**0.04**	**4,473**	**11,649**	**(7,176)**	**32,699**	**25,523**
	-4	0.01	813	2,158	(1,345)	33,756	32,411
RY	4	0.02	2,102	4,015	(1,913)	33,513	31,600
	3	0.01	1,391	2,676	(1,285)	32,830	31,545
	2	0.01	508	1,001	(493)	33,685	33,192
	1	0.00	308	659	(351)	35,916	35,565
	0	0.00	424	895	470	35,294	35,765
	-1	-0.05	4,639	9,701	5,062	33,224	38,286
	-2	**-0.05**	**5,050**	**10,475**	**5,425**	**34,026**	**39,451**
	-3	0.05	5,017	10,788	(5,771)	32,699	26,928
	-4	0.03	3,287	7,038	(3,751)	33,756	30,006
CADUSD	4	-0.11	11,413	8,802	(2,611)	33,513	30,902
	3	0.05	4,603	3,490	1,112	32,830	33,942
	2	-0.04	4,097	3,117	(980)	33,685	32,706
	1	0.07	7,075	5,473	1,602	35,916	37,518
	0	-0.06	5,848	4,586	(1,263)	35,294	34,031
	-1	0.02	2,370	1,784	585	33,224	33,809
	-2	-0.06	6,272	4,671	(1,602)	34,026	32,424
	-3	**0.16**	**15,883**	**12,126**	**3,757**	**32,699**	**36,456**
	-4	0.08	8,285	6,333	1,952	33,756	35,709

	4	0.00	237	213	(24)	33,513	33,489
Government of Canada 30 Year Bond	**3**	**0.06**	**5,887**	**5,423**	**465**	**32,830**	**33,295**
	2	0.00	132	120	12	33,685	33,697
	1	0.01	1,149	1,081	67	35,916	35,984
	0	-0.04	3,600	3,301	(298)	35,294	34,996
	-1	-0.03	2,678	2,360	(317)	33,224	32,906
	-2	-0.02	2,043	1,898	(145)	34,026	33,881
	-3	0.04	4,115	4,065	49	32,699	32,748
	-4	0.01	998	1,003	(6)	33,756	33,751
Government of Canada 10 Year Bond	4	-0.01	520	513	(6)	33,513	33,507
	3	**0.04**	**3,653**	**3,725**	**(72)**	**32,830**	**32,758**
	2	-0.01	506	502	(4)	33,685	33,681
	1	0.01	538	566	(28)	35,916	35,889
	0	-0.02	1,862	1,888	27	35,294	35,321
	-1	-0.01	1,039	847	(192)	33,224	33,032
	-2	-0.01	1,331	1,188	(143)	34,026	33,883
	-3	0.03	3,222	3,012	210	32,699	32,909
	-4	0.01	802	755	48	33,756	33,804
Government of Canada Marketable Bonds – Average yield of 3-5 year maturities	4	-0.21	21,014	37,810	16,796	33,513	50,309
	3	-0.22	22,244	40,532	18,288	32,830	51,118
	2	-0.47	47,257	87,187	39,930	33,685	73,615
	1	-0.43	43,158	80,667	37,509	35,916	73,425
	0	-0.67	67,059	126,745	59,686	35,294	94,980
	-1	-0.55	54,969	102,631	47,662	33,224	80,886
	-2	-0.53	53,250	98,583	45,334	34,026	79,360
	-3	-0.51	51,153	93,820	42,667	32,699	75,366
	-4	**-0.75**	**75,234**	**136,661**	**61,427**	**33,756**	**95,183**

Government of Canada Benchmark Bonds – Average yield of 3 year maturities	4	-0.35	34,648	56,933	22,285	33,513	55,798
	3	-0.34	34,444	57,259	22,815	32,830	55,645
	2	-0.64	64,440	108,367	43,927	33,685	77,613
	1	-0.53	52,962	90,161	37,199	35,916	73,115
	0	-0.88	88,083	151,448	63,366	35,294	98,660
	-1	-0.81	81,387	138,386	56,999	33,224	90,223
	-2	-0.67	66,706	112,578	45,873	34,026	79,899
	-3	-0.60	60,245	100,858	40,613	32,699	73,312
	-4	**-0.94**	**93,688**	**155,539**	**61,851**	**33,756**	**95,607**
Government of Canada Benchmark Bonds – Average yield of 5 year maturities	4	-0.27	26,741	51,736	24,994	33,513	58,507
	3	-0.24	23,782	46,628	22,845	32,830	55,675
	2	-0.47	46,923	93,203	46,280	33,685	79,965
	1	-0.43	43,233	87,058	43,825	35,916	79,741
	0	-0.60	60,424	123,086	62,663	35,294	97,957
	-1	-0.54	53,933	108,476	54,543	33,224	87,767
	-2	-0.51	50,907	101,437	50,530	34,026	84,556
	-3	-0.41	40,557	79,990	39,432	32,699	72,131
	-4	**-0.67**	**67,477**	**131,674**	**64,197**	**33,756**	**97,953**

For Table 6.4, the Growth period without any lagged months is from July 2012 to June 2017, and the monthly growth rates used are those as they were witnessed during this time period. Any negative lagged months would be equivalent to removing data from that many months, starting from July 2012 and moving successively, from the asset and removing data from that many months, starting from June 2017 and moving heretofore, from Canadian HPI. The Profit (Loss) on the Hedge is calculated depending on whether the position is short or long. If MVHR is negative, this indicates that the correlation with Canadian HPI is negative. Therefore, the position to hedge against Canadian HPI would be to long the asset with negative correlation. With a long position, profit/loss is calculated by subtracting the initial investment from the ending balance: Growth –

*$100K. If MVHR is positive, this indicates that the correlation with Canadian HPI is positive. Therefore, the position to hedge against Canadian HPI would be to short the asset with a positive correlation. With a short position, profit/loss is calculated by subtracting the ending balance from the initial balance: *$100K – Growth. The Total column adds the profits/losses from both the hedge investment position as well as the appreciation/depreciation in the real estate property. The bold figures are those of the highest significance of relationship, as determined in Table 6.3, and the highlighted Total figures are the end-of-term portfolio values closest to zero.

As evident in Table 6.4, none of the assets provided a perfect hedge. In fact, most of the ending portfolio sizes that are closest to a perfect hedge are not of the lagged relationship with the highest statistical significance. This is surprising as it is reasonable to expect the MVHR with the most significant relationship to be the most predictable, and therefore most successful in the construction of a hedge.

The closest hedged position to a perfect hedged was with a short position on the Canadian Mortgage Insurance company, Genworth. As predicted, the relationship the insurance company had with HPI was positive and lagged by a quarter of a year. Its strongest correlation coefficient within 4 periods of lag is 0.32, and it is one of the two assets to have its strongest correlated lagged variables also perform as the closest to a perfect hedge over the five-year period. However, as seen in Figure 6.1, its hedge was not without its volatility.

Figure 6.1 - Profit (Loss) of Investment Portfolio Hedged With MIC; Lagged 3 Months
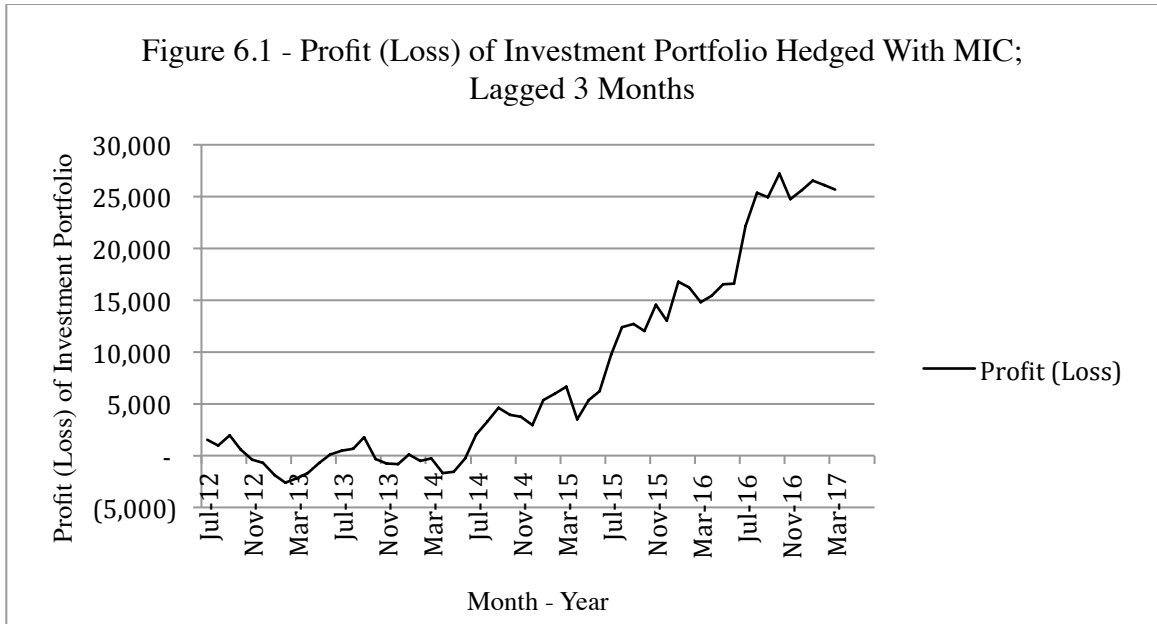
Returning to the REIT, REIT ETF, and market portfolio, the same hedging construction can be made. See Tables 6.5 and 6.6. The REIT ETF previously referenced by its ticker ZRE is not included as its performance is seen to be close of that of REIT ETF ticker XRE. The Growth of the assets without lag is from February 2013 to March 2017.

Table 6.5 - Select Regression Data of Select Canadian Real Estate Securities and Market Portfolio with Canadian HPI, February 2013-March 2017

Asset	Lag (Months)	Correlation Coefficient	Slope	Pr(>|t|)
TNT	4	-0.21	-0.07	0.17
	3	0.02	0.01	0.88
	2	0.01	0.00	0.92
	1	0.08	0.03	0.58
	0	0.10	0.03	0.49
	-1	-0.02	-0.01	0.91
	-2	0.00	0.00	1.00
	-3	0.23	0.07	0.13
	-4	**0.29**	**0.09**	**0.05**
XRE	4	-0.03	-0.01	0.84
	3	-0.11	-0.04	0.46
	2	0.00	0.00	0.99
	1	-0.28	-0.10	0.05
	0	-0.05	-0.02	0.73
	-1	0.08	0.03	0.58
	-2	-0.08	-0.03	0.59
	-3	0.03	0.01	0.83
	-4	**0.28**	**0.10**	**0.06**
GSPTSE	4	-0.05	-0.03	0.75
	3	0.01	0.01	0.94
	2	-0.12	-0.06	0.43
	1	-0.14	-0.07	0.32
	0	0.01	0.01	0.94
	-1	-0.01	0.00	0.96
	-2	-0.14	-0.07	0.34
	-3	**0.21**	**0.11**	**0.16**
	-4	0.13	0.07	0.38

Table 6.6 - Hedging Results of Investing $100,000 in Canadian Residential Real Estate, and According Minimum Variance Hedge in Selected Canadian Real Estate Securities, July 2012-June 2017

Asset	Lag (Months)	Slope = MVHR	*$100K	Growth	Profit (Loss) on Hedge	Profit (Loss) on House Invt	Total
TNT	4	-0.07	6,512	7,968	1,456	30,754	32,210
	3	0.01	684	803	(118)	32,075	31,957
	2	0.00	441	512	(71)	32,690	32,619
	1	0.03	2,509	2,907	(398)	33,905	33,507
	0	0.03	3,105	3,493	(387)	33,220	32,833
	-1	-0.01	528	594	66	33,878	33,944
	-2	0.00	23	26	3	33,283	33,286
	-3	0.07	6,958	7,826	(868)	32,610	31,742
	-4	**0.09**	**9,003**	**10,125**	**(1,122)**	**31,514**	**30,392**
XRE	4	-0.01	1,228	1,415	187	30,754	30,942
	3	-0.04	4,191	4,539	349	32,075	32,423
	2	0.00	56	64	(8)	32,690	32,683
	1	-0.10	10,348	11,761	1,413	33,905	35,318
	0	-0.02	1,882	2,154	272	33,220	33,492
	-1	0.03	2,953	3,379	(426)	33,878	33,452
	-2	-0.03	2,993	3,425	432	33,283	33,715
	-3	0.01	1,177	1,347	(170)	32,610	32,440
	-4	**0.10**	**10,414**	**11,917**	**(1,503)**	**31,514**	**30,011**
GSPTSE	4	-0.03	2,530	3,070	540	30,754	31,294
	3	0.01	589	726	(137)	32,075	31,938
	2	-0.06	6,099	7,339	1,240	32,690	33,930
	1	-0.07	7,434	8,895	1,461	33,905	35,366
	0	0.01	581	703	(122)	33,220	33,099
	-1	0.00	410	496	86	33,878	33,964
	-2	-0.07	7,248	8,765	1,518	33,283	34,801
	-3	**0.11**	**10,728**	**12,974**	**(2,246)**	**32,610**	**30,363**
	-4	0.07	6,813	8,239	(1,426)	31,514	30,088

These assets do not offer much stronger hedging positions. However, these values are not

perfectly comparable as they are invested for a shorter time period. Tables 6.7 and 6.8

offer a sensitivity analysis of the housing price index without Toronto or Vancouver.

Table 6.7 - Select Regression Data of Select Canadian Real Estate Securities and Market
Portfolio with Non-Toronto nor Vancouver Canadian HPI,
February 2013-March 2017

Asset	Lag (Months)	Correlation Coefficient	Slope	Pr(>|t|)
TNT	4	-0.27	-0.10	0.07
	3	-0.03	-0.01	0.84
	2	-0.07	-0.02	0.65
	1	-0.08	-0.03	0.61
	0	0.07	0.03	0.61
	-1	0.04	0.02	0.78
	-2	0.02	0.01	0.87
	-3	**0.40**	**0.15**	**0.00**
	-4	0.10	0.04	0.51
XRE	4	-0.07	-0.03	0.63
	3	0.08	0.03	0.59
	2	**-0.26**	**-0.11**	**0.08**
	1	-0.18	-0.08	0.21
	0	-0.17	-0.08	0.23
	-1	-0.05	-0.02	0.72
	-2	0.00	0.00	0.99
	-3	0.10	0.05	0.49
	-4	0.12	0.06	0.41
GSPTSE	4	0.03	0.02	0.86
	3	-0.02	-0.01	0.89
	2	**-0.20**	**-0.12**	**0.16**
	1	-0.07	-0.04	0.62
	0	-0.08	-0.05	0.58
	-1	0.02	0.01	0.90
	-2	0.08	0.05	0.59
	-3	0.13	0.08	0.37
	-4	0.06	0.04	0.70

Table 6.8 - Hedging Results of Investing $100,000 in Non-Toronto nor Vancouver Canadian Residential Real Estate, and According Minimum Variance Hedge in Selected Canadian Real Estate Securities, February 2013-March 2017

Asset	Lag (Months)	Slope = MVHR	*$100K	Growth	Profit (Loss) on Hedge	Profit (Loss) on House Invt	TOTAL
TNT	4	-0.10	9,730	11,905	2,175	10,499	12,674
	3	-0.01	1,072	1,258	185	10,195	10,380
	2	-0.02	2,423	2,812	390	12,415	12,805
	1	-0.03	2,784	3,226	442	10,849	11,290
	0	0.03	2,731	3,071	(340)	9,123	8,782
	-1	0.02	1,500	1,687	(187)	10,798	10,611
	-2	0.01	883	993	(110)	10,272	10,162
	-3	**0.15**	**14,743**	**16,582**	**(1,838)**	**9,773**	**7,935**
	-4	0.04	3,650	4,105	(455)	8,341	7,886
XRE	4	-0.03	3,346	3,857	510	10,499	11,010
	3	0.03	3,487	3,777	(290)	10,195	9,905
	2	**-0.11**	**11,097**	**12,593**	**1,496**	**12,415**	**13,911**
	1	-0.08	8,013	9,107	1,094	10,849	11,943
	0	-0.08	7,687	8,796	1,109	9,123	10,232
	-1	-0.02	2,292	2,623	331	10,798	11,128
	-2	0.00	76	87	11	10,272	10,283
	-3	0.05	4,560	5,218	(658)	9,773	9,115
	-4	0.06	5,570	6,374	(804)	8,341	7,537
GSPTSE	4	0.02	1,581	1,918	(337)	10,499	10,162
	3	-0.01	1,275	1,571	296	10,195	10,491
	2	**-0.12**	**12,471**	**15,007**	**2,536**	**12,415**	**14,951**
	1	-0.04	4,427	5,297	870	10,849	11,719
	0	-0.05	5,008	6,057	1,049	9,123	10,172
	-1	0.01	1,115	1,348	(233)	10,798	10,564
	-2	0.05	4,865	5,884	(1,019)	10,272	9,254
	-3	0.08	8,172	9,883	(1,711)	9,773	8,063
	-4	0.04	3,608	4,364	(755)	8,341	7,585

For both the 11 city composite Canada HPI as presented in Table 6.5 and 6.6, and the 9 city composite Canada HPI as presented in Table 6.7 and 6.8, the most hedged portfolio is that of 4 lags, even if that relationship is not the strongest with HPI. The hedge performance appears better in the 9 city composite than the 11 city composite, but the growth of the housing in the 9 cities are significantly less than if Toronto and Vancouver data are included.

To compare on the same time frame, Table 6.9 shows the indirect assets hedging results over the same time frame of February 2013 to March 2017.

Table 6.9 - Hedging Results of Investing $100,000 in Canadian Residential Real Estate, and According Minimum Variance Hedge in Selected Assets, February 2013-March 2017

Asset	Lag (Months)	MVHR	*$100K	Growth	Profit (Loss) on Hedge	Profit (Loss) on House Invt	TOTAL
MIC	4	0.00	39	74	(35)	30,754	30,719
	3	0.00	486	891	(405)	32,075	31,670
	2	-0.01	718	1,321	(602)	32,690	32,088
	1	0.00	371	684	(312)	33,905	33,593
	0	-0.02	1,637	3,159	(1,522)	33,220	31,698
	-1	0.00	363	714	(351)	33,878	33,527
	-2	-0.02	1,938	3,280	(1,342)	33,283	31,942
	-3	0.05	4,944	8,631	(3,687)	32,610	28,923
	-4	0.01	1,400	2,338	(938)	31,514	30,577

RY	4	0.02	1,524	2,665	(1,141)	30,754	29,614
	3	0.03	2,646	4,732	(2,087)	32,075	29,988
	2	0.00	128	228	(99)	32,690	32,591
	1	0.00	239	407	(167)	33,905	33,738
	0	0.02	2,262	3,998	(1,736)	33,220	31,484
	-1	-0.05	4,870	8,570	(3,700)	33,878	30,178
	-2	-0.04	3,850	6,512	(2,662)	33,283	30,621
	-3	0.07	6,627	10,887	(4,260)	32,610	28,350
	-4	0.04	3,721	5,858	(2,137)	31,514	29,377
CADUSD	4	-0.15	15,021	11,707	3,314	30,754	34,068
	3	0.07	6,957	5,263	1,694	32,075	33,769
	2	-0.04	4,109	3,138	970	32,690	33,661
	1	0.05	4,952	3,832	1,120	33,905	35,025
	0	-0.05	5,465	4,094	1,372	33,220	34,592
	-1	0.04	4,255	3,191	1,064	33,878	34,942
	-2	-0.06	5,729	4,385	1,344	33,283	34,627
	-3	0.20	19,914	14,786	5,128	32,610	37,738
	-4	0.08	8,377	6,219	2,158	31,514	33,672
Government of Canada 30 Year Bond	4	0.00	463	405	58	30,754	30,812
	3	0.07	6,517	6,327	190	32,075	32,265
	2	0.01	1,033	950	83	32,690	32,773
	1	0.00	426	388	38	33,905	33,943
	0	-0.03	2,525	2,257	268	33,220	33,488
	-1	-0.02	2,307	2,099	208	33,878	34,086
	-2	-0.02	2,214	2,072	142	33,283	33,425
	-3	0.05	4,554	4,087	467	32,610	33,077
	-4	0.00	438	368	69	31,514	31,583

Government of Canada 10 Year Bond	4	0.00	355	279	76	30,754	30,831
	3	0.04	4,352	4,165	187	32,075	32,262
	2	0.00	249	216	33	32,690	32,724
	1	0.00	160	141	19	33,905	33,924
	0	-0.01	1,208	984	224	33,220	33,444
	-1	-0.01	979	802	177	33,878	34,055
	-2	-0.01	1,352	1,192	160	33,283	33,443
	-3	0.04	3,513	3,020	493	32,610	33,103
	-4	0.01	541	430	111	31,514	31,625
Government of Canada Marketable Bonds – Average yield of 3-5 year maturities	4	-0.11	11,090	17,717	(6,628)	30,754	24,127
	3	-0.09	9,154	14,821	(5,668)	32,075	26,407
	2	-0.38	37,765	61,840	(24,075)	32,690	8,615
	1	-0.38	38,117	63,172	(25,055)	33,905	8,850
	0	-0.50	49,603	83,235	(33,632)	33,220	(412)
	-1	-0.42	42,094	69,956	(27,862)	33,878	6,016
	-2	-0.41	40,533	66,682	(26,149)	33,283	7,134
	-3	-0.41	41,094	66,883	(25,789)	32,610	6,821
	-4	-0.72	72,380	116,568	(44,187)	31,514	(12,673)
Government of Canada Benchmark Bonds – Average yield of 3 year maturities	4	-0.20	19,615	28,983	(9,368)	30,754	21,387
	3	-0.13	12,802	19,139	(6,337)	32,075	25,738
	2	-0.50	50,074	75,632	(25,558)	32,690	7,132
	1	-0.46	45,600	69,632	(24,032)	33,905	9,873
	0	-0.62	61,585	95,058	(33,473)	33,220	(253)
	-1	-0.60	59,728	91,424	(31,696)	33,878	2,183
	-2	-0.42	42,408	64,315	(21,907)	33,283	11,377
	-3	-0.40	40,402	60,672	(20,270)	32,610	12,340
	-4	-0.89	88,548	131,825	(43,277)	31,514	(11,763)
Government of Canada Benchmark Bonds – Average yield of 5 year maturities	4	-0.20	19,885	33,911	(14,026)	30,754	16,729
	3	-0.16	16,139	27,927	(11,788)	32,075	20,287
	2	-0.41	40,933	71,672	(30,740)	32,690	1,951
	1	-0.41	40,983	72,686	(31,703)	33,905	2,202
	0	-0.47	46,698	83,916	(37,218)	33,220	(3,997)
	-1	-0.47	46,861	83,317	(36,456)	33,878	(2,578)
	-2	-0.43	42,925	75,444	(32,519)	33,283	764
	-3	-0.36	35,593	61,834	(26,241)	32,610	6,369
	-4	-0.66	66,273	113,811	(47,539)	31,514	(16,025)

As most obviously shown in the Government of Canada 3 year benchmark bond, the four-year investment on an average Canadian residential real estate property can be nearly perfectly hedged using an indirect security. This is especially interesting as that same four-year hedge resulted in a $98,660 profit, as shown in Table 6.4, if invested for an additional year.

An alternative to hedge exposure to the housing market would be to rent. This strategy is prevalent for many residents who speculate that Toronto and Vancouver are in housing bubbles. It is also applicable to Canadian investors temporarily located in an emerging country, like Brazil, who do not wish to be exposed to both the Brazilian housing market, nor be exposed to foreign exchange risk.

Chapter 7: Conclusions

For Canadian investors with limited capital, and therefore limited diversification, investing in the real estate is likely a less efficient strategy than investment in the market portfolio. The benefits of offshore investment in real estate are mainly applicable to large investors who substitute investing in alternative assets with in-house management.

A sustainable hedging strategy against direct investment in Canadian residential real estate was not found. To hedge against the housing market, it is recommended to be a renter, rather than to invest in a rental property and offset the investment with another asset.

Future work in this area includes reaffirmation of conclusions reached across broader time spectrums with a sensitivity analysis of performance during a housing or other market crisis, analysis of co-investment relationships: investing in two assets to hedge the movement of Canadian HPI, hedging using private securities such as mortgage-backed securities, hedging commercial real estate investment with sectors such as retail, and hedging offshore real estate investment.

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