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Causality analysis of the Canadian city house price indices: A cross-sample validation approach

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ABSTRACT

We examine pair-wise causality between 11 Canadian city house price indices. Monthly data that span from 1990:7 to 2015:9 are employed. The traditional Granger-causality framework is relaxed by following the cross-sample validation approach of Ashley and Tsang (2014). This allows us to overcome the ad hoc partition of the sample and examine predictability both "in" and "out-of-sample". Toronto emerges as the driving force of the Canadian Housing Market.

1. Introduction

House prices have been on the spotlight of research in recent years. One strand of the literature focuses on aggregate prices whereas another on regional housing prices. Variations in relative house prices could have an impact on both aggregate and regional economic activity (see for instance Meen (1999, 2016)). Investigating regional house prices is of interest as a regional fluctuation can have a ripple effect to the economy as a whole. Most of the studies so far focus on either the US or the UK housing market (see Holmes, Otero, and Panagiotidis (2011, 2017) for more). In this study, we focus on Canada where the housing market has seen a significant increase in the last years.

Interest in the Canadian housing market has accelerated. It was reported in the press that Canada is "nearing peak crazy in the housing market".[1] Given the increased attention on the Canadian housing market, it would make sense to investigate the regional driving force of this market. In other words, identify the direction of causality at the regional level, as this would allow us to establish the potential source of the ripple effect.

One of the challenges we face in this line of research is to assess the causality/predictability of a time series given the information about another one. Granger causality provides the traditional framework for this type of analysis. However a satisfactory in-sample fit is not always the best indicator for forecasting or for the behaviour out-of-sample. The partition between in-sample and out-of-sample could be an onerous issue especially in relative small samples. One way of alleviating the crucial issue of separating the sample in in-sample and out-of-sample is to consider all possible such cases. The latter is of importance for the robustness of Granger-causality tests that do not rely only on the in-sample estimation.

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[1] http://www.businessinsider.com/canadian-housing-market-close-to-peak-crazy-2016-8.

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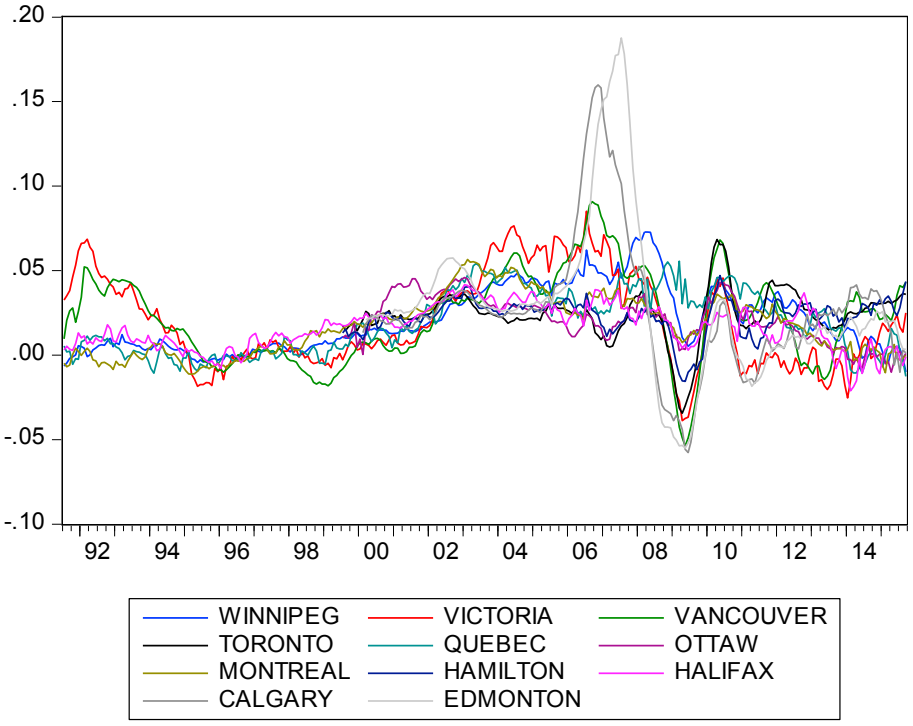

Fig. 1. Growth rates of regional Canadian House Price Indices.

A cross validation approach proposed by Ashley and Tsang (2014) (AT from now on) is employed in this study to overcome biases associated with the a priori partitioning of the sample. To the best of our knowledge, this is the first study in the housing market literature that is employing this methodology.

We conduct predictability tests that are based on the in-sample and out-of-sample fits using rolling windows. Good in-sample fits do not guarantee significant out-of sample predictability. Granger causality analysis assumes post-sample inference as in-sample fit could lead to anemic forecasting ability. Most studies would typically discard models when they do not perform well in-sample. This result has led to a post-sample implementation of Granger-causality and forecasts that are based on a wider sample. One would evaluate the performance of the estimated model (in-sample) over data not employed for this (out-of-sample).

These new tests are denoted as "cross-sample validation" or "CSV" Granger-causality tests. They essentially do what their name suggests: model parameters are estimated based on only part of the available data, while the rest data (the "Cross-Validation" data) is used for testing. It appears that these tests are more credible than common in-sample *F*-tests.

We follow the AT approach and explore the causality relationships between Canadian city housing prices indices. The contribution is twofold: (i) we examine causal relationships between Canadian House Price indices and (ii) we employ a recently proposed methodology that employs cross-sample validation.

The rest of this paper is organized as follows: Section 2 reviews the literature and Section 3 presents the data. The methodology appears in Section 4 and the results in Section 5. The last Section concludes.

Table 1
Summary statistics and ADF.

	Mean	Median	Max	Min	St. Dev.	ADF *p*-value	Obs
Calgary	0.0269	0.0240	0.1598	−0.0577	0.0388	0.0000	188
Edmonton	0.0294	0.0248	0.1876	−0.0550	0.0450	0.0000	187
Halifax	0.0163	0.0173	0.0417	−0.0210	0.0127	0.0000	291
Hamilton	0.0229	0.0247	0.0471	−0.0156	0.0105	0.0000	195
Montreal	0.0170	0.0165	0.0566	−0.0112	0.0173	0.0010	291
Ottawa	0.0212	0.0208	0.0459	−0.0101	0.0137	0.0000	195
Quebec	0.0187	0.0159	0.0555	−0.0126	0.0186	0.0000	291
Toronto	0.0241	0.0244	0.0684	−0.0344	0.0147	0.0000	195
Vancouver	0.0224	0.0237	0.0908	−0.0538	0.0265	0.0000	291
Victoria	0.0200	0.0119	0.0851	−0.0388	0.0276	0.0001	291
Winnipeg	0.0208	0.0146	0.0728	−0.0099	0.0192	0.0001	291