

Staff Analytical Note/Note analytique du personnel 2016-12

Assessment of the Effects of Macroprudential Tightening in Canada



by Martin Kuncil

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August 2016

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Acknowledgements

I would like to thank colleagues in the Bank of Canada's Canadian Economic Analysis and the Financial Stability departments as well as colleagues from the Data and Statistics Office for providing valuable inputs to this note. In particular, I would like to thank Gregory Bauer, Alexander Ueberfeldt and Katya Kartashova for helpful comments. All remaining errors are my responsibility.

Abstract

During the period of 2008 to 2012, the rules for government-backed mortgage insurance were tightened on four occasions. In this note, we estimate the effects through a simple econometric exercise using a vector error-correction model (VECM). Both a descriptive analysis of the raw data and an event-study analysis based on the output from the VECM suggest that while the tightening of the mortgage rules contributed to slower growth of both credit and residential investment, the effects were not always immediate. In some episodes, a tightening was followed by a temporary increase in residential mortgage credit growth (a finding that persists even after controlling for other events in the economy), possibly in anticipation of additional tightenings. In the long run, however, the residential mortgage growth rate was reduced. The consequences of rule changes were more persistent for residential mortgage growth than for the more volatile residential investment growth.

Bank topics: Credit and credit aggregates; Financial system regulation and policies; Housing

JEL codes: C32, E65, G28

Résumé

Entre 2008 et 2012, les règles applicables à l'assurance hypothécaire garantie par l'État ont été durcies quatre fois. Dans la présente note, nous analysons les effets de ce resserrement, dans le cadre d'une simulation économétrique réalisée au moyen d'un modèle vectoriel à correction d'erreurs (MVCE). Tout comme l'analyse descriptive des données brutes, l'analyse de l'étude événementielle fondée sur les résultats du modèle indique que les effets n'ont pas toujours été immédiats, bien que les durcissements successifs aient contribué au ralentissement de la croissance du crédit à l'habitation et de l'investissement résidentiel. Ils ont donné lieu dans certains cas à une hausse temporaire du crédit hypothécaire à l'habitation, un effet qui persiste même après la prise en compte d'autres phénomènes conjoncturels et qui est probablement causée par une réaction aux autres resserrements anticipés. Cependant, à long terme, le rythme de croissance du crédit hypothécaire a fini par baisser. Les conséquences des modifications apportées se sont fait sentir plus longtemps sur la croissance du crédit hypothécaire à l'habitation que sur la croissance de l'investissement résidentiel, plus volatile.

Sujets : Crédit et agrégats du crédit; Réglementation et politiques relatives au système financier; Logement

Codes JEL: C32, E65, G28

Introduction

During the 2008 to 2012 period, the rules for government-backed mortgage insurance were tightened on four separate occasions to support the stability of the mortgage and housing markets. This note estimates the effects of these regulatory changes on residential mortgage credit growth and residential investment growth by combining an econometric model with an event-study analysis.

An assessment of the effectiveness of these macroprudential tools is important in the current economic environment, which continues to be characterized by highly indebted households and a potential overvaluation in the housing market.¹ If instabilities in the mortgage and housing markets can be contained by macroprudential policies, then monetary policy may focus more on its price stability objective.²

This note contributes to a growing literature examining the effectiveness of macroprudential regulation.³ Recent cross-country studies (e.g., Cerutti, Claessens and Laeven 2015 and Akinci and Olmstead-Rumsey 2015) as well as studies on Canadian data (Krznar and Morsink 2014) find that macroprudential regulations were effective in reducing the growth of credit. However, the size of the effects can be influenced by various factors such as leakages to unregulated sectors⁴ and the potentially reduced ability of macroprudential policy in small, open economies to affect global risk premiums.⁵ While these factors may also apply in the context of the Canadian mortgage market, our study finds that the regulatory tightening did significantly lower the growth rates of mortgage credit and residential investment.

Overview of changes in regulation

During the period between 2008 and 2012, the rules for government-backed mortgage insurance were tightened on four separate occasions.⁶ The explicitly declared aim of the government regulatory changes was to “ensure stability and economic certainty in Canada’s housing market”⁷ in order to “encourage families to save by investing in their homes.”⁸ Thus, these measures should help prevent financial crises that may result from excessive residential mortgage credit growth and residential

¹ One recent Bank of Canada study suggests that Canadian housing markets may be overvalued by 10 to 30 per cent (Bauer 2014).

² Recent research suggests that monetary policy should not correct housing market imbalances (see, e.g., Alpanda and Ueberfeldt 2016), but that macroprudential policy is a more effective and less costly tool to deal with such issues (e.g., Alpanda and Zubairy 2014).

³ For a review see Damar and Molico (2015).

⁴ See, e.g., a study on UK data in Aiyar, Calomiris and Wieladek (2014).

⁵ See, e.g., Cerutti, Claessens and Laeven (2015) and Bauer, Pasricha, Sekkel and Terajima (forthcoming).

⁶ Tightening came after four consecutive rounds of easing of the rules for government-backed mortgage insurance in 2006 and 2007. These changes included a cumulative increase of the maximum amortization period from 25 to 40 years, an increase of the loan-to-value (LTV) ratio limit for new mortgages from 95 to 100 per cent, and an increase of the LTV ratio limit for mortgage refinancing from 90 to 95 per cent.

⁷ For a cross-country comparison of the house price evolution and overvaluation measures see Bauer (2014) and Schembri (2015).

⁸ Department of Finance archive of announcements (<http://www.fin.gc.ca/n11/11-003-eng.asp>).

investment growth.⁹ Since it is extremely difficult to directly estimate the probability of a financial crisis, or its response to regulatory changes, this note focuses on the effects of the changed regulations on residential mortgage credit growth and residential investment growth.

Table 1 lists the four key regulatory changes along with their announcement and implementation dates.¹⁰ The changes largely focused on increasing borrowers' equity in the housing collateral for insured mortgages by introducing lower limits on loan-to-value (LTV) ratios,¹¹ and lower maximum amortization periods. While the former raise borrowers' initial equity stake in their house, the latter increase the rate of accumulation of this housing equity over the life of the mortgage.¹²

Together, these measures should have resulted in lower mortgage demand and lower residential investment, because of effects on both the extensive and intensive margins. On the extensive margin, higher down payments for new mortgages due to a lower LTV ratio as well as higher mortgage payments due to a shorter amortization period make insured mortgages less affordable to households with low income or little savings. On the intensive margin, since all measures increase the required borrowers' equity in the housing collateral, they lower the size of mortgage funding available to borrowers.

Table 1: Key changes in government-backed mortgage insurance rules: 2008–12

Round of tightening	No. 1	No. 2	No. 3	No. 4
Announcement date	July 9, 2008	February 16, 2010	January 17, 2011	June 21, 2012
Implementation date	October 15, 2008	April 9, 2010	March 18, 2011	July 9, 2012
Maximum amortization period	40 to 35 years		35 to 30 years	30 to 25 years
LTV limit for new mortgages	100% to 95%			
LTV limit for mortgage refinancing		95% to 90%	90% to 85%	85% to 80%
LTV limit for investment properties		95% to 80%		

⁹ Rapid credit growth has been shown to increase the likelihood of financial crises over a long historical sample of developed countries (Schularick and Taylor 2012). Crawford and Faruqui (2012) study the factors responsible for increasing household debt in Canada. Bailliu et al. (2012) and Kartashova and Tomlin (2013) show that higher house prices increase household mortgage and non-mortgage debt, respectively. Cateau et al. (2015) and Schembri (2016) describe the risk of elevated household indebtedness for the financial stability, while Allen and Damar (2012) study the implication of indebtedness on household insolvency.

¹⁰ Crawford et al. (2013) and Schembri (2014) provide an overview of the residential mortgage market in Canada, a more detailed context for the regulatory changes and describe other changes in mortgage insurance rules that took place during the period between 2008 and 2012.

¹¹ In this category, more specifically, the LTV limits were gradually reduced from 100 to 95 per cent for new insured mortgages, from 95 to 80 per cent for mortgage refinancing, and from 95 to 80 per cent for investment properties.

¹² The maximum amortization period was gradually reduced from 40 to 25 years.

In this note, we test the hypothesis that each round of regulatory tightening lowered residential mortgage growth and residential investment growth.¹³ We also examine the cumulative effect of all of the changes.

Methodology

The analysis consists of two parts. The first is a descriptive analysis that studies the evolution of the two key variables of interest: residential mortgage credit and residential investment. We also describe movements in other variables, such as real gross domestic product (GDP), house prices, mortgage rates and chartered bank credit card loans. These variables are included in the analysis to take account of events (other than the tightening of mortgage insurance rules) in the real economy as well as in the credit and housing markets.

In the second part of the analysis, a reduced-form model is estimated. This econometric model includes residential mortgage credit and investment along with the control variables mentioned above. The model also includes dummies for the recession period 2008Q4–2009Q2 and dummy variables for each round of rule tightening.¹⁴ The latter are used to estimate the effect of the tightening on the two variables of interest.

Since many variables in the model are non-stationary and there is evidence of cointegration relationships among the variables, a vector error-correction model (VECM) is used for the estimation. The VECM method allows us to avoid spurious correlation between non-stationary variables while still accounting for the common stochastic trend within the variables. Therefore, it utilizes more information than alternative methods of dealing with non-stationary variables, such as simple de-trending.

Results

Descriptive analysis

Figure 1 depicts the evolution in the data of the two key variables (residential mortgage credit growth and residential investment growth) between 2006 and 2014 (in solid blue lines) along with the fitted values from the VECM model (in dashed black lines).¹⁵ The figure also shows the announcement dates (in green) and the implementation dates (in red) of the four rounds of rule tightening. We see that the rate of residential mortgage credit growth slowed from the 12 to 13 per cent range in the first half of

¹³ Higher borrower equity in their houses should also reduce the risk of mortgage default in an event of significant house price depreciation. But, because of lack of data, this note focuses only on the effects of regulation tightening on the two key variables of interest: mortgage credit and residential investment.

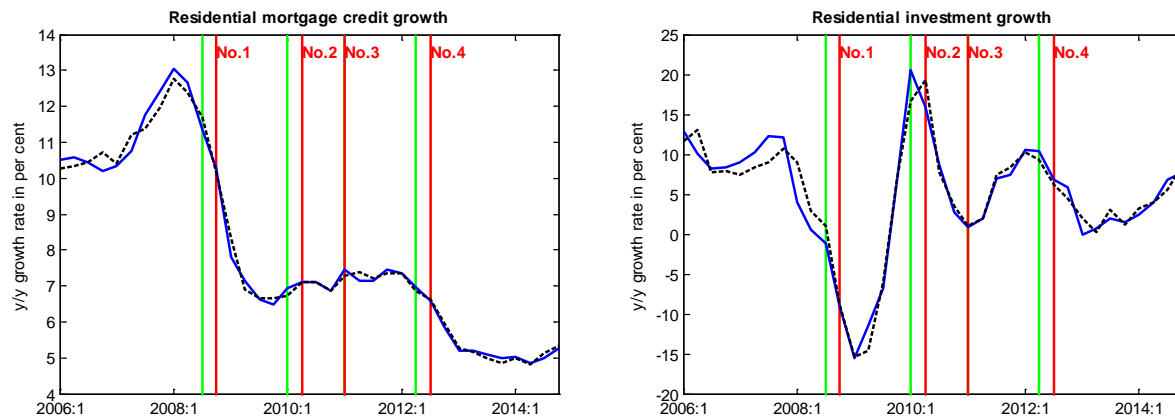
¹⁴ Dummy variables capture a persistent effect of regulation, as they are assigned a value of zero prior to the announcement of a particular round of regulation, and one otherwise. Both the descriptive and the event-study analyses seem to suggest that rule-tightening effects started already after the announcement, therefore dummies capture these dates.

¹⁵ Note that VECM is estimated in levels. Growth rates of fitted values are constructed from levels of fitted values of the respective variables.

2008 to around 7 percent between mid-2009 and mid-2012. The growth rate then declined further to around 5 per cent, where it has remained. Residential investment growth was more volatile. Its rate dropped from double-digit numbers in 2007 to negative double digits in the first half of 2009, before going back up in the first half of 2010. Since the second half of 2010, residential investment growth has fluctuated between 0 and 10 per cent.¹⁶

Figure 2 plots the evolution in the data of the control variables¹⁷ between 2006 and 2014, as well as the fitted values from the VECM model, together with the announcement and implementation dates of the four rounds of rule tightening.¹⁸ We can see that the growth rates of both real GDP and residential house prices were quite volatile. Notably, the growth of residential house prices turned negative during 2008 and real GDP growth became negative during the recession around the turn of 2008 and 2009. Mortgage interest rates declined significantly from the pre-2008 levels and have remained low. Growth of credit card balances outstanding steadily decreased from the peak at the end of 2007, until experiencing a trough with negative growth in 2011–13 and a recovery in 2014.

Figure 1: Evolution of variables of interest and rounds of regulatory tightening (quarterly frequency)



Note: Blue solid line shows the realized data, black dashed line shows fitted values from the VECM model, green and red vertical lines represent announcement and implementation dates of four rounds of regulatory tightening, respectively. The announcement and implementation of the third round took place in the same quarter.

Source: Bank of Canada

In Figure 1 we observe that after the first and fourth rounds of regulatory tightening, the growth rates of both key variables of interest decreased rapidly. However, the decrease following the first round may be driven by the recession,¹⁹ while the decrease following the fourth round was accompanied by an economic slowdown. Moreover, when real GDP returned to faster growth, residential investment growth recovered quickly in both cases. Residential mortgage credit growth increased after the second

¹⁶ Table A1 in the Appendix summarizes information on the average growth rates of the variables of interest before announcement and after the implementation of regulatory tightening.

¹⁷ Real GDP, house prices, mortgage rates and credit card loans growth.

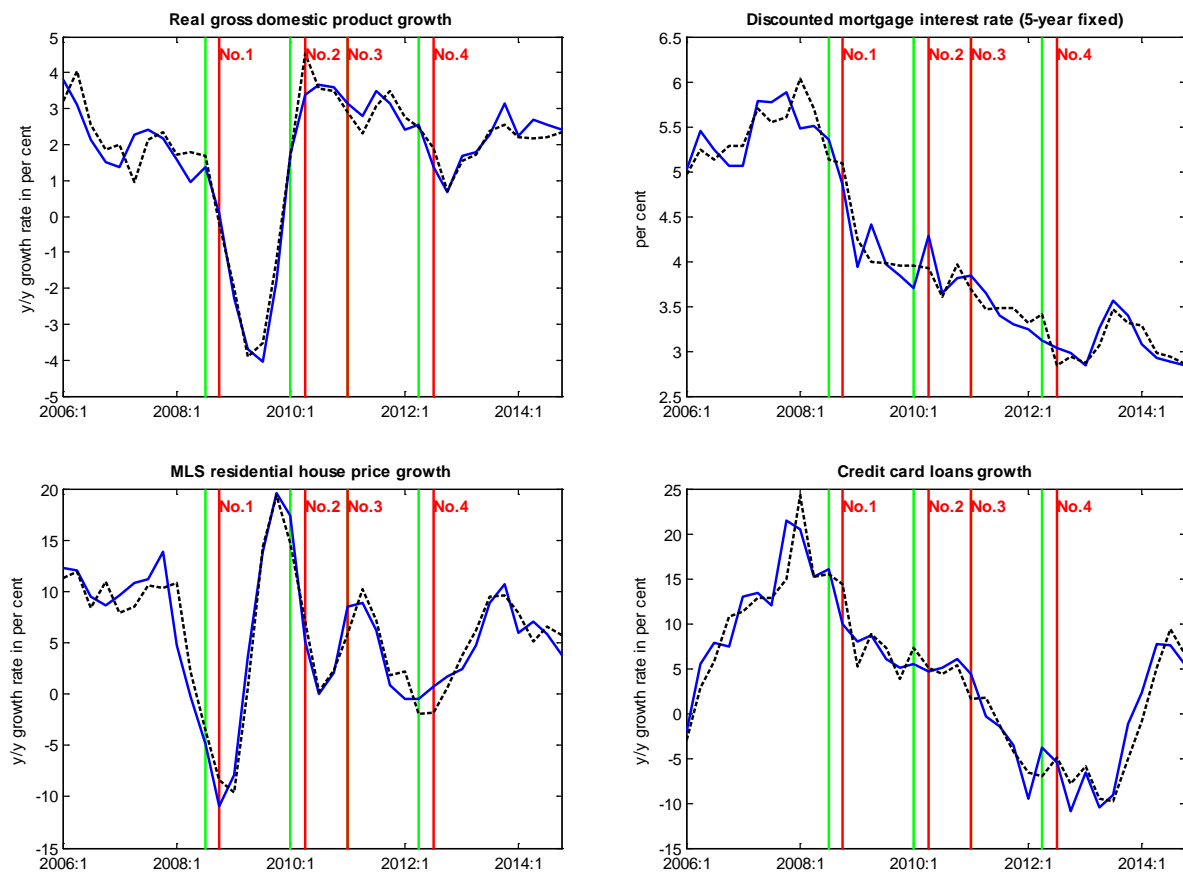
¹⁸ Figure 2 uses the same graphical representation of each element as Figure 1.

¹⁹ As shown in Figure 2, the period of negative real GDP growth in 2009 closely overlapped with the time period of negative residential investment growth and significantly lower residential mortgage credit growth.

and third rounds of regulatory tightening, and residential investment growth increased after the third round. These increases in growth rates of the key variables of interest could potentially be due to anticipation of further tightening, which could have raised demand for residential mortgage credit and led to temporary pickup in investment.²⁰ Additionally, the second round of tightening was likely influenced by the fast economic recovery.

While residential mortgage credit growth remained low following the multiple rounds of rule tightening, the growth of residential investment recovered to levels above those before the first round of tightening (see Figure 1). This suggests that the regulatory tightening effects were less persistent for residential investment growth, and that most effects have since dissipated.

Figure 2: Evolution of other variables and rounds of regulatory tightening (quarterly frequency)



Note: Blue solid line shows the realized data, black dashed line shows fitted values from the VECM model, green and red vertical lines represent announcement and implementation dates of four rounds of regulatory tightening, respectively. The announcement and implementation of the third round took place in the same quarter.

Sources: Bank of Canada, Statistics Canada, Canadian Real Estate Association and ING

²⁰ Note that in the National Accounts, residential investment includes not only new residential construction but also taxes associated with land transfers as a result of turnover of existing homes and home renovations, which could be affected by households' ability to refinance their existing mortgage loans.

Estimation of rule-tightening impact: VECM and event-study analysis

More formal tests of the effects of rule tightening, which explicitly control for the evolution of the economic environment, are conducted with the VECM. The VECM is estimated in levels on quarterly data from 2000Q1 until 2015Q1. The model fits the data relatively well, with the R^2 statistics ranging from 0.67 in the equation for the difference in mortgage rates to 0.996 in the equation for the difference in mortgage credit.

Figure 1 and Figure 2 show graphically the fit of the VECM model. While the overall fit is good, in some instances the model does not perfectly capture the magnitude and timing of peaks and troughs for more volatile time series such as residential investment growth or residential house price growth. For the mortgage rate variable, the model fits its longer-term fluctuations and trends but does not capture short-term fluctuations well.

To estimate the effects of regulatory tightening in the VECM, we introduce dummy variables—one for each round of regulatory tightening. Recall that the dummy variable is set to one after the announcement of the regulatory tightening; therefore, it captures a persistent effect of rule tightening. The null hypothesis is that the coefficients on the dummy variables are zero; i.e., regulatory tightening has no persistent effect on the variables of interest.

Table 2 reports estimated coefficients on the regulatory dummy variables in the equations for residential mortgage credit and residential investment, both in absolute value and as a percentage of the level of the respective variable. The findings suggest that the first, second and fourth rounds of regulatory tightening each had a significant persistent impact on residential mortgage credit, which can be expressed as an annualized quarterly growth effect of the size between -2.3 and -2.8 per cent.²¹ The positive coefficient for the third-round dummy is consistent with the previously mentioned hypothesis of the anticipation of further tightening, which could have led to a temporary increase in mortgage credit.

In the case of residential investment, the dummy variable coefficients are negative for all rounds of regulatory tightening, though only statistically significant in the first round, with a persistent impact equivalent to an annualized quarterly growth effect of -21.5 per cent.²² This could be due to the more volatile nature of residential investment, implying large standard errors. It is also consistent with the conjecture from the earlier descriptive analysis that the effects on residential investment may be short-lived.

²¹ The persistent impact is on the quarterly difference in residential mortgage credit. The percentage evaluation of the impact is expressed with respect to the level of residential mortgage credit prior to the announcement of the particular round of regulatory tightening. The obtained quarterly growth effect is then annualized.

²² This point estimate is suspiciously high and could be driven by another change in the economic environment in 2008, a turbulent year affected by the global financial crisis, which is not captured by the control variables already included in the VECM.

When imposing the equality of the dummy coefficients across all rounds of regulatory tightening and jointly testing their significance,²³ we find that the effects of regulatory tightening are significantly different from zero for both residential mortgage credit and residential investment. The VECM model captures persistent effects of rule tightening. Therefore, at the announcement of the last round of regulatory tightening, the cumulative impact of all four rounds on residential mortgage credit growth can be expressed as an annualized quarterly growth effect of -4.6 per cent.²⁴

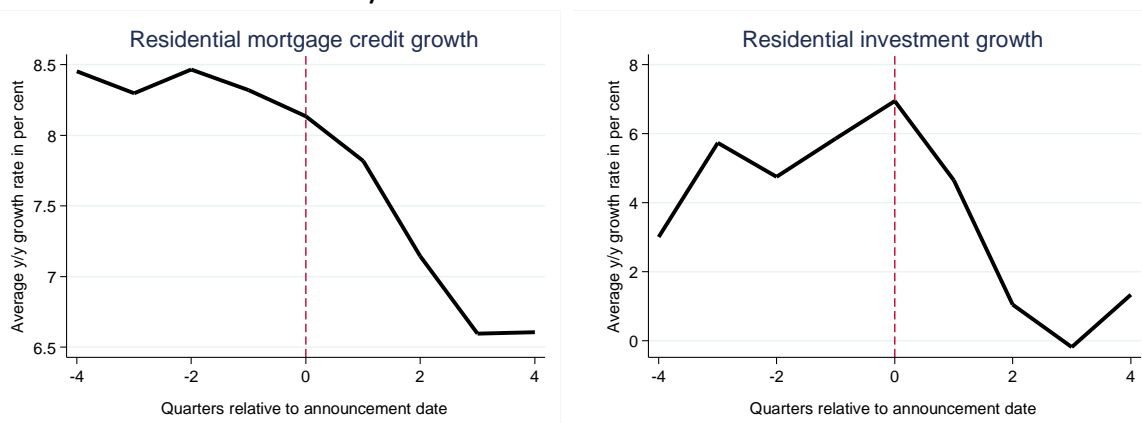
Table 2: Coefficients of dummy variables in the VECM model

	Equation for difference in residential mortgage credit			Equation for difference in residential investment		
	Coefficient	s.e.	Annualized quarterly effect in per cent of the level ¹	Coefficient	s.e.	Annualized quarterly effect in per cent of the level ¹
Reg. tightening no. 1	-5521***	1964	-2.55%	-6389***	2272	-21.47%
Reg. tightening no. 2	-6691***	2320	-2.78%	-2634	2685	-9.40%
Reg. tightening no. 3	5615***	1422	2.23%	-527	1646	-1.88%
Reg. tightening no. 4	-6625***	1908	-2.36%	-2245	2207	-7.00%

*** Symbol indicates statistical significance at 1 per cent level.

¹ We report the effect of the dummy on the relevant variable as an annualized quarterly effect in per cent. The quarterly effect is obtained by dividing the dummy coefficient by the level of the relevant variable in the quarter preceding the announcement of the particular round of regulatory tightening.

Figure 3: Average growth rate of variables of interest around announcement dates of regulatory tightening (fitted values from the VECM model)



The effects of the regulations on the variables of interest can also be shown graphically in an event-study analysis. The average annual growth rates of the fitted values for residential mortgage credit and residential investment, before and after the announcement of the regulatory tightening, are plotted in Figure 3. The event window spans four quarters both before and after the announcement period. Since there are only four events, the statistical significance of differences in the averages is difficult to ascertain. Nevertheless, the point estimates suggest that average annual growth rates of both mortgage

²³ Note, however, that equality of dummy coefficients can be rejected using the appropriate tests.

²⁴ The coefficient for the cumulative effect in the equation for difference in residential mortgage credit is -13222.5 with a standard error of 2990. Note that we do not report the cumulative effect for residential investment, since the effects of all rounds except the first are not statistically significant.

credit and residential investment decrease after the announcement of regulatory tightening. The drop in residential investment is more dramatic but also less persistent than residential mortgage credit.

The proposed interpretation of our analytical results is subject to a number of potential caveats. We use several variables to control for various events in the real economy, housing and mortgage markets. But our analysis omits potentially non-negligible effects of continued population aging on the demand for mortgage credit, the spillovers from regulation targeting insured mortgages to the demand for uninsured mortgages, or the role of foreign investors in supporting the residential investment in the long run. The assessment of the role of these alternative factors is left for future research.

Conclusion

This note reviews the effects of regulatory tightening for insured mortgages, which took place on four occasions in the period between 2008 and 2012. It provides a descriptive analysis of the changes in the residential mortgage credit and residential investment around the announcement and implementation dates of the regulatory tightening. It also reports estimation results for the impact of the rule tightening, using both a VECM and an event-study analysis.

Both the descriptive and the event-study analyses suggest that several rounds of rule tightening had a mitigating effect on both residential mortgage credit and residential investment growth, even though these effects might not have always materialized immediately. The average growth rate of residential mortgage credit declined substantially over the period of the four rounds of regulatory tightening. Furthermore, residential mortgage credit growth currently remains low, indicating that the effect of regulatory tightening was probably persistent. In the case of residential investment, a large drop in the average growth rate was observed after most rounds of regulatory tightening. However, the effects seem to be less persistent for this very volatile time series, as its growth has recovered to the average level observed before all the rounds of regulatory tightening.

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Appendix

Table A1: Comparison of average growth rates before announcement and after implementation

Regulatory tightening	Residential mortgage credit growth		Residential investment growth	
	Period	Average of y/y growth in per cent	Period	Average of y/y growth in per cent
Long-term average prior to the announcement of first tightening	Jun-04 : Jun-08	10.72	2004Q2 : 2008Q2	9.32
Round no. 1 (amortization 40y to 35y and LTV for new mortgages 100% to 95%)				
Year before announcement	Jun-07 : Jun-08	12.37	2007Q2 : 2008Q2	7.10
Year after implementation	Oct-08 : Oct-09	7.97	2007Q3 : 2008Q3	3.74
Difference in p.p.		-4.40		-3.36
Round no. 2 (LTV for mortgage refinancing 95% to 90% and LTV for investment properties 95% to 80%)				
Year before announcement	Jan-09 : Jan-10	7.18	2008Q4 : 2009Q4	-7.17
Year after implementation	Apr-10 : Apr-11	7.09	2010Q2 : 2011Q2	3.56
Difference in p.p.		-0.08		10.73
Round no. 3 (amortization 35y to 30y and LTV on mortgage refinancing 90% to 85%)				
Year before announcement	Dec-09 : Dec-10	6.88	2009Q4 : 2010Q4	11.79
Year after implementation	Mar-11 : Mar-12	7.35	2011Q1 : 2012Q1	6.72
Difference in p.p.		0.47		-5.07
Round no. 4 (amortization 30y to 25y and LTV on mortgage refinancing 85% to 80%)				
Year before announcement	May-11 : May-12	7.32	2011Q1 : 2012Q1	6.72
Year after implementation	Jul-12 : Jul-13	5.63	2012Q3 : 2013Q3	2.09
Difference in p.p.		-1.69		-4.63
Long-term average after to the implementation of last tightening	Jul-12 : May-15	5.31	2012:Q3 :2015Q1	3.96