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PRUDENTIAL POLICIES, CREDIT SUPPLY AND HOUSE PRICES: EVIDENCE FROM ITALY

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Abstract

We estimate the causal effect of a mortgage supply expansion on house prices by using an exogenous change in prudential regulation: the abolition in 2006 of the limit on banks' maturity transformation. After the repeal of the prudential rule, credit supply increased only for those banks that were previously constrained by the regulation, while it remained unchanged for the other banks. Such differential response rules out demand-based explanations and fully points to the abolition of the rule as being an exogenous shock, which we exploit as an instrument for mortgage supply expansion. We estimate the elasticity of house price growth with respect to new mortgage credit to be close to 5. Our results also show that the effect of a mortgage supply expansion on house prices significantly differs across municipality and borrower characteristics.

JEL Classification: G21, G28, R21, R31.
Keywords: prudential policy, credit supply, house prices, financial constraints.
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Contents

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1 Introduction[1]

Major financial distress episodes tend to be associated with real-estate price bubbles, as for example in the United Kingdom and Japan in the early 1990s and in the great financial crisis.

The cost of "twin" (credit and real estate) crises is larger and the recovery from leveraged property busts takes longer both with respect to non-credit housing bubbles and equity bubbles with or without credit (Jordà et al., 2015).

The ultimate objective of macroprudential policy is to prevent and mitigate systemic risk, which includes strengthening the resilience of the financial system and smoothening the financial cycle.

Excessive house price growth can be fuelled by unsustainable household indebtedness and followed by a vicious feedback loop between credit contractions and declining house prices. Although house price inflation *per se* is not a target of macroprudential policy, central banks and macroprudential authorities seek to counter financial stability risks created by house price booms by ensuring credit growth and leverage are not excessive. Furthermore, the concept of financial cycle is crucial for a counter-cyclical macroprudential policy, and the real estate component in the financial cycle is of paramount importance. Understanding how credit affects house prices is therefore key for policymakers.

Identifying the nexus between credit supply and house prices is however far from trivial. The supply of mortgages depends on the price of houses used as collateral. Also, credit responds endogenously to current and expected economic conditions. Both reverse causality and omitted variable issues might bias the analysis. In this paper, we are able to address these problems by combining several factors.

First, we rely on an exogenous shock to house prices: the abolition in 2006 of a regulatory limit on Italian banks' maturity transformation, aimed at enhancing the level plain field with other banks operating in the European single market.[2] Second, we move a step forward relative to most of the existing literature investigating the consequences of banking deregulation, for which the identification typically rests on the fact that the deregulation

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[2]Such a regulation was in fact unique in the European Union.

is motivated by political reasons (e.g. Greenstone et al., 2020 and Adelino et al., 2012), by studying a case where the regulatory change is driven by economic considerations. Third, we provide evidence, as in Favara and Imbs, 2015, that mortgages increase only for banks actually affected by the deregulation, and not for the others. Such differential response rules out demand-based explanations and clearly identifies the abolition of the maturity transformation as an exogenous credit supply shock.

Since the policy change we are studying is binding on lenders and not on households, there is the possibility that the impact we detect reflects only a reallocation towards relieved lenders and not an actual increase in mortgage credit. To exclude this possibility we study the effect on overall lending by aggregating mortgage credit by time (semester) and municipalities. We show that in municipalities with a greater presence of affected banks new mortgage supply was more pronounced; where all the lenders were affected, mortgage loans were 16 percent higher. These estimates constitute our first stage regressions: we instrument the supply of mortgage credit with the interaction between the presence of lenders affected by the deregulation and the deregulation indicator for the period after April 2006, when the maturity transformation limit was repealed. We show that house prices accelerate following the increase in credit. Specifically, we estimate that the elasticity of house price growth to new mortgage credit is close to 5. Our results also show that the mortgage supply shock we identify transmits to house prices through higher demand for housing, as the response of house prices is stronger where housing supply is inelastic compared to municipalities where construction is responsive and supply is relatively more elastic. Furthermore, our findings suggest that the effect of the prudential repeal is channeled into the real economy also through a relaxation of the borrowers' financial constraint. Mortgage lending increased more in municipalities where a higher number of borrowers was rationed before the deregulation. The positive mortgage supply shock allows marginal borrowers to enter the housing market. Since the housing demand of constrained borrowers is more elastic, we would expect also the elasticity of house price growth to be more reactive but this is not the case. The elasticity seems instead less reactive, in a way that is consistent with a higher housing supply elasticity that balances the more elastic demand.

Finally, we also investigate the dynamics of the adjustment process that followed the change in the prudential regulation. While our results suggest that the effects of the credit supply shock persist, consistently with the argument of Kiyotaki and Moore, 1997, the main driver of the persistence does not appear to be the dynamic interaction between credit and asset prices that allows borrowers to have larger mortgage loans, but instead the higher probability to obtain a mortgage. It is also worth noting that, the absence of a persistent increase in the average mortgage amount, together with the plateau reached after some time by the cumulative rise in credit and in house price, suggest that the interaction between credit and asset prices fades out and does not lead to a housing market bubble.

A number of empirical papers have stressed the role of mortgage finance in amplifying housing cycles, (Mayer et al., 2009; Mian and Sufi, 2009; Favara and Imbs, 2015; Jordà et al., 2015; Bhutta et al., 2017; Di Maggio and Kermani, 2017). However, the role of positive credit supply shock could deeply differ over the cycle, for instance, Barone et al., 2020 find no role for mortgage credit during busts. By accident, the abolition of the maturity transformation limit came in the midst of a turning point of the real estate price cycle, constituting an example of loosening of a regulatory constraint after the cycle has reached its peak and enters the descending phase. Therefore, our work also contributes to the literature on the effect of macroprudential easing, supporting the use of countercyclical policies to sustain lending.

The remainder of the work is organized as follows. Section 2 presents a review of the related literature. Section 3 describes the Italian regulatory limit on bank maturity transformation and the prevailing macroeconomic environment at the time of the deregulation. Section 4 presents the data. Section 5 introduces the empirical strategy. Section 6 evaluates the impact of the deregulation on mortgage credit. Section 7 assesses the causal effect of the credit supply shock on house prices. Section 8 concludes.

2 Related Literature

The literature on the effects of credit shifts on house prices is quite limited, also due to the difficulty in dealing with the issue of reverse causality.

As a result of these challenges, only a few papers have estimated the impact of a change in credit availability on house prices, and mostly for the United States. In particular, Adelino et al., 2012 test the impact of easier access to credit by using the changes in the conforming loan limit (maximum size of a mortgage that can be purchased or securitized by Fannie Mae or Freddie Mac) as an instrument for exogenous variation in the cost and availability of credit. The authors find that the pricing of houses that can be financed more easily using a conforming loan increases by 1.16 dollars per square foot (for an average price per square foot of 220 dollars) between 1998 and 2005; the increase is lower but still significant after controlling for house characteristics. Moreover, the estimated effect of the conforming loan limit on house prices is stronger in the first half of the sample than in the second half (2002-2005), which is the period when jumbo loans became cheaper and easier to obtain and also when second lien mortgages became widely available making the conforming loan limit less relevant.

Rajan and Ramcharan, 2015 by examining the farmland price boom and bust in the US in the 1920's find that credit availability likely has a direct effect on inflating land prices. In particular, to address the issue of reverse causality between land prices and credit, the authors use as instrumental variable the number of banks that were active in 1910 (this is due to the fact that they perform a 1920 cross-sectional analysis). They also show that the number of banks reflects the availability of credit by using interesting aspects of bank regulation in the early 20th century (inter-state bank lending was not allowed in the US).

Similarly, Favara and Imbs, 2015 rigorously establish the existence of an exogenous credit supply shock in the US motivated by the branching deregulations between 1994 and 2005. The authors use these deregulations as instruments to estimate the causal effect on the price of houses. They estimate a house price growth rate elasticity to the growth rate of credit of 0.12, which peaks two years after the credit shock at 0.2.

As regards Italy, Nobili and Zollino, 2017 have simulated the effect of a credit supply negative shock (i.e. a 0.5% increase in the bank capital ratio) on house prices using a structural model for the housing and credit markets. The resulting fall in house prices begins one year after the shock and is persistent over time.

Barone et al., 2020, inspired by Greenstone et al., 2020[3], construct an exogenous and fully data-driven indicator of mortgage supply and show that outstanding mortgages do affect house prices: a 10% increase in outstanding mortgages entails around a 1% rise in house prices. Their estimates also suggest that the effect is larger during the expansionary phase of the housing cycle and heterogeneous across cities.

In this paper, we follow Favara and Imbs, 2015 in the identification strategy while exploring whether the positive credit supply shock speeds up house prices. Specifically, thanks to the abolition of the prudential rule limiting banks' maturity mismatch we do not have to build a credit supply shock indicator and we are able to empirically estimate the elasticity of house price growth to new mortgage credit.

[3]Exogenous credit supply shocks are indeed rare events. To overcome this problem Greenstone et al., 2020 propose to isolate supply-side shocks by estimating changes in bank lending with bank and county fixed effects and then using the estimates of the bank fixed effects to construct a county-level measure of the predicted lending supply shock.

We also contribute to the literature on the pass-through of easing regulatory constraints, particularly those due to macroprudential policies. Many of the existing estimates are based on aggregate data while those using microdata focus mainly on corporate lending (for instance Behn et al., 2016 and Jiménez et al., 2017) or prudential restrictions (see among others Basten and Koch, 2015, Acharya et al., 2020, and Peydró et al., 2020). This is not only due to the scarcity of administrative data on mortgages but also to the relative recency of loosening measures, especially in advanced economies. Araujo et al., 2020 review over 6000 estimates, their findings include relatively stronger impacts for tightening than easing actions. However, within the set of papers they analyze, the bulk of the evidence comes from tightening episodes with fewer papers exploring loosenings.

3 Regulatory change and economic conditions

The limit on banks' maturity transformation was in place in Italy for almost sixteen years. The abolition was decided to enhance the harmonization of the Italian regulation with the European framework. While independent of economic conditions, the abolition of the limit came amid a turning point of the real estate price cycle, providing the ideal experiment to explore the effects of loosening a prudential constraint after the cycle has reached its peak and enters the descending phase. In this chapter, we describe the maturity transformation limit, the reasons guiding its abolition, and the economic environment in which the decision displayed its effects.

3.1 The Italian regulatory limit on bank maturity transformation and its repeal

The institutional reforms of the banking system that took place in Italy at the beginning of the 1990s cleared the way to the universal banking model by abolishing the institutional separation between financial intermediaries providing long-term financing and those focused on short- and medium-term lending.

The institutional despecialisation of the banking system was accompanied by the introduction in 1993 of a regulation to limit bank maturity transformation (*Limite alla trasformazione delle scadenze*). The aim of the regulation was to prevent banks from excessively growing their long-term exposures without a proportional lengthening of the maturity of their liabilities, limiting therefore the possibility to incur in excessive maturity transformation and structural funding risk.[4] In particular, the limit consisted of two rules: the first capped the sum of real estate and investments holdings to the bank's regulatory capital (rule n.1); the second limited the amount of medium- and long-term assets to a weighted funding mix by maturity (rule n.2). The rationale for this regulation was that banks engaged in short-term lending before the institutional reform could not have been adequately prepared to manage the change in their risk profile stemming from an increase in long-term lending after the reform, i.e. approaching a universal banking model.

More formally the regulation consisted of the following rules:

1. real estate investments + investments in associates $\leq$ regulatory capital

2. long-term assets + 0.5 medium-term assets < surplus + non-maturing liabilities + long-term liabilities + 0.5 medium-term liabilities + 0.25 (short-term customer liabilities + interbank liabilities)

where:

- surplus = regulatory capital − real estate investments − investments in associates

- non-maturing liabilities are the employee pension funds and the risk funds that exceed the portion that can be accounted for in the regulatory capital

- long-term assets and liabilities have a maturity longer than 5 years, medium-term assets and liabilities have a maturity between $1\frac{1}{2}$ and 5 years, short-term customer liabilities have a maturity up to $1\frac{1}{2}$ year, and interbank liabilities have a maturity between 3 months and $1\frac{1}{2}$ year.

Maturities were referred to the residual contractual maturity - the relevant time dimension to measure maturity transformation - and not to the time to re-pricing, more appropriate for interest rate risk measurement.

The financial innovation, the developments of financial markets, the diversification and the stabilization of the funding sources, as well as the evolution of the risk control techniques that occurred in the 2000s enabled Italian banks to improve their management of the risks related to maturity imbalances.

[4]The regulation was applied at consolidated level only, in order to make it neutral with respect to banks' organizational choices.

These developments made the need for a limit on maturity transformation less compelling. The regulation was abolished in April 2006 (please refer to the supervisory instructions by Banca d'Italia, 2006b).[5] The deregulation was also aimed to foster the simplification of the prudential regulation and its harmonization with the EU framework, as the rule was an unicum of the Italian banking system (Draghi, 2007). It also reduced banks' operational constraints and pursued higher levels of banking system efficiency.

3.2 Economic conditions

In the five years before the regulatory change (i.e. 2001-2005) the average annual GDP growth was barely half of the rate observed during the previous cyclical downturn, that occurred between the peak of 1988 and the trough of 1993 (Banca d'Italia, 2006a and Figure 1 upper panel). In a prolonged phase of weak economic activity, financial conditions of Italian households, firms and banks remained solid as a whole. The demand for loans was fueled above all by households and by sectors connected with the property market. In 2006 bank lending to households continued to grow, although at a lower rate than in 2005. Almost half of the slowdown in lending had been attributed to the slower increase in property prices (Banca d'Italia, 2007). The rate of growth in lending to households for house purchases, though declining in 2006 with respect to 2005, remained however high (Figure 1 lower panel).

In 2005 house price was at the peak of the cycle that started at the end of 2000. The decline in the cost of money and the recovery in households' purchasing power fueled a prolonged upswing in house price, which began to show signs of slowing at the end of 2005 (Figure 2).[6] Therefore, the abolition of the maturity transformation limit in April 2006 coincided with the turning point of the property price cycle. It provides the ideal experiment to explore the effects of easing prudential constraint at a turning point.

4 Data

4.1 Banks' mortgage lending and balance sheet data

Our main data source is the Italian Credit Register (CR) that includes very detailed information on the end-of-month bank debt exposure for each

[5]The first rule was left in place but it is so loose to be extremely unlikely to represent a binding constrain for banks in normal operating conditions. It was also no more referred as a limit on maturity transformation.

[6]Muzzicato et al., 2008 explore Italian housing market cycles since the late 1960s.

borrower whose total debt from a bank is at least euro 75,000.[7] This very detailed data allows us to define an accurate proxy for the volume and the number of new mortgages granted by each bank, in each quarter, accounting for households' residence.[8] First, we identify mortgages by selecting only households loans that: i) have a maturity longer than 18 months, ii) are backed by real estate collateral, and iii) have an amount of at least euro 75,000. Then, by exploiting the loan level dimension, we are able to identify the loan inception date by checking quarter by quarter whether there is a change in the household-bank exposure.

What is critical to our perspective is to verify whether the abolition of the regulatory limit caused a credit supply shock exogenous to credit demand and to the housing market and, if this is the case, to estimate the elasticity of house prices to credit. While we have information on new mortgage for each borrower, house prices are not available at the same level. However, we obtain a reliable measure of house prices at the borrower's residence level and, even aggregating our dataset from the bank-household to the bank-municipality level, we preserve a very granular dimension. There are about 8000 municipalities in Italy, their average extension is very low (around 37 square kilometers) the median extension is 22 square kilometers and only 5 percent exceed 120 square kilometers.

As in Favara and Imbs, 2015 we also use as an additional measure of credit supply the number of denials. We exploit information about loan requests, which are collected through the preliminary information service of the CR.[9] We collect the loan requests that each bank posts on households. Information on whether the loan request is to purchase a property is not reported. However, this is the more frequent event. For the period we analyze the largest portion of households' debt, around 70 percent, consisted of loans for house purchase (Banca d'Italia, 2008 and Banca d'Italia, 2010). The number of denials is then computed following Favara and Imbs, 2015 as the number of applications net of the number of originations. For our purpose, the number of denials will only provide additional evidence while our preferred indicator remains the new mortgage loans.[10]

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[7]Starting from the reports of January 2009 the census threshold of the Credit Register has been reduced from euro 75,000 to euro 30,000.

[8]The flow of new mortgages is a far more accurate measure of the actual supply of credit than outstanding mortgages, whose growth rate is also affected by mortgage repayments.

[9]The CR collects the requests of information each bank posts on each borrower. Banks automatically receive information about borrowers they are currently lending to and can ask the CR for information about borrowers they are not lending to. By law, banks are allowed to do that only in certain circumstances that are tracked in the CR.

[10]Bank of Italy also collects information on the interest rate charged on mortgages at the individual level. However, this is done for a sample of banks, which includes only a

To assess whether the abolition of the regulatory limit on bank maturity transformation, which occurred in the second quarter of 2006, had an impact on mortgages supply, we restrict our sample to a two-year window around the shock, i.e. from 2004q2 to 2008q2.[11]

We check the consistency of our estimation sample - based on the new mortgages that we identify using CR data - by comparing it with the observed values of new mortgage loans reported by the banks in the supervisory reports. As a whole, our sample covers around 70 percent of the new mortgage lending observed, closely tracking its dynamic with a correlation of 87 percent (Figure 3 upper panel).

To implement our identification we exploit differences between banks that were constrained by the regulation, i.e. non-cooperative banks (Non-BCCs), and those for which the maturity transformation limit not binding, i.e. cooperative banks (BCCs). Table 1 provides descriptive statistics on new mortgage lending at the municipality level for the two groups of banks.

The target-dependent variables are the natural logarithm of the amount and of the number of new mortgage loans, as well as of the number of denials, granted by bank i in municipality z between quarter t and $t-1$. Over the period under analysis, the 186 non-cooperative banks have granted an average number and an average amount of new mortgages per quarter t and per municipality z 1.5 times higher than the 365 cooperative banks, while the number of denials was in line with that of the cooperative banks. After the deregulation the average number of originations by the non-cooperative banks remained broadly stable (at about 3) while the average amount of new mortgages increased (from 446 to 459 thousands euros). For the cooperative banks, instead, both the average number and the average amount of new mortgage loans have slightly decreased after 2006q2 (respectively at about 2 and 303 thousands euro).

Table 2 presents the summary statistics for the banks' balance sheet controls used in the analysis: total assets, mortgage loans weight (i.e. the weight of the stock of mortgage loans over total assets), the average risk weight of the bank portfolio, leverage (i.e. the equity-to-assets ratio) and operational costs (i.e. the ratio of operational costs to total assets). Data are half-yearly at the bank level and have been interpolated to obtain quarterly observations. The main difference between the two categories of banks concerns size, which is significantly larger for non-cooperatives, as expected. Cooperative banks instead are more capitalized (i.e. their leverage ratio

few cooperative banks.

[11]Closing our sample of analysis to June 2008 also allows us to not include the great financial crisis.

is higher compared to non-cooperative banks) and have a higher share of mortgage loans over total assets. Regarding riskiness, the non-cooperative banks have a lower average risk weight of their loan portfolio, which can be at least in part due to the fact that some of the largest banks use the Basel II internal-ratings based approach to compute risk-weighted assets, which typically yields lower risk-weight that the standardized approach. Notwithstanding these differences, as we will show in the following, new mortgage loans would evolve similarly for the two groups of banks, absent the regulatory shock.

4.2 House prices

House price data are provided by the Osservatorio Mercato Immobiliare (OMI), which collects information at municipality level.

Table 3 presents the descriptive statistics of house prices expressed in levels (log of house price index) and growth rate for the 4642 Italian municipalities used in the regressions out of a total of about 8000.[12] House price has increased overall from the pre-deregulation period to the post-deregulation period: the increase occurred in particular in the 1950 municipalities where the market share of the non-cooperative banks before the deregulation was above the median (treated municipalities) while in the other 2692 municipalities (control municipalities) the price increased less. The average house price growth rate decreased overall from the pre-deregulation period to the post-deregulation period: however, it remained stable in the treated municipalities while it decreased in the control municipalities. All in all Table 3 highlights heterogeneous house price dynamics across municipalities according to the market share of the affected banks.

We check whether our estimation sample is informative of the house price path observed at the aggregate level. The lower panel of Figure 3 shows that an aggregate indicator of house price growth constructed on our estimation sample closely tracks the observed dynamic. The correlation between the sample and the observed house price growth is 76 percent.

[12]The municipalities used in the regressions are those for which there are on average at least two originations per quarter, in addition to all the control variables. The results are robust to the use of all municipalities (results available upon request).

5 Research Design

To assess the impact of the credit supply shock on house prices, we use a difference-in-difference (DD) strategy that compares outcomes in municipalities where the banks affected by the regulatory change had a larger market share before the event to those where they had a smaller market share. This empirical strategy and the related proof of a causal effect of credit supply on house prices rests on three key identification assumptions:

1. The repeal of the maturity transformation limit is uncorrelated to the housing market and to the current and expected economic conditions. The abolition of the prudential limit allowed the banks that were actually constrained by the limit to increase the supply of mortgages to households. Such an increase would not have occurred without the regulatory change (shock exogeneity).

2. The market share of the affected banks in a given municipality before the regulatory change is positively related to their supply of mortgages in the same municipality after the deregulation (first stage assumption).

3. Conditional on a set of controls, the presence of affected banks in a given municipality before the regulatory change is uncorrelated with (i) local credit demand shocks, (ii) local credit supply shocks affecting other lenders, and (iii) omitted determinants of local real outcomes. Thus, credit and housing market outcomes in the municipalities where the affected banks have higher and lower market shares would have evolved similarly in the absence of the credit supply shock caused by the removal of the prudential constraint (parallel trends/exclusion restriction assumption).

Holding these identification assumptions, our DD estimates will have a valid causal interpretation.

We test three difference-in-difference related hypotheses:

Hypothesis H1: The abolition of the prudential rule leads non-cooperative banks to increase mortgage supply compared to cooperative banks. Differential responses to the repeal of the limit would rule out any demand-based explanations and establish the abolition as a fully exogenous credit supply shock.

Hypothesis H2: There is a positive relationship between the initial lending by the affected banks in a municipality and the subsequent mortgages originations in that municipality.

Hypothesis H3: There is a positive relationship between the initial presence of affected banks in a given municipality and the subsequent changes in house prices.

By combining H2 and H3, we can obtain an instrumental-variables (IV) estimate of the impact of a mortgages supply shock on housing prices.

Although our primary focus is on the results of the IV estimation, it is critical to our aim to establish that the abolition of the maturity transformation limit constitutes an exogenous credit supply shock. We devote the next section to formally test this assumption.

6 Banks' maturity transformation, deregulation and mortgages

In what follows we present the identification strategy, the estimation set-up, and the results of the evaluation of the impact of the maturity transformation deregulation on banks' mortgage supply (H1).

6.1 Identification

The decision to repeal the limit on banks' maturity transformation constitutes the perfect candidate for an exogenous shock to mortgage supply as it was fairly exogenous to economic conditions, occurred on a precise date without anticipation effects, affected mortgages supply and had a heterogeneous effect across banks.

A fairly exogenous shock: The limit on banks' maturity transformation was established for prudential purposes after the institutional reforms of the baking system that occurred at the beginning of the 1990s (see Section 3.1 for details). After almost a decade many factors, such as the stabilization of the funding sources and the evolution of the risk control techniques, enabled banks to improve the management of the risks related to maturity imbalances. The rule was obsolete and no longer needed to ensure banks' stability. Therefore the Italian central bank decided to repeal the limit on maturity transformation enhancing the harmonization of the Italian regulation with the European framework (Draghi, 2007). The decision was independent of local economic conditions and indeed unrelated to housing price dynamics.[13]

Clear timing: The Bank of Italy did not carry out any formal consultation with the banking industry before amending the regulation, nor there was any speech by the governor, the Bank's board members and the senior staff about the forthcoming change. The first document indicating the change in the regulation is dated March 2006 (Banca d'Italia, 2006b).[14]

Affecting mortgage supply: A limit on banks' maturity transformation should be by its nature closely related to the banks' lending policy, and in particular to the choices to provide loans with shorter or longer maturities. The looser the limit the more banks can provide loans with longer tenors, among which mortgages play a central role. Figure 4 shows that the higher the share of mortgages over total assets the higher is banks' maturity transformation, as proxied by the maturity transformation index (MTi).[15]

Heterogeneity across banks: Even though the maturity transformation limit was formally applied to all Italian banks, it was slack for some of them that were well below the prudential threshold, because being constrained by other more stringent limits. This is the case of the cooperative banks which at the time represented a large portion of the Italian banks (more than 60 percent). BCCs have a mutual nature and are subject by the law to a set of constraints - on size and scope of activity - that are much tighter than the cap on maturity transformation. Among the specific requirements, BCCs are subject to limitations on lending (as credit has to be granted mainly to the banks' shareholders), on profit distribution (as 70 percent of the yearly profits have to be retained) and on the bank shareholders (that have to be residents or have to have their main operations in the geographical area of competence of the cooperative bank).[16] In addition BCCs have also no direct access to wholesale funding. All in all, cooperative banks have limited scope for growth and, as a consequence, had an intrinsically low scope for increasing their maturity transformation regardless of the regulatory change. This is

[13]One could suspect that the largest banks could have played a role in the regulatory change, by lobbying the Bank of Italy. Estimations in Table A.4 show that our results are robust to the exclusion of the three largest Italian banks.

[14]The deregulation took place at the beginning of Mario Draghi's term as governor of the Bank of Italy. Neither his predecessor nor himself referred to this regulatory change in their respective public speeches.

[15]The MTi is a rearrangement of the prudential rule explained in Section 3.1 to express the limit as equal to 1, so that any value below 1 is within the limit (Bologna, 2017).

[16]Legislative Decree 385/1993 referred to as Consolidated Law on Banking (Testo Unico Bancario), artt. 33-37.

why BCCs were *de facto* not constrained by this regulation.

Figure 5 and Figure 6 provide a visual overview of the different aptitudes in increasing maturity mismatch by the two groups of banks. Figure 5 shows that over the entire period considered BCCs have a lower maturity transformation that non-BCCs. In particular, as shown in Figure 6, after the deregulation the MTi for the majority of cooperative banks remains below 1 while a significant share of the Non-BCCs raises their MTi above the pre-existing limit. This is confirmed by Table 4 which shows that, before the deregulation, around 5 percent of Non-BCCs were breaching the limit. After the deregulation, 25 percent of Non-BCCs had an MTi higher than 1 while 95 percent of the BCCs remained below 1.

6.2 Empirical strategy

To formally establish the occurrence of an exogenous credit supply shock, we empirically explore whether cooperative and non-cooperative banks had a different response to the regulatory change. We analyze the mortgage lending decisions of the two groups of banks, before and after April 2006 exploiting the cooperative banks as the control group, and the non-cooperatives as the treated group. The relationship of interest is the effect of the deregulation on local mortgage supply by treated banks:

$$Y_{i,z,t} = \beta_1(con_i \times dereg_t) + \alpha_i + \beta_2\mathbf{X}_{j,i,t-1} + (\gamma_t \times \sigma_z) + \epsilon_{i,z,t} \tag{1}$$

where $Y_{i,z,t}$ is one of three alternative variables capturing local mortgage supply: i) the flow of new mortgage loans granted by bank i in municipality z, between quarter t and $t-1$, our key dependent variable; ii) the number of new mortgages originated by bank i in municipality z, between quarter t and $t-1$; and iii) the number of loan applications posted at time t by households resident in municipality z that did not correspond to new originations by bank i within the following quarter.[17] con is a dummy variable equal to 1 for constrained banks (non-cooperatives) and 0 for unconstrained (cooperatives), $dereg$ is a dummy variable equal to 0 when the limit on maturity transformation is in place (i.e. until 2006Q1) and 1 after it is revoked (as of 2006Q2). The coefficient β_1 is the main parameter of interest as it captures the differential behavior of the non-cooperative banks relative to the cooperative banks after the regulatory change; a positive and

[17]Namely, $Y = Ln(NewML)$ where $NewML$ is alternatively the flow of new mortgages in euros, the number of the new mortgages or the number of denials. All these indicators are adjusted to account for flows not reflecting actual new originations, e.g. subrogation.

significant coefficient would signal the presence of a credit supply shock. α_i refers to bank-fixed effects which ensure that all bank-specific time-invariant observable and unobservable characteristics are accounted for, including systematic differences in banks' business models. $\mathbf{X}j, i, t-1$ is a vector of bank-level covariates to control for possible time-varying bank-specific characteristics, like size, capitalization and the share of mortgages over total assets.[18] $(\gamma_t \times \sigma_z)$ are municipality-by-quarter fixed effects that control for the local demand. Such a granular level of geographic disaggregation allows us to compare mortgages supply by constrained and unconstrained banks towards the same residential real estate local market mimicking, as much as possible, the identification strategy *á la* Khwaja and Mian, 2008, based on comparing loans to the same borrowers from banks with different characteristics, that has become very common to disentangling demand and supply for credit to corporate borrowers.[19] $\epsilon_{i,z,t}$ is the error term. Standard errors are clustered at the municipal level.[20]

6.3 Results

Table 5 presents the results for the estimation of Equation 1 by using the three different indicators described above, to capture any increase in mortgages by banks no longer constrained by the regulation. The point estimates for β_1 in the first two columns report that constrained banks increased the volume and number of new mortgage originations by about 4 percent after the removal of the prudential restriction. Consistently, the last column of Table 5 shows that the number of loan applications denied decreased. Overall, the results in Table 5 suggest that lenders no longer constrained by the maturity transformation limit lent more compared to other banks even after controlling for a granular set of fixed effects such as municipality-by-time.[21]

Parallel trends - Our identification framework rests on a difference-in-difference analysis based on the within-municipality comparisons of the lending behavior of cooperative (unconstrained) and

[18] The use of one lag avoids endogeneity concerns, which might be due to the contemporaneity of the observations. Results are robust to the exclusion of these controls, see Table A.3.

[19] Using a pure multi-relationships procedure to study the mortgage markets would provide misleading results. Purchasing a house normally happens once in a life and entails a relationship with only one bank at a time. Indeed, second homebuyers or multiple homebuyers are particular, and relatively rare cases.

[20] Results are robust to different clustering (Tables A.1 and A.2).

[21] The results are robust to different set of fixed effects (Table A.3).

non-cooperative (constrained) banks. In this framework, the identification assumption becomes one of parallel trends: absent the prudential rule abolition, local lending from constrained and unconstrained banks would have evolved along the same path. To facilitate a transparent examination of any pre-trends in the data, we estimate a quarter-by-quarter DD of the local lending behavior of constrained banks compared to unconstrained banks and present the results in Figures 7, 8 and 9. The results confirm that before the deregulation credit from constrained and unconstrained banks evolved similarly: the parallel trends assumption holds.

Placebo Test - One relevant critique to our identification strategy could concern the definition of the control group, which is based on the assumption that cooperative banks were not affected by the repeal of the prudential rule. We have already provided evidence in the preceding sections to resolve any doubts about our identification strategy. Here we conduct a test based on *placebo* constrained banks to corroborate once again the validity of our control group. In particular, we restrict our sample of analysis only to cooperatives and assign the treatment to those that have an MTi closer to the limit of 1 before the deregulation. The idea of this test is that placebo constrained banks should not be affected by the abolition of the prudential rule, despite being close to the threshold of 1, as their functioning is already constrained by other more binding limits. If we would find a change in the lending behavior of the placebo banks, the result would undermine our identification strategy. If instead we would not find any significant effect, this would further confirm that cooperative banks are a reliable control group. Table 6 reproduces the estimations presented in Table 5 based on alternative sets of placebo constrained banks: cooperatives with MTi greater or equal to 0.7, 0.8, 0.9 or 0.95, respectively. We find no significant effect across all the thresholds and mortgage supply indicators.

7 Mortgage credit supply and house prices

We now analyse whether the exogenous credit supply shock identified in the previous section had an impact on house prices in Italy. First we study whether the relationship between mortgages origination in a municipality and the presence of banks affected by the prudential repeal was positive after the deregulation (H2). Secondly, we explore if the initial presence of affected banks was also positively correlated to subsequent changes in house prices (H3). Finally, combining H2 and H3 we estimate the house price elasticity to mortgage supply.

7.1 House prices and deregulation

To identify whether the credit shift caused by the deregulation drives house prices we estimate a two-stage regression of house price growth on new mortgage origination using the market share of banks affected by the deregulation as instrument for new mortgages in the first stage:

$$\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right) = \delta_1 \ln \widehat{NewML}_{z,t-1} + \delta_2 \mathbf{X}_{z,t-1} + \\ + (area_z \times \gamma_t) + (type_z \times \gamma_t) + \alpha_z + \epsilon_{z,t} \quad (2)$$

$$\ln NewML_{z,t} = \beta_1 dereg_t * MktShare_z + \beta_2 \mathbf{X}_{z,t-1} + \\ + (area_z \times \gamma_t) + (type_z \times \gamma_t) + \alpha_z + \epsilon_{z,t} \quad (3)$$

$P_{z,t}$ is the house price at the municipal level, $NewML_{z,t}$ is the amount of new mortgage loans for the municipality z, $dereg_t$ is the deregulation dummy taking value 1 from 2006h1, and $MktShare_z$ is the average market share of the treated banks (the Non-BCCs) in the mortgage loans market in each municipality z before the deregulation.[22] The matrix $\mathbf{X}_{z,t-1}$ includes a set of controls to approximate time-varying local conditions which could be additional drivers of house prices. In particular, it includes: i) lagged values at the municipal level for population density; ii) fraction minority; iii) households wealth, proxied by the average amount of deposit and loans[23]; iv) housing supply elasticity at the province level, as estimated by Accetturo et al., 2020, which we allow to vary by semester; v) lag of the dependent variable to control for dynamics in house prices, as in Case and Shiller, 1989. $(area_z \times \gamma_t)$ are geographic area-by-time fixed effects capturing differences in cycles between the Center-North and the South of Italy (Boeri et al., 2014 and D'Alessio, 2018. $(type_z \times \gamma_t)$ are type-by-time fixed effects where type groups municipalities in five categories distinguishing between the city center and periphery.[24] Finally, α_z are municipality fixed effects that capture time-invariant unobservable structural differences across municipality that

[22]The market share is computed based on the borrowers' residence. It therefore considers lending in a given municipality provided by banks regardless of their location, i.e. from within or outside each given municipality. Results are confirmed using alternative measures of market relevance, including also market share based on banks' residence, Table A.6.

[23]Measures for wealth at the municipal level are not available, and measures for average income at the municipal level are available since 2008. The proxy we use for wealth is positively correlated with actual income in 2008 (Figure A.13).

[24]Manzoli and Mocetti, 2019 find for Italy evidence of large price differentials between center and periphery, even larger than those observed between the Center-North and South of Italy. The higher real estate prices in the centers of urban areas are affected

may affect housing supply as terrain irregularities and physical constraints (Saiz, 2010).[25] This reach set of fixed effects allows us to exploit the heterogeneity within the same type of municipality in the same geographic area.[26]

Table 7 presents the results. Column (1) reports the first stage estimation (FS). The estimates are very significant in both economic and statistical terms, revealing a strong and robust positive relationship between the initial presence of deregulated banks in a municipality and new mortgage originations from 2006h1. To illustrate the economic impact of the effect, we compare the change in mortgages in a municipality without deregulated banks, i.e. with a market share of zero, to the change in mortgages in the average affected municipality. On average the market share of deregulated banks is 0.82. Thus, in the average affected municipality new mortgage loans were 13 percent higher after the deregulation. In column (2), we estimate the direct effect of the deregulation on house price growth, i.e. the reduced form model (RF). House price growth was about 1.4 percentage points higher where deregulated banks dominated the mortgage market, consistent with the interpretation of the prudential repeal as a positive shock to the demand for housing channeled into the economy via an increase in the supply of mortgages. In the last column of Table 7, we combine the intuitions from columns (1) and (2) to estimate the instrumental variable model (IV). The F-statistic is well above the threshold of 10 below which Stock et al., 2002 argue that weak instruments become a concern, thus rejecting the hypothesis that our IV is weak. Results show that the expansion in mortgages triggered by the prudential repeal accelerates house prices. We estimate an elasticity of house price growth to new mortgage loan of 4.8, meaning that 1 percentage increase in new mortgage credit would shift house price growth from 2 to 2.1 percent.[27] Our results are consistent with the estimates by Barone et al., 2020 for Italy and Favara and Imbs, 2015 for the US.[28]

by centripetal pressures from the demand side, to which supply only partially adjusts. Consistently, in our sample we find evidence of higher housing supply in the periphery (Figure A.14).

[25] Table A.5 describes all the variables used.

[26] Results are robust to different sets of fixed effects and control variables (Table A.7).

[27] $Elasticity = \widehat{\delta_1}/\overline{(ln\frac{P_{z,t}}{P_{z,t-1}})} = 8.273/1.73 = 4.78$. Starting from an average house price growth of 2 percent, 1 percentage increase in new mortgages implies a house price growth of $2 \times (1.048) = 2.096$.

[28] Barone et al., 2020 and Favara and Imbs, 2015 estimate the elasticity of house price to credit supply. For the sake of comparability, we report estimates of the elasticity of house price to new mortgages in Table A.8. We obtain a value of 0.13, consistent with Barone et al., 2020 who estimate a value around 0.1 and Favara and Imbs, 2015 whose estimates

7.2 Inspecting the mechanism

In the previous section, we have shown that the credit supply shock speeds up house prices. However, the effect we uncover may be heterogeneous across many dimensions. Physical constraints to housing supply as well as constraints to borrowers' ability to obtain funding may affect our results.

Constraints to Housing Supply - The inability of housing supply to quickly adjust to demand may amplify the impact of the shock. If the mortgage supply shock we identify transmits to house prices through higher demand for housing, the response of house prices should be stronger where housing supply is inelastic compared to municipalities where construction is responsive and supply is relatively more elastic. Existing literature highlights the role of land regulations (Glaeser et al., 2005; Libecap and Lueck, 2011; Gyourko and Molloy, 2015) and physical constraints (Saiz, 2010) on housing supply and prices. To understand whether house price growth elasticity to credit supply is increasing in housing supply inelasticity, we use three time-invariant characteristics at the municipal level that limit residential development: (i) land slope variance as a proxy to terrain irregularities and ruggedness (Saiz, 2010); (ii) the share of the municipal surface covered by forests, and (iii) the share of the municipal surface covered by heritage sites that in a country like Italy also represents a limitation to developable land.[29] Table 8 reports the estimations showing that the elasticity of house price growth to mortgage supply is on average 20 percent higher where housing supply is less elastic. In other words, more credit feeds through to house prices more frequently in the municipalities where the supply of houses cannot easily adjust, a result in line with the existing literature (Mian and Sufi, 2009; Adelino et al., 2012; Barone et al., 2020) and with our ex ante expectation.

Financial constraints - A positive mortgage credit supply shock means more lending to new borrowers that were, presumably, not able to afford the mortgage before the shock. If the effect of the prudential repeal is channeled into the real economy through a relaxation of the borrowers' financial constraint, the response of mortgages should be stronger where borrowers face tighter constraints, and house price growth should be more

range from 0.12 to 0.14.

[29] Italy is the country with more World Heritage Sites along with China.

reactive, in line with the finding by Di Maggio and Kermani, 2017. To capture the level of borrowers' financial bindingness we rely on the average number of households at the municipal level that asked for a loan before the deregulation but did not obtain it. This indicator is in our view a more precise measure of borrowers' bindingness than those commonly used in the existing literature.[30] We modify our main model by adding a triple interaction variable that includes an indicator, $Constrained_z$, that equals 1 for municipalities whose number of denials was above the median before the deregulation. Table 9 reports the estimation results. Column 1 shows that mortgage lending increased more in municipalities where a higher number of borrowers was rationed before the deregulation: the amount of new mortgage credit was 22 percent higher in the constrained municipalities, around 6 percentage points over the average effect of the deregulation. Also house prices were higher: in Column 2 we estimate an additional impact of about 0.2 percent. However, the elasticity of house price growth to credit in municipalities where borrowers were facing tighter financial constraints is not statistically different from that estimated for other municipalities, as shown in Column 3. We further explore this issue by disentangling the interaction with financial constraints across increasing levels of bindingness. The upper panel of Figure 10 shows that the impact of new mortgage credit was increasing in the tightening of the financial constrains up to a certain level of bindingness and then decreased, suggesting a hump-shaped path. The lower panel shows that if there is any difference in the elasticity this is decreasing in the level of financial constraints. The relaxation of borrowers' credit constraints has a role in channeling the effect of the credit supply shock to asset prices as more households are successful in obtaining credit. Since housing demand of constrained borrowers is more elastic, we would expect also the elasticity of house price growth to be more reactive but this is not the case. The elasticity seems instead less reactive, in a way that is consistent with a higher housing supply elasticity that balances the more elastic demand. Households facing tighter financial constraints typically belong to areas where the housing supply is higher (Figure 11) and therefore housing demand has more space to be satisfied before triggering a price increase.[31]

[30] For robustness and for the sake of comparability we re-estimate our model using also other measures closer to those already used by the literature, such as level of wealth and house affordability. The results are mostly consistent across the different indicators (Table A.9).

[31] In line with this interpretation, Table A.10 shows that when we exclude housing supply controls, we wrongly estimate a stronger elasticity of house price growth to credit supply for financially constrained borrowers.

Dynamics - In this paragraph, we explore the dynamic impact on mortgages and house prices following the initial shock in 2006h1. What adjustment process might one expect to see? Initially, higher mortgage supply leads to higher housing demand and higher house prices, as we saw in Section 7.1. Over time, the effect of the shock on loans and house prices could either vanish or be long lasting. Kiyotaki and Moore, 1997 argue that the dynamic interaction between credit and asset prices might be a powerful transmission mechanism by which the effects of shocks persist, amplify, and spillover to other sectors. Higher house prices relax the collateral constraint of borrowers, allowing them to obtain a larger mortgage. This mechanism might also lead to a feed-back loop between credit, house prices, feeding a bubble. We explore whether these mechanisms were at work for the shock we analyze.

To trace out the cumulative response of loans and house prices following the initial shock, we adapt our baseline difference-in-difference methodology. We estimate time-varying coefficients that capture any difference in the cumulative change of mortgage lending and house prices from 2004h1 between municipalities with higher and lower initial presence of deregulated banks. This analysis allows us to test also if the parallel trend assumption for the baseline model holds.

Figure 12 plots the estimated coefficients and confidence intervals over time, effectively tracing out the cumulative impulse response from the deregulation shock to local credit and housing market outcomes. Panel (a) plots the coefficients reflecting the cumulative percentage point increase in house prices associated with the credit supply shock. The plot shows that the differences in house prices becomes statistically significant only after 2006h1, confirming that housing market outcomes in municipalities with higher and lower market shares of the affected banks have evolved similarly before the shock and would have continued to evolve similarly in the absence of the shock, i.e. the parallel trend assumption holds. The graph then shows that the increase in house prices in the municipalities with a higher initial presence of deregulated banks peaks in 2006h2. The house prices do not turn within the two years following the shock. Panel (b) plots the cumulative percentage point rise in new mortgage loan. A statistically significant difference in mortgage dynamics between the municipalities with higher and lower market shares of the affected banks is detected only since 2006h1. This confirms that credit would have evolved similarly without the removal of the prudential constraint. The flow of new mortgages peaks in 2007h1, a semester after house prices, and there remains in the following year. While results suggest that the effects of the credit supply shock persist, consistently with the argument of Kiyotaki and Moore, 1997, the main driver of the persistence does not appear to be the dynamic interaction between credit and asset prices. Panel (c) suggests only a temporary and not statistically significant increase in the amount of the average mortgage, while panel (d) shows a statistically significant and persistent increase in the number of new mortgages. These results suggest that the main driver of the shock persistence is not the borrower's ability to obtain larger mortgages, as suggested by Kiyotaki and Moore, 1997, but instead the higher probability to obtain a mortgage. The increase in the collateral value reduces the loan-to–value ratio. This constraint relaxation along with the banks' possibility to supply mortgages with longer maturity after the repeal of the maturity transformation limit, allows banks to ease credit conditions by lowering the monthly mortgage payments.[32] Thus, *ceteris paribus*, mortgages become affordable for a larger number of borrowers in affected municipalities. It is also worth noting that, the absence of a persistent increase in the average mortgage amount, together with the plateau reached after some time by the cumulative rise in credit and in house price, suggest that the interaction between credit and asset prices fades out and does not lead to a dynamic conducive to a housing market bubble. This behavior is prudent compared to the experience of other economies (Mayer et al., 2009; Mian and Sufi, 2009; Jordà et al., 2015; Bhutta et al., 2017) and can be due to several factors, the assessment of which go beyond the scope of this analysis.

8 Conclusions

Financial vulnerabilities are often related to real estate market conditions. Measuring the sensitivity of house price to credit is therefore critical for central banks and macroprudential authorities which can steer developments in the credit markets.

This paper provides new evidence for Italy of a causal relationship

[32] The Survey on Household Income and Wealth conducted every two years by the Bank of Italy shows that in 2008 74.3 percent of households' debt consisted of loans for the purchase of property, higher than the share of 60 percent measured in 2006. The ratio of total expenditure on repayment (principal and interest) to disposable income was about 17 percent in 2008, one percentage point higher than the 2006 survey. The increase in debt servicing was relatively small, despite the rise in overall debt, due partly to a reduction in the size of repayments as a result of a lengthening of the contractual maturity of mortgages. Consistently, information from the Italian banking groups participating in the Eurosystem's quarterly Bank Lending Survey suggests that growing competitive pressure translated into an increase in the loan-to-value ratio and a lengthening of the average term to maturity.

between an expansion in credit and house prices. This is shown using the lift of a prudential limit on maturity transformation that took place in Italy in 2006. Only the banks that were affected by the regulation - i.e. the non-cooperative banks - expanded credit in response to the deregulation. Cooperative banks did non react. The heterogeneity in banks' response allows us to confirm the existence of a credit supply shock, which caused in turn an economically relevant response of house prices. Such a response differs across municipalities' and borrowers' characteristics, namely housing supply and financial constraints. Our results also indicate that the effects of the credit supply shock persist, but the interaction between credit and house price was not conducive to a housing market overheating.

Tables and Figures

Table 1: Descriptive statistics on credit dependent variables

	Mean	Median	p1	p99	St.dev.	Obs.
			Volume			
2004q2-2008q2	436.68	170.82	76	3888.43	2313.41	424186
pre-deregulation	429.77	169.26	75	3823.43	2242.95	191989
post-deregulation	442.39	175	76.71	3930.83	2370.08	232197
Cooperative Banks						
2004q2-2008q2	305.04	165	75.49	2050.22	583.24	46867
pre-deregulation	306.88	165	75	2050.16	599.44	22353
post-deregulation	303.36	165.72	77.47	2055.46	568.08	24514
Non-cooperative banks						
2004q2-2008q2	453.03	172.81	76	4154.69	2443.76	377319
pre-deregulation	445.96	169.45	75.18	4118.74	2375.75	169636
post-deregulation	458.8	176	76.64	4172.06	2497.94	207683
			Number of originations			
2004q2-2008q2	3.12	1	1	27	15	424186
pre-deregulation	3.13	1	1	27	14.85	191989
post-deregulation	3.11	1	1	27	15.12	232197
Cooperative Banks						
2004q2-2008q2	2.09	1	1	12	3.75	46867
pre-deregulation	2.14	1	1	12	3.98	22353
post-deregulation	2.04	1	1	12	3.53	24514
Non-cooperative banks						
2004q2-2008q2	3.25	1	1	29	15.84	377319
pre-deregulation	3.26	1	1	30	15.72	169636
post-deregulation	3.23	1	1	29	15.94	207683
			Number of denials			
2004q2-2008q2	22.67	15	1	90	21.2	141393
pre-deregulation	21.57	14	1	89	20.99	57689
post-deregulation	23.43	16	1	90	21.32	83704
Cooperative Banks						
2004q2-2008q2	22.57	14	1	91	22.37	11754
pre-deregulation	21.46	13	1	92	22.3	4997
post-deregulation	23.39	16	1	91	22.38	6757
Non-cooperative banks						
2004q2-2008q2	22.68	15	1	90	21.1	129639
pre-deregulation	21.58	14	1	89	20.87	52692
post-deregulation	23.43	16	1	90	21.22	76947

Notes: Volume is the amount in euros of new mortgage loans granted by bank i, in municipality z at quarter t. Number of originations refers to the number of new mortgages, and number of denials is the difference between loans requested in quarter t to bank i by households resident in municipality z and loans originated. The pre-deregulation period goes from 2004q2 to 2006q1. The post-deregulation period goes from 2006q2 to 2008q2.

Table 2: Summary statistics of balance sheet variables

	Mean	Median	p25	p75	St.dev.	Obs
		Cooperative Banks (365)				
2004q2-2008q2						
Log total assets	12.61	12.62	10.8	14.36	0.78	4467
Mortgages loans weight	36.81	37.28	16.23	53.65	7.79	4467
Average risk weight	73.51	72.96	41.82	120.21	15	4467
Leverage	11.59	11.03	7.16	19.85	2.9	4467
Operational costs	1.31	1.29	0.81	1.94	0.24	4467
pre-deregulation						
Log total assets	12.51	12.54	10.7	14.21	0.77	1965
Mortgages loans weight	35.24	36.06	15.17	51.81	7.8	1965
Average risk weight	72.08	70.65	40.8	119	15.25	1965
Leverage	11.65	11.12	7.16	20.93	2.98	1965
Operational costs	1.29	1.28	0.81	1.88	0.22	1965
post-deregulation						
Log total assets	12.68	12.69	10.89	14.47	0.78	2502
Mortgages loans weight	38.04	38.39	18.49	54.2	7.55	2502
Average risk weight	74.64	74.49	42.97	122.05	14.71	2502
Leverage	11.54	10.93	7.19	19.76	2.84	2502
Operational costs	1.32	1.3	0.81	1.97	0.24	2502
		Non-cooperative banks (186)				
2004q2-2008q2						
Log total assets	14.63	14.47	11.06	19.05	1.64	2534
Mortgages loans weight	30.53	31.26	0.77	61.02	12.6	2534
Average risk weight	68.79	68.33	28.28	121.88	17.46	2534
Leverage	10.1	8.86	4.05	36.5	5.42	2534
Operational costs	1.39	1.34	0.18	3.12	0.52	2534
pre-deregulation						
Log total assets	14.55	14.43	10.95	19.04	1.61	1091
Mortgages loans weight	28.24	28.86	0.44	59.42	12.28	1091
Average risk weight	68.55	68.21	28.52	126.62	17.75	1091
Leverage	10.25	8.94	3.93	33.36	5.47	1091
Operational costs	1.4	1.35	0.17	3.81	0.6	1091
post-deregulation						
Log total assets	14.7	14.53	11.44	19.11	1.66	1443
Mortgages loans weight	32.27	32.93	0.77	61.15	12.56	1443
Average risk weight	68.96	68.42	27.83	116.17	17.24	1443
Leverage	9.99	8.8	4.17	38.29	5.39	1443
Operational costs	1.38	1.34	0.19	2.94	0.46	1443

Notes: Log total assets is the log of the total bank assets in thousands of euros. Mortgage loans weight is the weight of mortgage loans over total assets. Average risk weight is the average risk weight of the bank portfolio. Leverage is the equity-to-asset ratio. Operational costs is the ratio between operational costs and total assets. The pre-deregulation period goes from 2004q2 to 2006q1. The post-deregulation period goes from 2006q2 to 2008q2.

Table 3: Descriptive statistics for house prices

	Mean	Median	p25	p75	St.dev.	Obs
			House Price index (log)			
2004h1-2008h1	6.9	6.9	5.95	8.02	0.42	35784
pre-deregulation	6.83	6.83	5.86	7.86	0.41	15542
post-deregulation	6.95	6.94	6.02	8.09	0.41	20242
Control municipalities						
2004h1-2008h1	6.96	6.95	6	8.01	0.39	21250
pre-deregulation	6.9	6.88	5.93	7.85	0.39	9151
post-deregulation	7.01	6.99	6.11	8.06	0.39	12099
Treated municipality						
2004h1-2008h1	6.81	6.81	5.9	8.04	0.44	14534
pre-deregulation	6.74	6.74	5.8	7.87	0.43	6391
post-deregulation	6.87	6.87	5.99	8.15	0.43	8143
			House Price Growth rate			
2004h1-2008h1	1.73	0	-5.14	12.06	3.1	35784
pre-deregulation	1.86	0.14	-5.27	12.4	3.22	15542
post-deregulation	1.63	0	-5.06	11.83	2.99	20242
Control municipalities						
2004h1-2008h1	1.75	0	-5.13	12.2	3.09	21250
pre-deregulation	1.98	0.71	-5.61	12.64	3.3	9151
post-deregulation	1.58	0	-4.93	11.83	2.91	12099
Treated municipality						
2004h1-2008h1	1.7	0	-5.14	11.84	3.11	14534
pre-deregulation	1.69	0	-5.17	11.86	3.11	6391
post-deregulation	1.71	0	-5.08	11.84	3.11	8143

Notes: *Control municipalities* are municipalities were the market share of non-cooperatives banks before the deregulation was below the median. *Treated municipalities* are municipalities were the market share of non-cooperatives banks before the deregulation was above the median. The pre-deregulation period goes from 2004h1 to 2005h1; the post-deregulation period goes from 2006h1 to 2008h1.

Table 4: Maturity transformation index: BCCs vs Non-BCCs

	Maturity transformation index				
	p25	p50	p75	p90	p95
			Full sample		
BCCs	0.560	0.700	0.810	0.910	0.960
Non-BCCs	0.560	0.780	0.940	1.120	1.240
			Before Deregulation		
BCCs	0.500	0.630	0.740	0.830	0.870
Non-BCCs	0.510	0.710	0.850	0.950	1.040
			After Deregulation		
BCCs	0.610	0.750	0.860	0.940	1
Non-BCCs	0.635	0.850	1.010	1.190	1.330

Notes: The maturity transformation index is a rearrangement of the prudential rule explained in section 3.1 to express the limit as equal to 1, so that any value below 1 is within the limit (see Bologna, 2017).

Table 5: Deregulation and Credit Supply

VARIABLES	(1) Volume	(2) Number of originations	(3) Number of denials
Deregulation*constrained	0.043***	0.036***	-0.084***
	(0.008)	(0.007)	(0.027)
Observations	424186	424186	141393
Adjusted R^2	0.242	0.239	0.389
Banks time-varying controls	Yes	Yes	Yes
Municipality-Date FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE	Municipality	Municipality	Municipality

Notes: Standard errors clustered at the municipal level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Deregulation and Credit Supply - Placebo Sample

	(1) Volume	(2) Number of originations	(3) Number of denials
$MTi \geq 0.7$			
placebo	-0.019	-0.007	0.017
	(0.026)	(0.021)	(0.064)
$MTi \geq 0.8$			
placebo	-0.037	-0.030	0.046
	(0.027)	(0.022)	(0.065)
$MTi \geq 0.9$			
placebo	0.010	0.013	-0.075
	(0.041)	(0.037)	(0.092)
$MTi \geq 0.95$			
placebo	0.051	0.073	-0.027
	(0.058)	(0.051)	(0.106)
Observations	49210	49210	30681
Banks time-varying controls	Yes	Yes	Yes
Municipality-Date FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes

Notes: Standard errors clustered at the municipal level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Credit Supply and House Prices

VARIABLES	(1) FS $\ln NewML_{z,t}$	(2) RF $\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right)$	(3) IV $\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right)$
$dereg_t * MktShare_z$	0.161***	1.373***	
	(0.028)	(0.167)	
$\ln \widehat{NewML}_{z,t-1}$			8.273***
			(1.735)
Observations	40123	37444	35775
Adjusted R^2	0.887	0.151	
F-test of weak instrument			35
Municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Constraints to Housing Supply

VARIABLES	(1) Terrain Elevation Variance	(2) Land Scarcity Share of forests	(3) Share of heritage sites
$\ln \widehat{NewML}_{z,t-1}$	7.579***	7.662***	8.008***
	(1.655)	(1.667)	(1.722)
$\ln NewML_{z,t-1} \widehat{\times} Constrained_z$	1.350***	1.390**	1.837***
	(0.454)	(0.599)	(0.598)
Observations	35775	35775	35775
F-test of weak instrument	17	18	17
Municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes

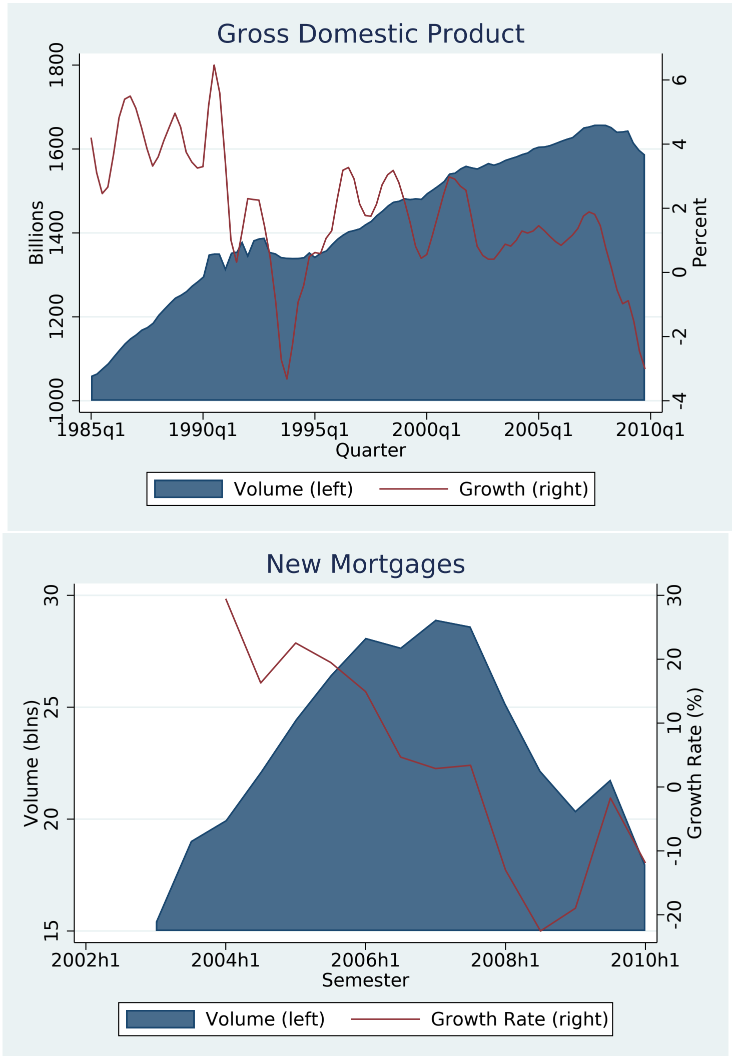
Notes: $Constrained_z$ is an indicator variable taking value one if for the municipality z the characteristic reported in the column title (i.e. Terrain elevation variance, Share of forest and Share of heritage sites) is above the median value. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Borrowers' Financial Constraints

VARIABLES	(1) FS $\ln NewML_{z,t}$	(2) RF $\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right)$	(3) IV $\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right)$
$dereg_t * MktShare_z$	0.166***	1.332***	
	(0.029)	(0.168)	
$dereg_t * MktShare_z \times Constrained_z$	0.055***	0.196**	
	(0.018)	(0.089)	
$\ln \widehat{NewML}_{z,t-1}$			8.529***
			(1.818)
$\ln NewML_{z,\widehat{t-1} \times C}onstrained_z$			-0.850
			(0.574)
Observations	37546	37458	35784
Adjusted R^2	0.887	0.151	
F-test of weak instrument	,	,	18
Municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes

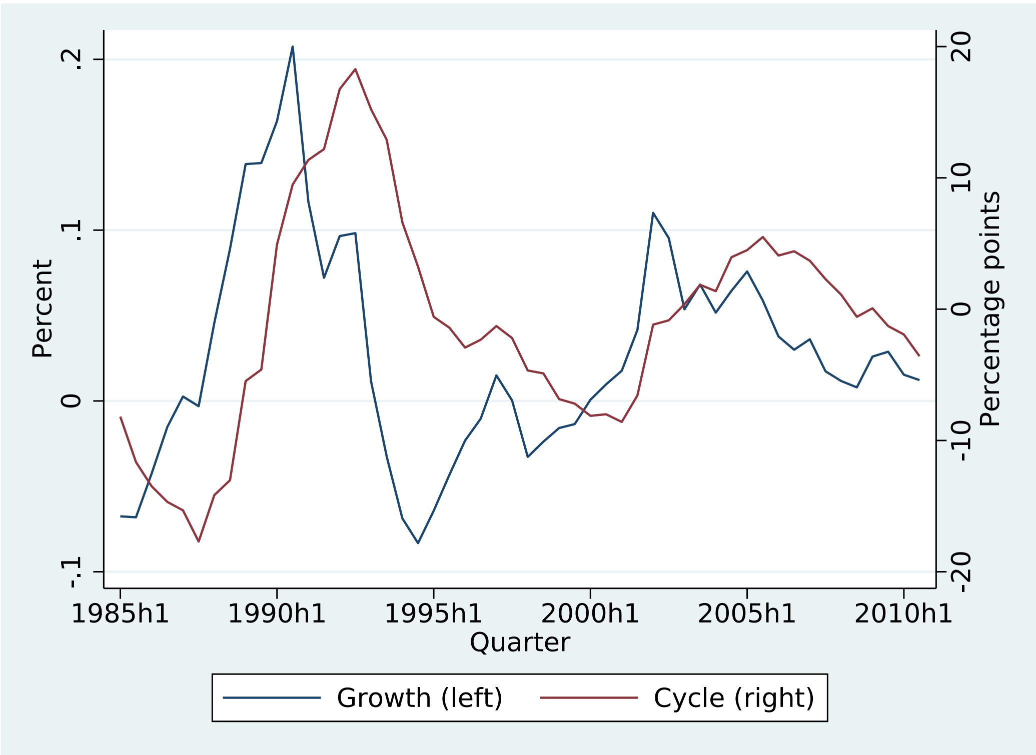
Notes: $Constrained_z$ is an indicator variable taking value one if for the municipality z the average number of loans denied before the deregulation is above the median value. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Economic Conditions



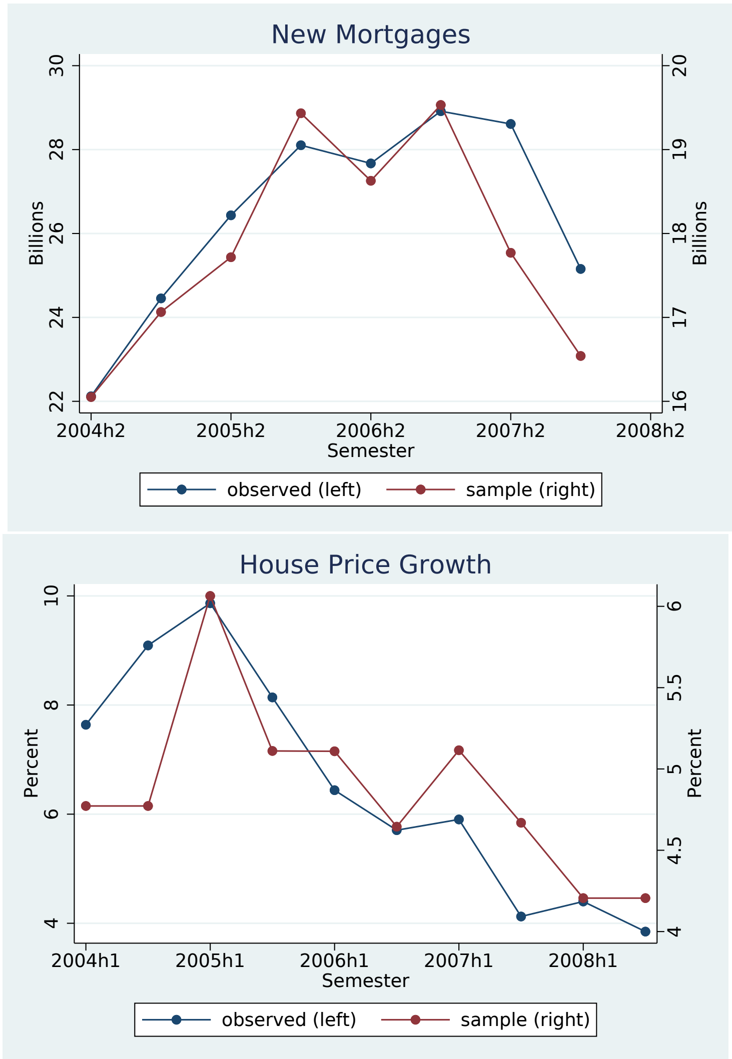
Notes: Data on GDP from De Bonis and Silvestrini, 2014 and Istat (the Italian National Institute of Statistics). Data on new mortgage loan comes from Supervisory reporting.

Figure 2: House Price



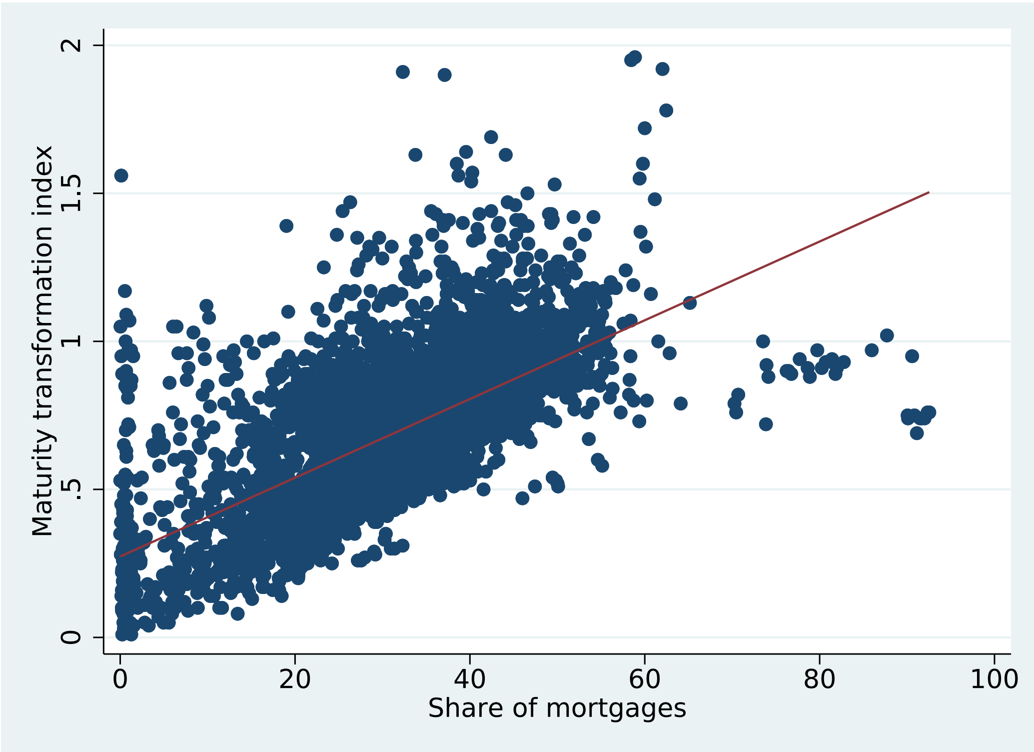
Notes: House price index constructed by Muzzicato et al., 2008 using data from the review *Il Consulente Immobiliare*. Cycle is the percentage deviation of the real property price index from its long-term trend calculated by Hodrick-Prescott (HP) filter.

Figure 3: Sample vs Observed



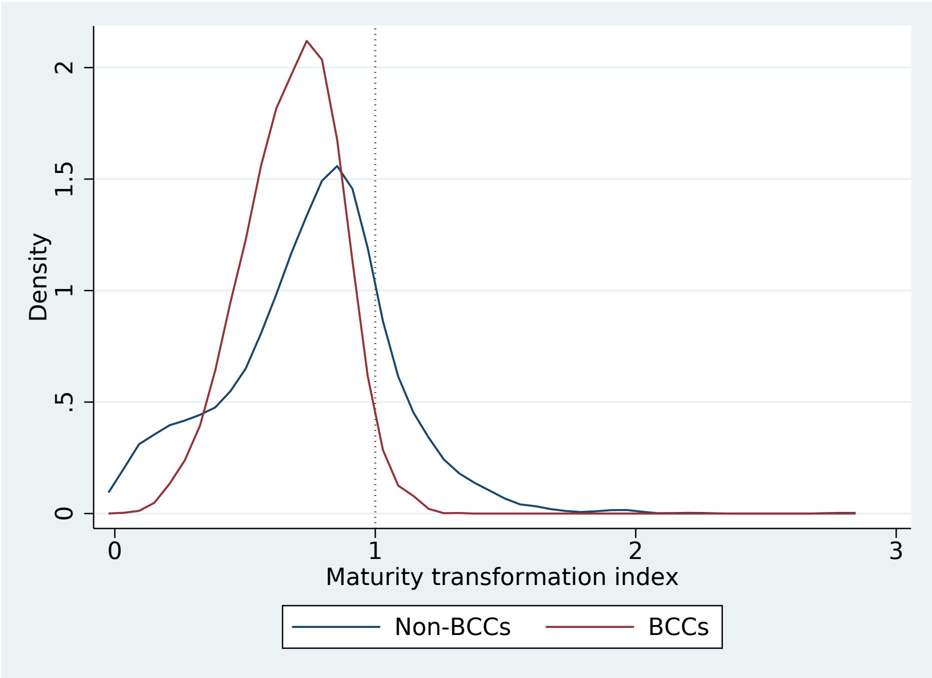
Notes: Sample refers to the dataset used for the estimations of this paper. Observed refers to real data. The observed series of new mortgages are the amounts declared by banks in the supervisory reports. The observed series of house prices comes from the review *Il Consulente Immobiliare* (Muzzicato et al., 2008).

Figure 4: Maturity mismatch and mortgages



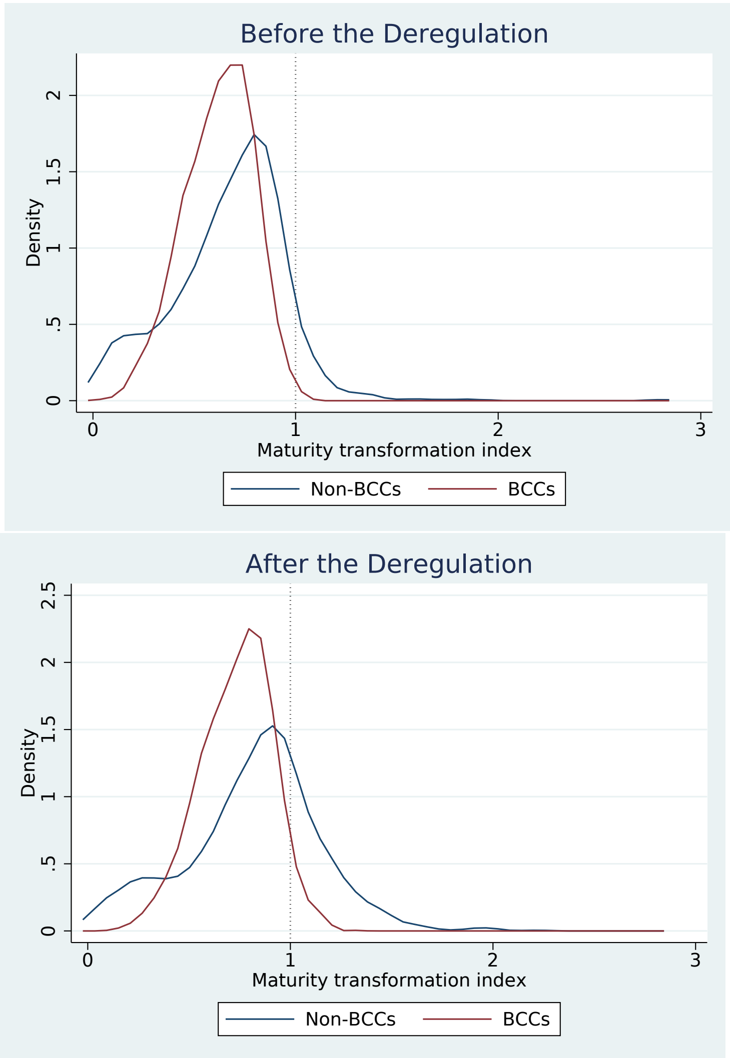
Notes: The maturity transformation index captures banks' maturity mismatch. Share of mortgages refers to the ratio of mortgages over total assets.

Figure 5: Maturity transformation of Italian banks by legal status (BCCs and Non-BCCs)



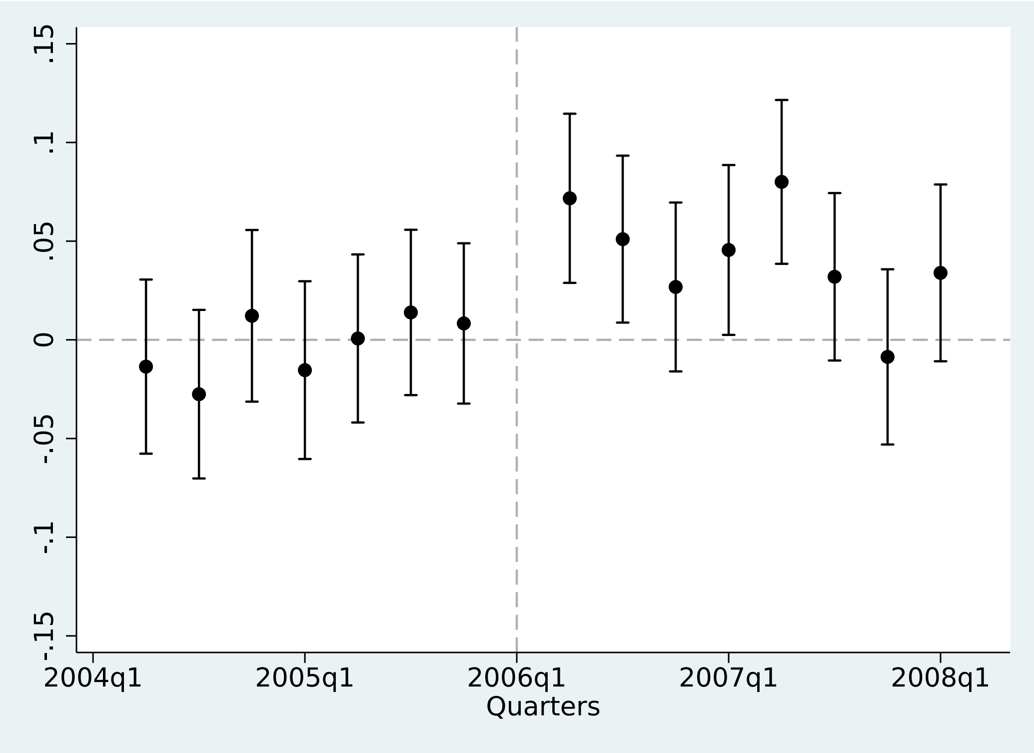
Notes: The figure plots the kernel density for the maturity transformation index of the Italian banks from 2004q2 to 2008q2 differentiating between cooperatives (BCCs) and non-cooperative banks (Non-BCCs). The maturity transformation index is a rearrangement of the prudential rule to express the limit as equal to 1. The dotted vertical line marks the maturity transformation limit, any value below is within the limit.

Figure 6: Maturity transformation of Italian banks by legal status (BCCs and Non-BCCs) before and after the deregulation



Notes: The figures plot the kernel density for the maturity transformation index of cooperatives (BCCs) and non-cooperative banks (Non-BCCs). The maturity transformation index is a rearrangement of the prudential rule to express the limit as equal to 1. The dotted vertical line marks the maturity transformation limit, any value below is within the limit. The upper panel refers to the period before the deregulation, i.e from 2004q2 to 2006q1. The lower panel refers to the period after the deregulation, i.e. from 2006q2 to 2008q2.

Figure 7: Parallel trends: Constrained banks and the flow of new mortgages

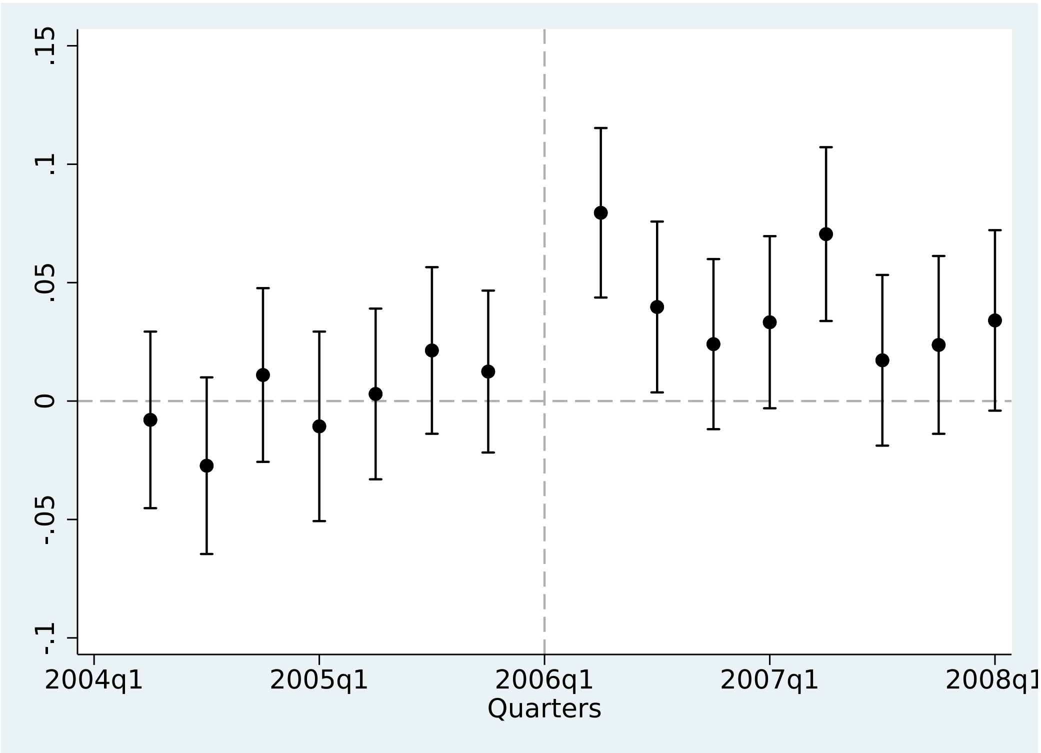


Notes: This figure plots the coefficients δ_t measuring the difference between constrained and unconstrained banks in lending to borrowers located in the same municipality. Bars show 95 percent confidence intervals and the vertical line at 2006q1 denotes the quarter before the deregulation. Notice, $\delta_t = 0$ indicates that before 2006q1 constrained and unconstrained banks behaved similarly: the parallel trends assumption holds. The coefficients are obtained from estimating the following equation:

$$Y_{i,z,t} = \alpha_i + \sum_t \delta_t (D_t \times con_i) + \beta_2 \mathbf{X}_{i,t-1} + (\gamma_t \times \sigma_z) + \epsilon_{i,z,t}$$

where $Y_{i,z,t}$ is the flow of new mortgages by bank i in quarter t to households located in municipality z. $\mathbf{X}_{i,t-1}$ is a vector of bank-level covariates. Robust standard errors are clustered at the municipality level.

Figure 8: Parallel trends: Constrained banks and number of new mortgages

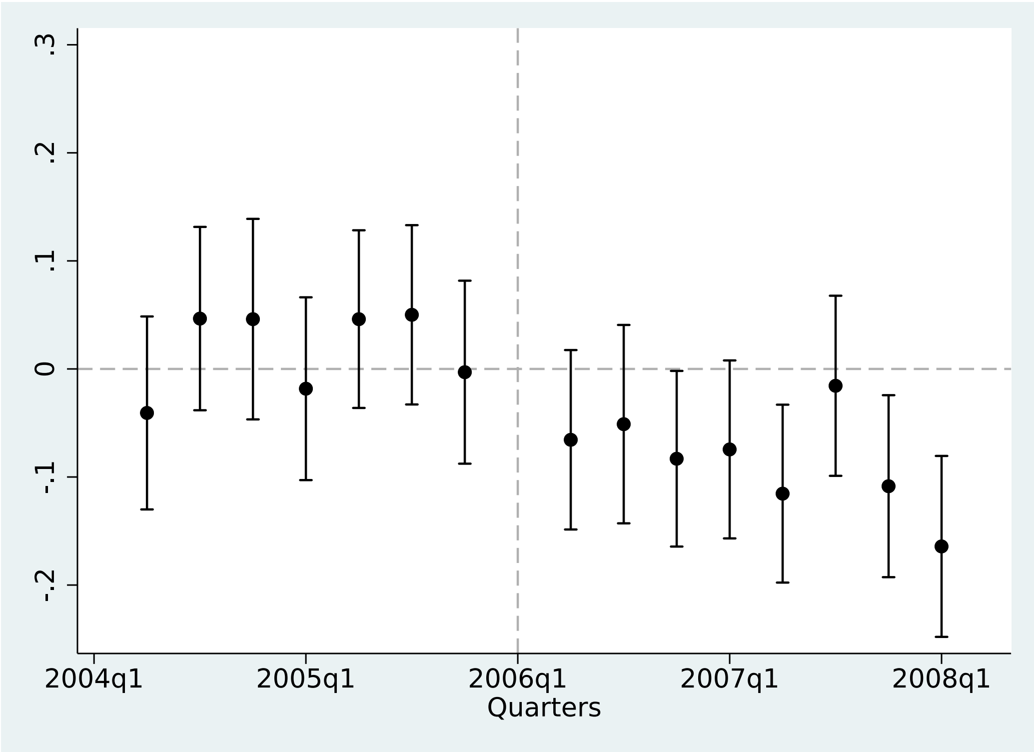


Notes: This figure plots the coefficients δ_t measuring the difference between constrained and unconstrained banks in lending to borrowers located in the same municipality. Bars show 95 percent confidence intervals and the vertical line at 2006q1 denotes the quarter before the deregulation. Notice, $\delta_t = 0$ indicates that before 2006q1 constrained and unconstrained banks behaved similarly: the parallel trends assumption holds. The coefficients are obtained from estimating the following equation:

$$Y_{i,z,t} = \alpha_i + \sum_t \delta_t (D_t \times con_i) + \beta_2 \mathbf{X}_{i,t-1} + (\gamma_t \times \sigma_z) + \epsilon_{i,z,t}$$

where $Y_{i,z,t}$ is the number of new mortgages by bank i in quarter t to households located in municipality z. $\mathbf{X}_{i,t-1}$ is a vector of bank-level covariates. Robust standard errors are clustered at the municipality level.

Figure 9: Parallel trends: Constrained banks and number of denials



Notes: This figure plots the coefficients δ_t measuring the difference between constrained and unconstrained banks in dining loan applications by borrowers located in the same municipality. Bars show 95 percent confidence intervals and the vertical line at 2006q1 denotes the quarter before the deregulation. Notice, $\delta_t = 0$ indicates that before 2006q1 constrained and unconstrained banks behaved similarly: the parallel trends assumption holds. The coefficients are obtained from estimating the following equation:

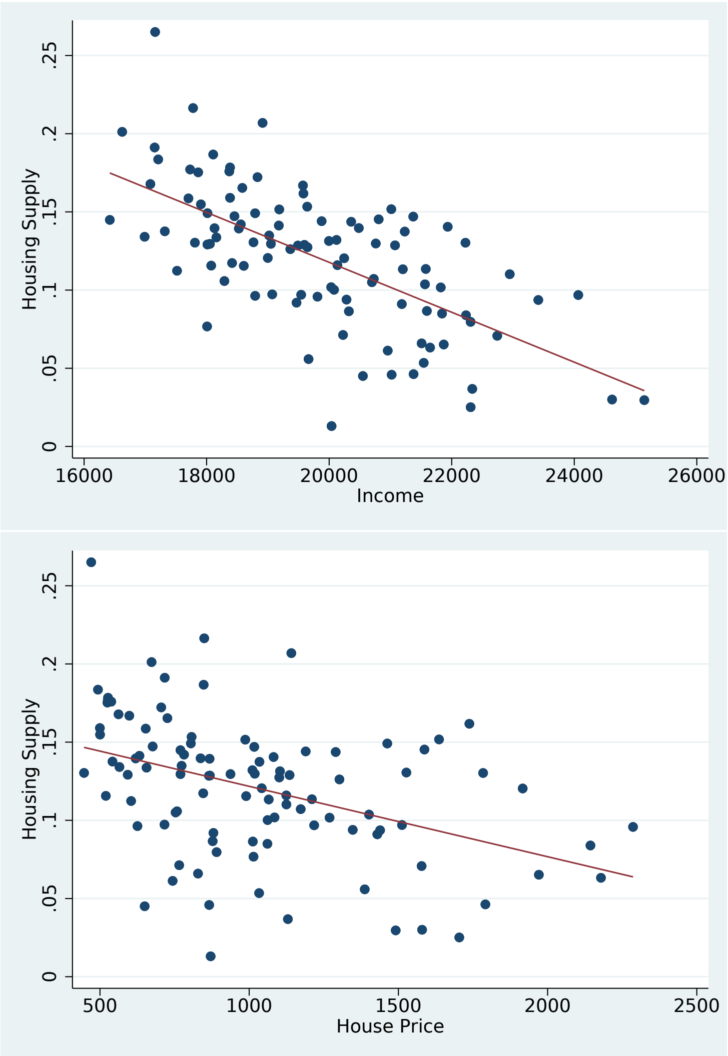
$$Y_{i,z,t} = \alpha_i + \sum_t \delta_t(D_t \times con_i) + \beta_2 \mathbf{X}_{i,t-1} + (\gamma_t \times \sigma_z) + \epsilon_{i,z,t}$$

where $Y_{i,z,t}$ is the number of new mortgages by bank i in quarter t to households located in municipality z. $\mathbf{X}_{i,t-1}$ is a vector of bank-level covariates. Robust standard errors are clustered at the municipality level.

Figure 10: Financial Constraints

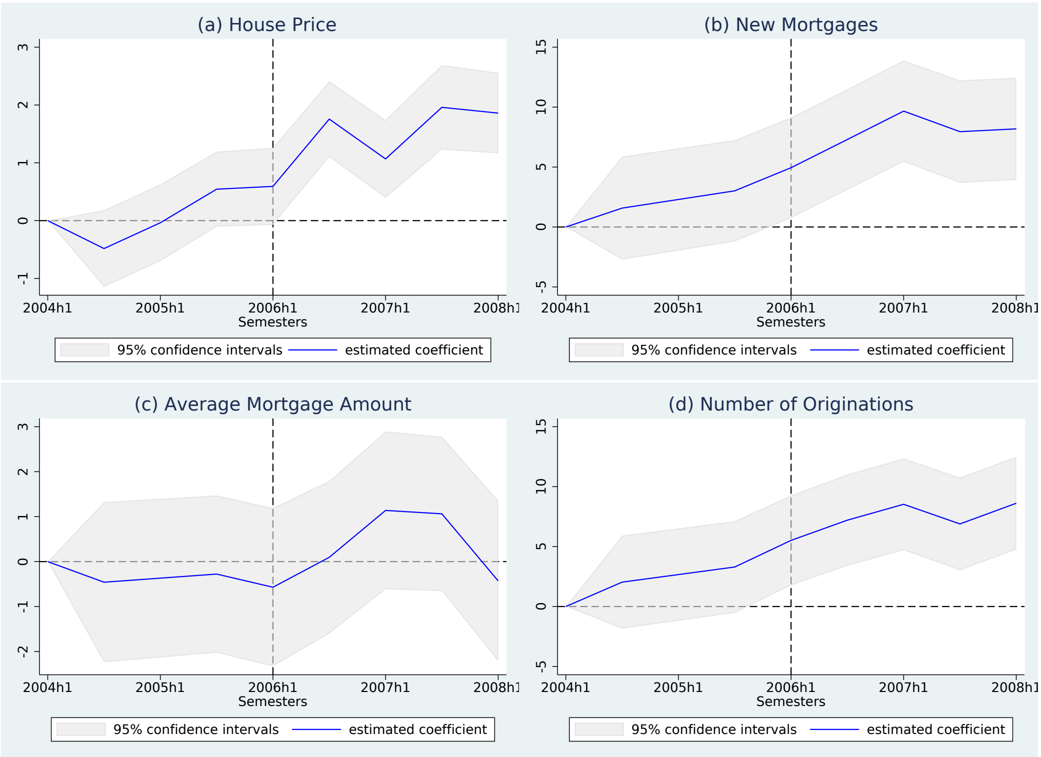
Notes: This figure plots the decomposition over increasing levels of financial bindingness (6 percentiles) for: (i) the impact of the deregulation on new mortgage loans
$\ln NewML_{z,t} = \delta_b dereg_t * MktShare_z * Bind_z^b + \beta dereg_t * Bind_m + \beta_2 \mathbf{X}_{z,t-1} +$
$+ (area_z \times \gamma_t) + (type_z \times \gamma_t) + \alpha_z + \epsilon_{z,t}$, (upper panel);
and (ii) the elasticity of house price growth to new mortgage credit
$\ln\left(\frac{P_{z,t}}{P_{z,t-1}}\right) = \delta_b \ln \widehat{NewML_{z,t-1}} * Bind_z^b + \beta dereg_t * Bind_m + \delta_2 \mathbf{X}_{z,t-1} +$
$+ (area_z \times \gamma_t) + (type_z \times \gamma_t) + \alpha_z + \epsilon_{z,t}$, (lower panel).
$Bind_z^b$ is an indicator variable taking value 1 if the level of financial bindingness of the municipality z belongs to percentile b, which goes from 1 to 6. All other variables are as in Equation 2 and 3.

Figure 11: Housing Supply



Notes: The figures plot the relation of housing supply with income (upper panel) and with house price (lower panel).

Figure 12: Estimated impact of the prudential repeal on house price and new mortgages over time



Notes: This figure plots the coefficients and confidence intervals on $MktShare_z \times Semester_t$ as estimated by the following equation:

$$Y_{z,t} = \delta(MktShare_z \times Semester_t) + \beta X_{z,t-1} + (area_z \times \gamma_t) + (type_z \times \gamma_t) + \alpha_z + \epsilon_{z,t}$$

where $Y_{z,t}$ are: 1) house price in municipality z in semester t scaled by 2004h1 house price in municipality z (panel a); 2) the new mortgages granted in municipality z in semester t scaled by 2004h1 new mortgages to municipality z (panel b); 3) average mortgage in municipality z in semester t scaled by 2004h1 average mortgage in municipality z (panel c); 4) the number of new mortgages granted in municipality z in semester t scaled by 2004h1 number of new mortgages to municipality z (panel d). $Semester_t$ is an indicator variable for semester t for all the semester except 2004h1. All the other controls and fixed effects are as in Equation 2.

Appendix

A Additional Robustness Checks

A.1 Deregulation and Credit Supply

We further explore the robustness of our results concerning the credit supply shock induced by the deregulation by running the following additional tests.

Errors Clustering - We re-estimate Equation 1 by clustering standard errors at the bank level and by using two-way clustering at the municipal and bank level. The results, shown in Table A.1 and Table A.2, are robust to these alternative clustering.

Alternative specifications - We explore whether our main results change excluding bank time-varying controls or using alternative sets of fixed effects. Table A.3 shows the effect of the deregulation on our three indicators of credit supply: the volume of new mortgages, the number of originations and the denials. The results indicate that for all the alternative specifications the value of the new quarterly mortgage lending by the treated banks (non-BCC) is significantly higher than that of the control group of the cooperative banks (BCC) after the deregulation. The joint reading of the results with and without the bank-fixed effects suggests that observed and unobserved time-invariant bank characteristics have an important role in explaining credit supply, as shown by the increase in the R^2 obtained adding bank-fixed effects. Instead, time-varying bank controls do not play a relevant role when controlling for bank-fixed effects. Also accounting for time-varying demand factors results to be essential. We estimate alternative models considering first the province as areas relevant for credit demand and then municipality, and find that results are consistent. The last column of Table A.3 shows the estimation of our main specification including bank-fixed effects and time-varying controls to ensure that any supply factor other than the deregulation is accounted for, and municipality-by-date fixed effects ensuring that any observable and unobservable demand factor is controlled.

Lobbing by largest banks - We also assess whether any possible lobbying in favor of the deregulation could have undermined the exogeneity and the relevance of the identified shock. At this regard we argue that if any lobbying had taken place, it could have been only by the largest banks. We therefore re-estimate Equation 1 by excluding the three largest

Italian banks (namely Intesa, Unicredit and MPS) from the sample of treated banks. The results in Table A.4 confirm the significance of the coefficient of $con_i x dereg_t$ and hence excludes that lobbying could have been "the" cause of the deregulation. Instead the result confirm the existence of an exogenous credit supply shock, even without considering the three largest banks.

A.2 Mortgage supply and house prices

In this section we perform further robustness exercises for our results concerning the relationship between credit supply shocks and house prices.

***Alternative specifications* -** We explore whether our main results change under different specifications. First, we test alternative measures of market share. Table A.6 reports estimates based on: (i) a dummy indicating if the market share of the treated banks in the mortgage market before the deregulation was above the 75 percentile (Column 1); (ii) the average pre-deregulation market share of the treated banks in terms of number of new mortgages (Column 2); (iii) the market share of total loans that treated banks had before 2006h1 (Column 3); and (iv) the share of deposits (Column 4). The main results are confirmed, but the F-test for the last two measures of market share calls for weak identification. Table A.7 shows that our results are robust to different sets of controls and fixed-effects. In Table A.8 we also estimate an alternative functional form that is in line with Favara and Imbs, 2015 and Barone et al., 2020.

***Financial Constraints* -** We use three different proxies to capture borrowers' financial constraints: (i) the average level of wealth before the deregulation; (ii) house affordability, measured as the ratio between average deposits and the price of a 100 square meters house before 2006h1; and (iii) the average number of households at the municipal level that asked for a loan before the deregulation but did not obtain it. The latest is our preferred measure as in our view it is a better indicator of bindingness while the measures sub (i) and (ii) might be affected by the price level observed in each municipality. Table A.9 shows that our main results are consistent across different indicators of bindingness: the impact of the deregulation on credit was stronger in the constrained municipalities compared to the unconstrained ones, as well as on house price growth. However, the estimated elasticity is the same in the constrained and unconstrained municipalities. We further explore this issue by re-estimating our model excluding regressors controlling for housing supply, namely municipality fixed effects and housing elasticity-by-time. Table A.10 shows that when housing supply controls are excluded our triple interaction terms gain significance and wrongly suggests that elasticity is higher in financially constrained municipalities. The positive coefficients we estimate seem to reflect the bias due to the omission of housing supply controls (see Figure 11 and Figure A.15 for the relevant correlations).

Table A.1: Deregulation and Credit Supply - Bank level Clusters

VARIABLES	(1) Volume	(2) Number of originations	(3) Number of denials
Deregulation*constrained	0.043***	0.036**	-0.084
	(0.015)	(0.016)	(0.052)
Observations	424186	424186	141393
Adjusted R^2	0.242	0.239	0.389
Banks time-varying controls	Yes	Yes	Yes
Mun-Date FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE	Bank	Bank	Bank

Notes: Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.2: Deregulation and Credit Supply - Two-way Clustering

VARIABLES	(1) Volume	(2) Number of originations	(3) Number of denials
Deregulation*constrained	0.043***	0.036**	-0.084*
	(0.014)	(0.015)	(0.048)
Observations	424186	424186	141393
Adjusted R^2	0.242	0.239	0.389
Banks time-varying controls	Yes	Yes	Yes
Mun-Date FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE	Bank Mun	Bank Mun	Bank Mun

Notes: Standard errors are clustered two-way at the bank and municipal level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Deregulation and Credit Supply - Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
							Volume									
Deregulation*constrained	0.031***	0.048***	0.039***	0.049***	0.018***	0.036***	0.028***	0.037***	0.035***	0.056***	0.044***	0.057***	0.018**	0.042***	0.032***	0.043***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Observations	485714	485704	450315	450314	485714	485704	450315	450314	485555	485545	450138	450137	459977	459967	424187	424186
Adjusted R^2	0.045	0.086	0.064	0.086	0.045	0.086	0.064	0.086	0.220	0.299	0.261	0.299	0.146	0.246	0.194	0.242
							Number of originations									
Deregulation*constrained	0.019***	0.036***	0.026***	0.038***	0.011**	0.028***	0.021***	0.031***	0.022***	0.043***	0.030***	0.045***	0.010	0.035***	0.024***	0.036***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Observations	485714	485704	450315	450314	485714	485704	450315	450314	485555	485545	450138	450137	459977	459967	424187	424186
Adjusted R^2	0.037	0.087	0.063	0.086	0.037	0.086	0.062	0.086	0.214	0.309	0.264	0.307	0.124	0.245	0.185	0.239
							Number of denials									
Deregulation*constrained	-0.016	-0.085***	-0.006	-0.097***	0.004	-0.063***	0.010	-0.076***	-0.011	-0.065***	0.013	-0.079***	-0.010	-0.065**	0.013	-0.084***
	(0.025)	(0.021)	(0.025)	(0.021)	(0.027)	(0.023)	(0.027)	(0.023)	(0.024)	(0.021)	(0.024)	(0.021)	(0.031)	(0.027)	(0.031)	(0.027)
Observations	169202	169164	159400	159370	169198	169160	159396	159366	168541	168505	158734	158706	151377	151324	141438	141393
Adjusted R^2	0.040	0.211	0.051	0.206	0.041	0.212	0.051	0.207	0.189	0.447	0.222	0.447	0.084	0.394	0.118	0.389
Banks time-varying controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Prov-Date FE	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Prov FE	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No
Date FE	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
Bank FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mun-Date FE	No	No	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Mun FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No

Notes: Standard errors clustered at the municipal level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Credit supply shock and new mortgage loans value. Robustness to banks' lobbying.

VARIABLES	(1) Volume	(2) Number of originations	(3) Number of denials
Deregulation*constrained	0.040***	0.031***	-0.042*
	(0.008)	(0.007)	(0.031)
Observations	314873	314873	86568
Adjusted R^2	0.181	0.165	0.389
Banks time-varying controls	Yes	Yes	Yes
Municipality-Date FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE	Municipality	Municipality	Municipality

Notes: In this estimate the three largest banks are excluded from the sample of treated banks. Standard errors clustered at the municipal level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Variables Description

VARIABLES	All	Sample	Control	Exposed	Description	Source
House price growth	1.505	1.730	1.750	1.699	Biannual house price growth at the municipal level. Percentage.	Osservatorio del Mercato Immobiliare, a research data center of the Italian Revenue Agency specialized on real estate markets.
New Mortgage Loan	3.507	4.825	5.534	3.788	New mortgage loans granted to all the resindents of a municipality in a semester. Millions.	Credit Register
New Mortgage Number	24.95	34.37	38.48	28.37	Number of new mortgages granted to all the residents in a municipality in a semester.	Credit Register
Market Share	0.837	0.816	0.696	0.991	Share of mortgages granted by affected banks before the deregulation.	Credit Register
Area	37.12	45.59	45.24	46.10	Area of the municipality in square kilometers.	Istat
Population (t)	7478	11905	12074	11657	Annual population.	Istat
Population density	289.9	431.8	385.0	500.2	Number of people per square kilometer. Annual.	Istat
Fraction minority	0.0446	0.0494	0.0568	0.0386	Annual share of the population without Italian citizenship.	Istat
Wealth	17583	18836	21701	14647	Loans and deposits over population. Annual.	Supervisory Reports
Housing supply elasticity	0.113	0.112	0.114	0.108	Elasticities at the province level.	Accetturo et al., 2020
Distance from the center	3.720	3.401	3.330	3.504	Municipalities are grouped in 5 classes. 217 municipalities are identified as central municipalities based on the services offered. The other municipalities are grouped in 4 categories according to the travel distance from the central municipality.	The Territorial Cohesion Agency
Terrain elevation	2.504	2.191	2.103	2.320	Stadrad deviation of terrain elevation in the municipality. Quartile.	Istat
Land Scarcity (forest)	1.974	1.657	1.582	1.767	Share of the municipal area covered by forest. Four classes (less than 25%, between 25 and 50%, between 50 and 75%, above 75%).	Ministry of Agricultural, Food and Forestry Policies
Land Scarcity (heritage site)	1.487	1.427	1.374	1.505	Share of the municipal area with heritage site. Quartile.	Istat
Credit Denials	2.653	2.207	2.121	2.332	Average number of denials per municipality before the deregulation. Six percentiles.	Credit Register
Municipalities	8097	4612	2680	1932		

Table A.6: Credit Supply and House Price - Alternative measure of market share

VARIABLES	(1) MrkShare Top quartile	(2) N. Originations	(3) Loans	(4) Deposits
	Loan Volume (First Stage)			
$dereg_t * MktShare_z$	0.062***	0.243***	0.049***	0.049***
	(0.010)	(0.052)	(0.018)	(0.018)
Observations	40134	9782	40110	40110
Adjusted R^2	0.887	0.948	0.887	0.887
	House Price (Reduced Form)			
$dereg_t * MktShare_z$	0.358***	2.173***	0.652***	0.756***
	(0.064)	(0.675)	(0.102)	(0.104)
Observations	37458	8680	37428	37428
Adjusted R^2	0.150	0.180	0.150	0.150
	House Price (IV)			
$\ln \widehat{NewML}_{z,t-1}$	6.010***	10.000**	11.988**	14.076**
	(1.546)	(4.117)	(4.717)	(5.534)
Observations	35784	8662	35760	35760
F-test of weak instrument	30	16	8	8
Municipality time-varying controls	Yes	Yes	Yes	Yes
Date FE	No	No	No	No
Mun FE	Yes	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Credit Supply and House Price - Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Volume (First Stage)							
$dereg_t * MktShare_z$	0.215***	0.225***	0.162***	0.175***	0.205***	0.217***	0.161***	0.177***
	(0.025)	(0.026)	(0.028)	(0.028)	(0.025)	(0.026)	(0.028)	(0.028)
L.House Price Growth		0.001		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)		(0.001)
Observations	45921	42982	40123	37536	45437	42512	40123	37536
Adjusted R^2	0.876	0.875	0.887	0.887	0.877	0.877	0.887	0.887
	House Price (Reduced Form)							
$dereg_t * MktShare_z$	0.770***	0.483***	1.352***	1.334***	0.788***	0.498***	1.388***	1.373***
	(0.144)	(0.152)	(0.160)	(0.167)	(0.144)	(0.152)	(0.160)	(0.167)
L.House Price Growth		-0.077***		-0.081***		-0.080***		-0.081***
		(0.005)		(0.005)		(0.005)		(0.005)
Observations	54220	46307	43871	37444	53531	45708	43871	37444
Adjusted R^2	0.109	0.138	0.123	0.149	0.111	0.140	0.124	0.151
	House Price (IV)							
$\ln \widehat{NewML}_{z,t-1}$	2.351***	3.352***	6.690***	8.034***	2.592***	3.574***	7.008***	8.273***
	(0.793)	(0.849)	(1.593)	(1.707)	(0.847)	(0.896)	(1.653)	(1.735)
L.House Price Growth		-0.085***		-0.086***		-0.087***		-0.086***
		(0.006)		(0.009)		(0.006)		(0.009)
Observations	43717	40984	38182	35775	43249	40529	38182	35775
F-test of weak instrument	65	67	31	35	58	62	31	35
Municipality time-varying controls	No	No	Yes	Yes	No	No	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	No	No	No	No
Mun FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area-Date FE	No	No	Yes	Yes	No	No	Yes	Yes
Class Mun-Date FE	No	No	No	No	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.8: Credit Supply and House Price

VARIABLES	(1) FS $\ln NewML_{z,t}$	(2) RF $\ln(P_{z,t})$	(3) IV $\ln(P_{z,t})$
$dereg_t * MktShare_z$	0.161***	0.021***	
	(0.028)	(0.004)	
$\ln \widehat{NewML}_{z,t-1}$			0.132***
			(0.031)
Observations	40123	39271	37536
Adjusted R^2	0.887	0.967	
F-test of weak instrument			39
Municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes

Notes: The dependent variable for columns (2) and (3) is the natural log of house price. The estimated coefficient in column (3) is the elasticity of house price to new mortgage loans. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.9: Borrowers' Financial Constraints

VARIABLES	(1) Wealth	(2) House Affordability	(3) Denials
	Loan Volume (First Stage)		
$dereg_t * MktShare_z$	0.147***	0.161***	0.166***
	(0.029)	(0.029)	(0.029)
$dereg_t * MktShare_z \times Constrained_z$	0.043***	0.024**	0.055***
	(0.013)	(0.012)	(0.018)
Observations	37546	37546	37546
Adjusted R^2	0.887	0.887	0.887
	House Price (Reduced Form)		
$dereg_t * MktShare_z$	1.061***	1.364***	1.332***
	(0.176)	(0.172)	(0.168)
$dereg_t * MktShare_z \times Constrained_z$	0.451***	0.014	0.196**
	(0.078)	(0.071)	(0.089)
Observations	37458	37458	37458
Adjusted R^2	0.152	0.151	0.151
	House Price (IV)		
$\ln \widehat{NewML}_{z,t-1}$	7.898***	8.820***	8.529***
	(2.024)	(1.950)	(1.818)
$\ln \widehat{NewML_{z,t-1} \times Constrained_z}$	0.358	-0.595	-0.850
	(0.530)	(0.423)	(0.574)
Observations	35784	35784	35784
F-test of weak instrument	14	16	18
Municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	Yes	Yes	Yes
Area-Date FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes

Notes: $Constrained_z$ is an indicator variable taking value one if: (1) the average wealth in municipality z before the shock was below the median value, column Wealth; (2) the average house affordability for the municipality z calculated before the deregulation is below the median value; (3) for the municipality z the average number of loans denied before the shock is above the median value, column Denials. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.10: Borrowers' Financial Constraints - Excluding housing supply controls

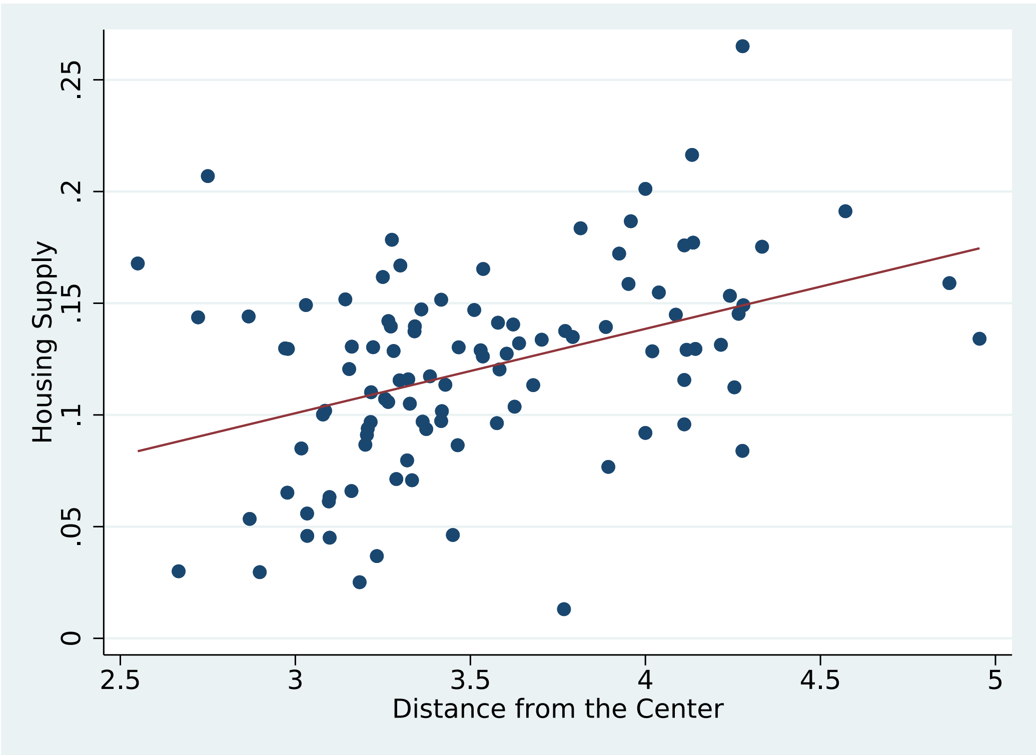
VARIABLES	(1) Wealth	(2) House Affordability	(3) Denials
	House Price (IV)		
$\ln \widehat{NewML}_{z,t-1}$	6.158***	6.441***	5.893***
	(2.124)	(2.263)	(1.863)
$\ln \widehat{NewML_{z,t-1} \times Constrained_z}$	0.109***	0.177**	0.338***
	(0.033)	(0.070)	(0.112)
Observations	35791	35791	35791
F-test of weak instrument	5	5	6
Housing supply controls	No	No	No
Other municipality time-varying controls	Yes	Yes	Yes
Date FE	No	No	No
Mun FE	No	Nos	No
Area-Date FE	Yes	Yes	Yes
Class Mun-Date FE	Yes	Yes	Yes

Notes: $Constrained_z$ is an indicator variable taking value one if: (1) the average wealth in municipality z before the shock was below the median value, column Wealth; (2) the average house affordability for the municipality z calculated before the deregulation is below the median value; (3) for the municipality z the average number of loans denied before the shock is above the median value, column Denials. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure A.13: Income and Wealth

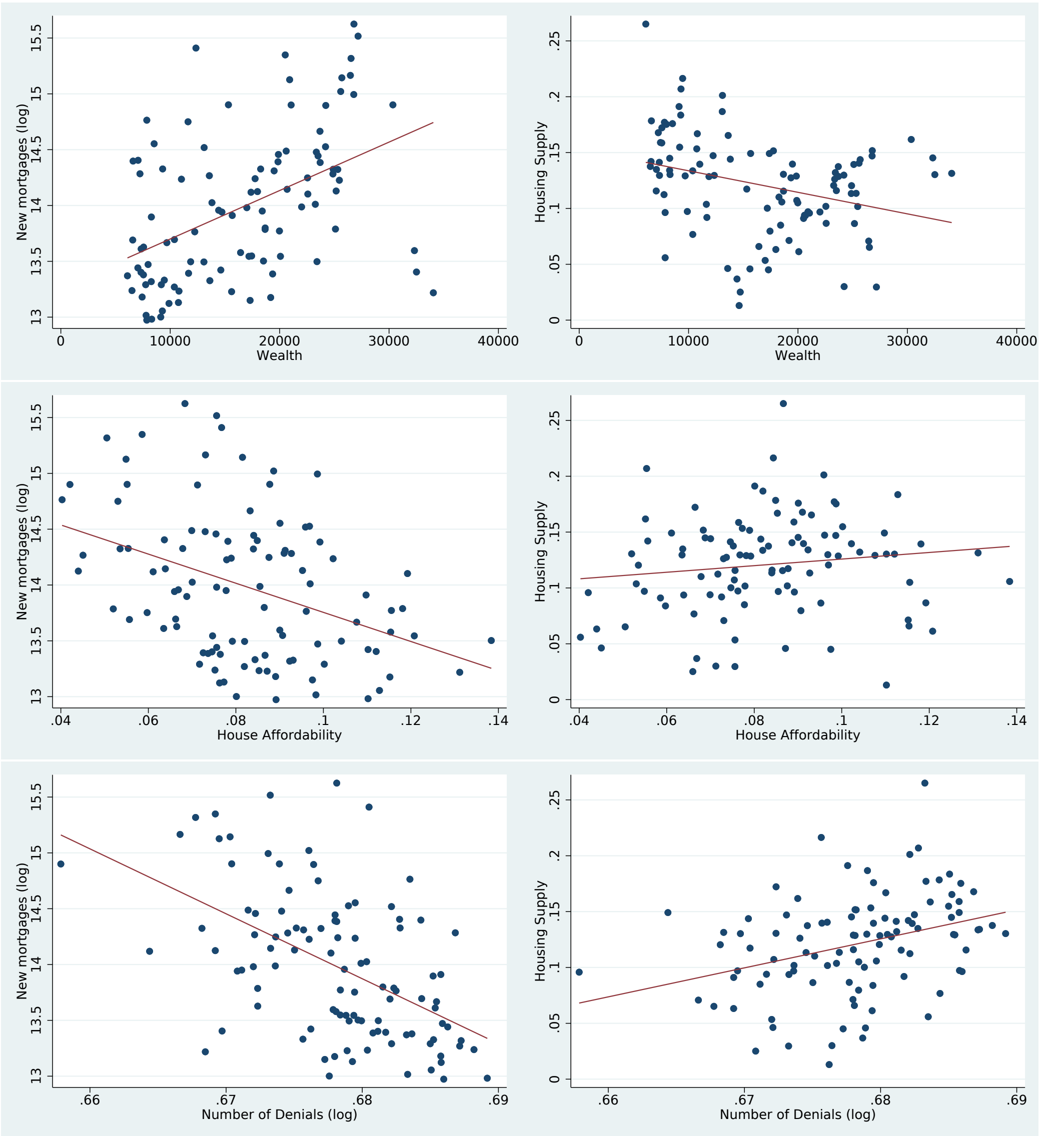
Notes: The y-axis reports income at municipal level in 2008, the x-axis our proxy for wealth calculated as $\log((deposits + loan)/population)$ in 2008.

Figure A.14: Housing Supply and Distance from the Center



Notes: The y-axis reports housing supply as computed by Accetturo et al., 2020, the x-axis a proxy of the relevance of center and periphery areas at the province level.

Figure A.15: Relations between new mortgages and measures of financial constraints and between housing supply and measures of financial constraints



Notes: The figures plot the relations of our measures of borrowers' financial bindingness with new mortgages and housing supply.

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