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**Downward nominal house price rigidity:
Evidence from three centuries of data on housing transactions¹**

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Abstract

By analyzing housing data from the period 1850 to 2019 in Norway, we find evidence of downward nominal house price rigidity. More specifically, we document that there is a marked fraction of repeat-sales housing transactions with a zero nominal price change and show that this fraction increases in housing market downturns. While the former result reveals a rigidity in nominal house prices, the latter suggests that the direction of it is predominantly downward.

Keywords: *House prices, Repeat sales transaction data, Price rigidity, Monetary policy, Financial crisis*

JEL Codes: *R31, E30, N13, N14*

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1. Introduction

Are nominal house prices downwardly rigid? The answer to this question is important for the understanding of the dynamics of the housing market and the macroeconomy. Furthermore, given that housing is a major source of household wealth, the existence of downward nominal house price rigidity (“DNHR”) would affect the asset price risk faced by households. Finally, DNHR could affect monetary policy transmission, for instance through the wealth channel or through asymmetric responses to interest rate changes.⁴ Einiö, Kaustia, and Puttonen (2008) have documented that a sizable fraction of repeat-sales housing transactions in their 1987-2003 sample from Finland is associated with a zero nominal price change. This important finding implies that nominal house prices are rigid. An unresolved question is, to the best of our knowledge, whether the nominal zero fraction is more pronounced in housing market downturns than in other periods, a feature which suggests that the rigidity is downward.⁵

The main contribution of our paper is that it documents the *time-series* aspects of nominal price rigidity in housing markets. Our analysis is based on housing data for Norway from most of the years between 1850 and 2019, allowing us to investigate for DNHR over numerous housing market cycles. The analysis is done in two steps. First, we document that, throughout our sample, a marked fraction of repeat-sales housing transactions has zero nominal price change. Hence, our results indicate that nominal house prices exhibit a rigidity, confirming those of Einiö, Kaustia, and Puttonen (2008). Second, we show that this nominal zero fraction varies with aggregate house prices. Specifically, the fraction of houses sold at *exactly* same price in two consecutive sales increases in housing market downturns. This suggests that house prices are *downwardly* rigid. In terms of magnitudes, a one standard deviation fall in aggregate house prices increases the nominal zero fraction by about 23% of a standard deviation.

2. Methodology

We explore the frequency distribution of repeat-sales nominal house price changes over many housing market cycles to investigate for the presence of nominal rigidity. The intuition is as follows: If nominal house prices are fully flexible, the probability of a dwelling being sold at the same price at two consecutive sales is very small. Conversely, an accumulation of repeat sales with zero nominal house price change - that is, a sizable nominal zero fraction - indicates rigidity in nominal house prices. Second, if house prices are rigid *downwardly*, this fraction appears primarily in housing market downturns.^{6,7}

3. Data

Our analysis is based on two different types of housing data for Norway – repeat-sales housing transaction data (Section 3.1) and an aggregate house price index (Section 3.2) – from two different time periods. The first period — the *historical period* – stretches from 1850 to 1989 but excludes

⁴ See Tsai (2013).

⁵ Downward nominal rigidity has been documented in other markets, such as the labor market (see among others, Blinder and Choi (1990) and Kahn (1997)), and in equity markets (Odean (1998)).

⁶ Our approach is purely empirical. However, the methodology is consistent with, for example, house sellers exhibiting loss aversion (see Genesove and Mayer (2001)) or down-payment restrictions on sellers (see Stein (1995)).

⁷ By investigating long-ranging house price data, our paper is related to other historical studies of the housing market, see for example Knoll, Schularick, and Steger (2017).

observations from the period 1940 to 1954, since a price-freeze law was in force in this sub-period. The second period – the *modern period* – covers the years from 2004 to 2019.

3.1 Repeat-sales housing transaction data

The repeat-sales housing transaction data are obtained from two different sources. For the *historical period*, our sample consists of 11,506 repeat-sales transactions taken from Norges Bank's Historical Monetary Statistics database. This database contains housing transaction information on inner city dwellings in four of Norway's largest cities in the period between 1819 and 1989 (see Eitrheim and Erlandsen (2004) for details).⁸ For the *modern period*, our sample of 880,943 repeat-sales transactions is taken from the universe of dwelling transactions in Norway. The sample is restricted to open-market housing transactions.

3.2 Aggregate house price index

The aggregate house price index measures annual, nominal house prices in Norway. For the *historical period*, the index is based on house prices in four of Norway's largest cities (see Eitrheim and Erlandsen (2004)). For the *modern period*, the index is based on house prices for all Norway (see Norges Bank's Historical Monetary Statistics database).

4. Results

This section presents our empirical results. First, we show evidence of rigidity in nominal house prices (Section 4.1), before we present results suggesting that this rigidity is predominantly *downward* (Section 4.2).

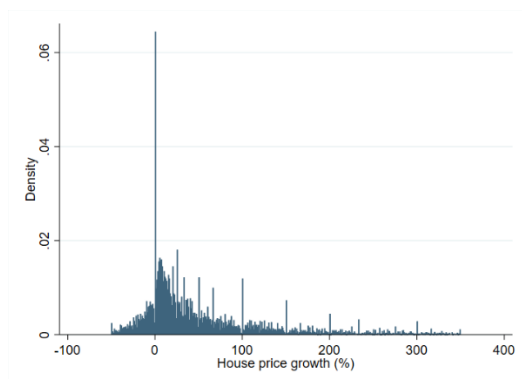
4.1 Evidence of nominal house price rigidity

Figure 1 plots the frequency distribution of repeat-sales nominal house price changes in the two samples. The figure shows that there is a marked fraction of repeat sales with a zero nominal price change in both.⁹ In fact, in 4.8%¹⁰ and 1.5% of the transactions in the historical and modern sample, respectively, a dwelling was sold at *exactly* same selling price in two consecutive transactions. The bunching at nominal zero confirms that the pattern in Einiö, Kaustia, and Puttonen (2008) is present over three different centuries in Norway, revealing a rigidity in nominal house prices.

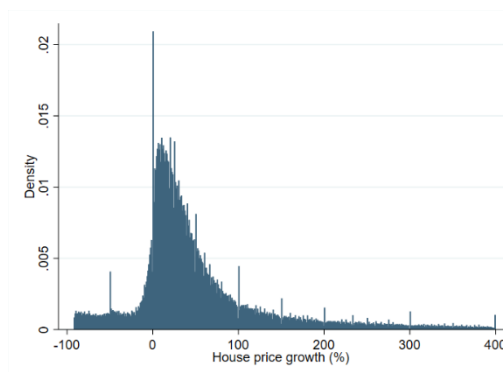
⁸ Our sample is a revised version of the sample Eitrheim and Erlandsen (2004) used.

⁹ The figure shows bins of percentage points, so the "zero" bin includes repeat sales with a nominal price change between 0 and 1%. However, the vast majority of the repeat sales in this bin is with an exact zero nominal price change (95% and 75% in the historical and modern sample, respectively). In the time-series analysis, repeat sales with an exact zero nominal price change are used.

¹⁰ This fraction increases to 5.6% if observations from the price-freeze law period from 1940 to 1954 are included in the sample.



Historical sample (1819 – 1989)



Modern sample (2004 – 2019)

Figure 1. Frequency distribution of repeat-sales nominal house price changes. In percent

4.2 Evidence of *downward* nominal house price rigidity

Figure 2, which plots the nominal zero fraction and annual changes in aggregate house prices over time, is the key figure of this paper. It exhibits two interesting features. First, it reveals that the nominal zero fraction is well above zero in most of the years in our long sample, documenting that nominal rigidity is a prevailing property of house prices. Second, the figure shows that the nominal zero fraction fluctuates over time. Importantly, it seems to be negatively correlated with changes in aggregate house prices. For instance, during the World War I boom-bust years of the housing market, the nominal zero fraction declined to a low level before it increased sharply. Similarly, during the Great Financial Crisis of 2008, the nominal zero fraction rose at the same time as aggregate house prices fell. The negative correlation between the nominal zero fraction and aggregate house prices suggests that this price rigidity is primarily downward.

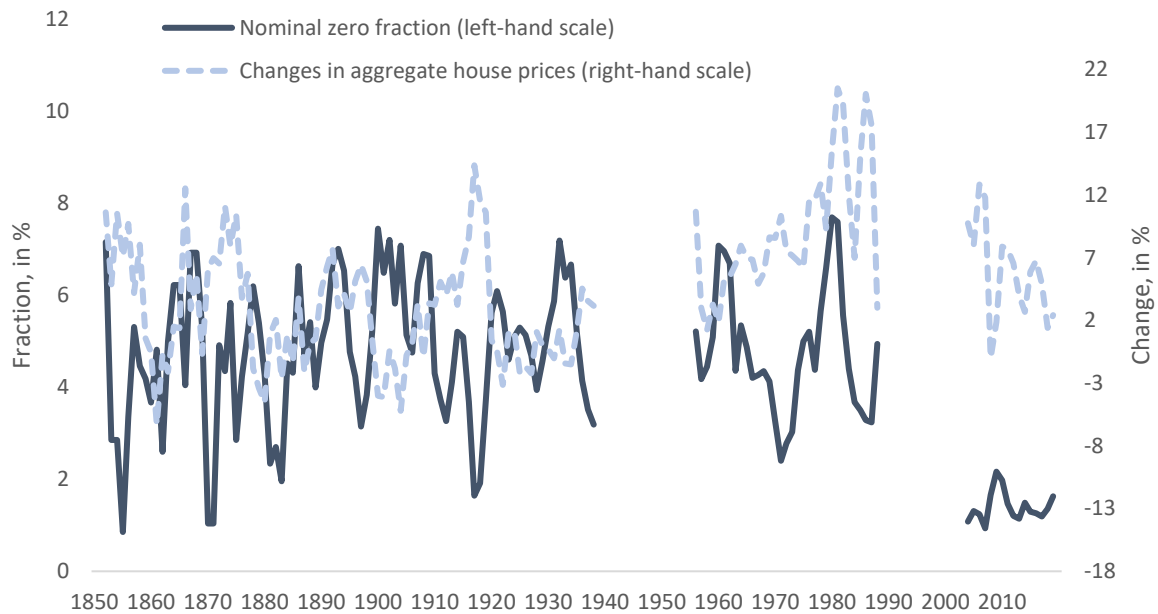


Figure 2. The nominal zero fraction and annual changes in aggregate house prices.¹¹

To investigate further the relationship between the two variables, we run a simple univariate regression of the form

$$\text{Nominal zero fraction}_t = \alpha + \beta \Delta HP_t + \epsilon_t$$

where $\text{Nominal zero fraction}_t$ is the fraction of repeat sales with a zero nominal house price change within a given year and ΔHP_t is the percentage change in the aggregate house price index. We report the estimated parameters in Table 1.

	(1)	(2)	(3)
	<i>Historical sample</i>	<i>Modern sample</i>	<i>Full sample</i>
House price changes (%)	-0.061** (0.024)	-0.038** (0.017)	-0.077** (0.282)
Constant	5.047*** (0.173)	1.641*** (0.131)	4.733** (0.198)
Number of observations	120	16	136
Adjusted R ²	0.042	0.203	0.045

Standard errors in parentheses

* p<0.1

** p<0.05

*** p<0.01

Table 1. Regression results. Dependent variable: Nominal zero fraction

¹¹ Figure 2 and the regression analysis are based on a three-year centered average of the series for the historical period and on annual series for the modern period.

The estimation results in Table 1 confirm the eye-balling analysis in Figure 2; the nominal zero fraction is significantly negatively correlated with changes in aggregate house prices, both in the two subsamples and in the full sample. The constant terms are also significant, indicating that when changes in aggregate house prices are zero, the nominal zero fraction is 5.0% and 1.6% in the historical and modern sample, respectively.

To get a sense of the economic magnitudes, note that the standard deviation of annual aggregate house price change over the full sample is 5.3%. At the same time, the standard deviation of the nominal zero fraction is 1.7%. The estimated coefficient from the simple univariate full-sample regression can therefore imply that roughly a quarter of the dispersion in the nominal zero fraction across time is explained by the dispersion in aggregate house price changes across time

$$\left(\frac{5.3 \times (-0.077)}{1.7} \approx 23\%\right).$$

While we caution against interpreting the estimated $\hat{\beta}$ as causal, our results are consistent with the housing market cycle being important for understanding the prevalence of DNHR.

4. Conclusion

In this paper we have documented that nominal house prices exhibit rigidity, which is prevalent over three centuries. The nominal price rigidity correlates negatively with aggregate house price changes, both statistically and economically, suggesting that nominal house prices are downwardly rigid. To explore the determinants of DNHR further, thereby improving the understanding of housing market dynamics and the macroeconomy, is a potential alley for future research. Other interesting research questions include investigating the implications of DNHR for households' asset price risks and for monetary policy transmission.

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