



UNIVERSITY OF CENTRAL ASIA
GRADUATE SCHOOL OF DEVELOPMENT
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Real Estate Market Evolution and Monetary Policy in Kazakhstan

Zhandos Ybrayev
Charles M. Becker



WORKING PAPER #54, 2019



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Abstract:

This paper considers the link between macroeconomic policy and housing demand in an upper middle-income transition economy, Kazakhstan. The paper further explores price cointegration and contagion across cities. We find evidence that some parts of the housing market lead others but that, overall, regional housing markets are only weakly interlinked. The markets also tend to respond weakly to policy interventions – a matter of possible concern to the nation’s central bank.

Keywords: real estate markets, mortgage credit policy, transition economies, Kazakhstan.

JEL classification: R30, R21, P34, E21, E63, G21

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1. Introduction

Housing expenditures comprise a large share of household consumption and in many countries, housing is the largest component of household wealth. Fluctuations in real estate prices affect household wealth and potentially have large effects on consumer demand. At the same time, the housing market often experiences cyclicalities that differs across countries both in magnitude and in impact on demand. These impacts reflect the extent to which housing wealth can be used as a source of credit as well as the frequency of housing turnover.

While there has been much debate, Case, Quigley, and Schiller (CQS, 2005, 2011) find strong evidence that housing wealth effects have large impacts on aggregate demand in both the United States and elsewhere.^{1 2} However, empirical work linking housing wealth to macroeconomic fluctuations has focused largely on developed countries, in part because data are better, and in part because more developed credit markets make it easier to monetize housing wealth.

On the other hand, housing wealth fluctuations can be extreme in middle-income countries, especially those with substantial mineral wealth. In transition economies, stunted housing markets from the socialist era often gave way to housing booms, and housing investment now comprises a large share of GDP. Consequently, it is important to study real estate dynamics and their relationships with key macroeconomic variables in transition economies, since housing comprises a large share of the non-tradable-goods sector.

In this paper, we focus on housing wealth and macroeconomic variables for an oil-rich transition economy, Kazakhstan. Our choice of Kazakhstan is opportunistic: it is fortunate to have a real estate market website <https://krisha.kz/> that is similar to www.zillow.com in the United States, and hence that provides detailed real estate price estimates over time and by city. While there are also good Chinese and Russian websites, among others, the information content of *krisha* (roof) exceeds other sites of which we are aware.^{3, 4}

1 See Glaeser, 2014, Iacovello, 2011, and Calomiris *et al.*, 2009. For a more sophisticated delineation that corroborates CQS in the case of Hong Kong, see Gan, 2010; for a comparably thorough treatment in the case of Great Britain that finds significant but smaller effects, see Cloyne *et al.*, 2017; for a treatment that incorporates inequality and demographic effects in the US context, see Bampinas *et al.*, 2016.

2 Calomiris *et al.* (2009) and Iacovello (2011) dispute the CQS finding, noting that housing wealth is highly correlated with permanent income, which is omitted from their empirical work. While we do not estimate these wealth effects here, and do not have a measure of permanent income for Kazakhstani households, it is important to acknowledge the potential omitted variables bias. On the other hand, this problem should be less in Kazakhstan and other emerging markets because discount rates are far higher, thereby making permanent income effects less important.

3 There is a vast literature on the Chinese housing market, which is sufficiently idiosyncratic to analyze independently. Land supply policies and other restrictions make the land and housing markets differ from those of advanced market economies, or most middle- and upper-middle-income countries. In particular, the absence of alternative high-yield savings instruments appears to have a large effect on demand (Chen and Wen, 2017). Jin (2011) argues that aggregate data also are poorly estimated and inconsistent with micro data, which appear to support the CQS hypothesis. In an important paper, Dong *et al.* (2017) argue that wealth and substitution effects are not constant, based on a sample of 35 Chinese cities, but rather that there is a crossover effect beyond which the former dominates. This point is relevant to our discussion of the distinction between Almaty and Nur-Sultan and other Kazakhstani cities below.

4 An exception to our pessimistic assessment of other emerging market economies housing price indices is Hungary, where the central bank bases price estimates on repeat sales. See Banai *et al.*, 2017. Also, Czerski *et al.* (2017) create and present a repeat sales price index for Krakow, Poland. The dominant real estate portal in Russia appears to be <https://www.cian.ru/>, which contains a detailed analytic and research section, but does not provide city indices similar to that in *krisha*.

Thus, based on Kazakhstani city-level data, we investigate the causal mechanisms between housing market price changes and such factors as interest rates, unemployment levels, and mortgage availability. In addition, we touch upon interactive aspects of the housing market structure across Kazakhstan's cities, as the hierarchy of cities within the nation suggests the possibility of a cascading effect. The spatial concentration of different income groups within urban areas is also of interest, as different types of housing and social classes may be affected differentially by macro policy. The analysis below emphasizes the importance of the interest rate channel of the monetary transmission mechanism on local housing markets. Thus, we need to test whether different city housing prices are correlated between each other, the importance of regional variables in city-level real estate price dynamics, and to what extent price movements respond to government monetary instruments.

There is a growing literature analyzing the national and cross-country housing market that identifies various macroeconomic relationships in housing price dynamics. Unlike other capital market assets, housing often exhibits downward price stickiness; hence, macroeconomic shocks may affect key real estate indicators with a lag. Agnello & Schuknecht (2011) find that financial variables such as the interest rate, inflation growth, and credit supply, along with fundamental variables, strongly affect housing price variations. Based on U.S. city level data, Jud & Winkler (2002) argue that the real housing price increase is largely determined by the growth in construction costs, interest rates and income levels. In general, higher credit availability tends to increase the weight of interest rate movements as economic agents increasingly rely on debt financing instruments. In addition, for homeowners, rising housing prices lead to an increase in the value of collateral upon which they can borrow – a source of borrowing of particular importance to liquidity-constrained households. Correspondingly, declining house prices should lead to a reduction of bank consumer credit supply, which then negatively affects aggregate consumption. Thus, in addition to directly affecting financing costs, tight monetary policy reduces housing wealth and consumer creditworthiness, which further constrains consumption and investment.

The remainder of the paper is organized as follows. Section 2 provides a summary of Kazakhstan's housing market and discusses relevant literature, especially outlining the Johansen cointegration approach to study long run relations between real estate markets in Kazakhstan and key macroeconomic variables. Data are discussed in Section 3, while Section 4 examines the effectiveness of the credit channel of the monetary policy transmission mechanism, accounting for a number of region-specific factors in each city. A final section summarizes findings and offers future research extensions and policy suggestions.

2. Background: Kazakhstan's housing market

Advanced market economies are overwhelmingly urban, generally experience slow population growth and economic growth, and have mature urban housing stocks. These forces combine to limit the rate of growth of housing prices and wealth in advanced market economies – though, even there, large rises have been witnessed in many countries during prolonged periods.

Abraham and Hendershott (1966) provide an early work on regional housing prices and their relationship to overall housing dynamics in the U.S.. They find that local construction costs, employment growth, and income growth are significant in predicting housing prices across metropolitan areas. More recently, Del Negro and Otrok (2007) conclude that U.S. house prices are largely driven by local factors, rather than national fluctuations. Consequently, emphasis on re-

gional price differentials and movements can be expected to produce better results when explaining transmission mechanisms of monetary policy accommodations, such as unanticipated interest rate or exchange rate shocks. Specifically, Fratantoni and Schuh (2003) find that regional heterogeneity is substantial when absorbing the impacts of a monetary policy shock.

If this is true in an integrated market economy like the United States, one might expect even more regional heterogeneity in relatively fragmented emerging market economies. Many transition and emerging market economies have enjoyed rapid economic growth and urbanization in some but not all areas. This is certainly true in Eastern Europe and the former USSR, which were already substantially urbanized and experienced an initial economic implosion with the fall of communism, with the decline hitting hardest in remote cities dominated by industries that were relics of central planning (Becker *et al.*, 2012).

Countries like Kazakhstan and Russia have had slow indigenous population growth but very large immigration inflows. Indeed, Kazakhstan experienced massive outmigration and population losses, along with economic decline, immediately following Independence at the end of 1991. However, economic transformation and rising mineral wealth resulted in immigration, rising fertility, and very rapid economic growth following 2000. It also led to spectacular growth of the nation's major cities. The new capital Nur-Sultan (formerly named Astana, Akmola, and Tselinograd) grew from 275,000 people in 1998 to an estimated 875,000 in 2016; the old (and still commercial) capital Almaty rose from 1.129 million in 1999 to 1.713 million in 2016 (and the metro area was estimated at 2.460 million in 2015); the leading southern city of Shymkent rose from 420,000 in 1998 to reach 1 million in early 2018.⁵ Even Karaganda, the dominant traditional industrial city, experienced growth from 437,000 in 1999 to 500,000 in 2016, though that number remains well below the Soviet era peak in 1989 of 613,000.

In short, Kazakhstan has been urbanizing and, within its urban system has experienced population concentration in the limited number of dynamic urban areas.⁶ In particular, more than one-quarter of the nation's population of slightly more than 18 million now lives in one of the four urban areas mentioned above. Rapid, concentrated urban growth means that there should be upward pressure on housing prices in dynamic urban areas, and hence that housing wealth should be rising as a share of GDP. At the same time, this concentration of housing wealth and of transactions in a limited number of large, high price cities also means that National Bank of Kazakhstan (NBK, the nation's central bank) policies may swiftly affect real estate prices and consumer demand. To summarize, we anticipate that Kazakhstani real estate wealth is likely to strongly affect aggregate demand, and at the same time that real estate prices will be highly

5 In March 2018, Shymkent was designated the third "city of Republican significance" as its population reached one million. What this means in practice is not yet clear, since, as has been pointed out, it is much less wealthy and has a much smaller budget and tax base than Almaty and Nur-Sultan: <https://ism.kz/kak-shymkent-otlichaetsya-ot-drugih-gorodov-respublikanskogo-znacheniya>. In principle, the designation entitles Shymkent to additional infrastructure investments and possibly at some point a metro system (which would be in line with USSR practice). See also <https://vlast.kz/novosti/28176-naselenie-symkenta-dostiglo-milliona-celovek-akimat.html> and the official June 19, 2018 announcement: https://vlast.kz/novosti/28400-symkent-stal-gorodom-respublikanskogo-znachenia.html?utm_source=email&utm_medium=evening

6 Some secondary cities have not fared nearly as well. For example, the mining city of Temirtau had a peak population in 1979 of 213,000, stagnated in the following decade, and has declined to an estimated 179,000 as of the beginning of 2019. Rudny peaked at 124,000 in 1989 and has since fallen to 115,000; Zhezkazgan peaked at 109,000 in 1989 and has declined to 87,000; Petropavlovsk peaked at 241,000 in 1989 but has declined to 218,000. See: <https://www.citypopulation.de/Kazakhstan-Cities.html>

sensitive to monetary policy. We further anticipate that there may be both regional market fragmentation and/or a cascading effect from central to outlying real estate markets.

Kazakhstan's house prices in various urban areas experienced periods of booms and busts over the last two decades. These aggregate patterns are discussed in An *et al.* (2017), who test for bubbles during the housing boom and bust periods during the entire 2000-2017 post-crisis period. They conclude that, while there may have been some "intrinsic bubbles," surging demand due to rising income and expansionary policy during the boom was a more important force. This paper explores sub-market linkages, and takes advantage of recent and more disaggregated data. Specifically, we address the effects on housing prices of recent monetary and exchange rate policy: since 2014, the *tenge* (Kazakhstan's currency, usually abbreviated as KZT) shifted toward a more passive float, with the exception of occasional large depreciations, most notably in August 2015. Recent monetary policy reforms, including the NBK's introduction of an inflation-targeting regime, also have created a large negative shock to the entire system, and may have contributed to a decline in housing prices as the market adjusted expectations.

The fact that Kazakhstan's cities play very different roles suggests that sharp movements in housing prices might be driven by one or two particular cities, with contagion across regions possible but not inevitable. The large distances between many cities and their varied roles seem to invite segmentation of regional housing prices as can be seen from Figure 1 and Table 1. Moreover, as distinct from mobile assets, the ability to arbitrage across different locations exists only to the extent that people migrate to cheaper housing. On the other hand, currency depreciations and credit crunches may affect all regions.

Figure 1. Map of Kazakhstan



Source: Committee of Statistics of the Republic of Kazakhstan.

Table 1. Administrative division of the Republic of Kazakhstan

Number	Region	Administrative center
1	Akmolinskaya region	Kokshetau
2	Aktobinskaya region	Aktobe
3	Atyrauskaya region	Atyrau
4	West Kazakhstan region	Ural
5	East Kazakhstan region	Oskemen
6	Turkistan region	Turkistan
7	Karaganda region	Karaganda
8	Mangystau region	Aktau
9	Zhambyl region	Taraz
10	Almaty region	Taldykorgan
11	North Kazakhstan region	Petropavl
12	Kostanay region	Kostanay
13	Pavlodar region	Pavlodar
14	Kyzylorda region	Kyzylorda
15	Almaty	Republican city status
16	Shymkent	Republican city status
17	Nur-Sultan	Capital city

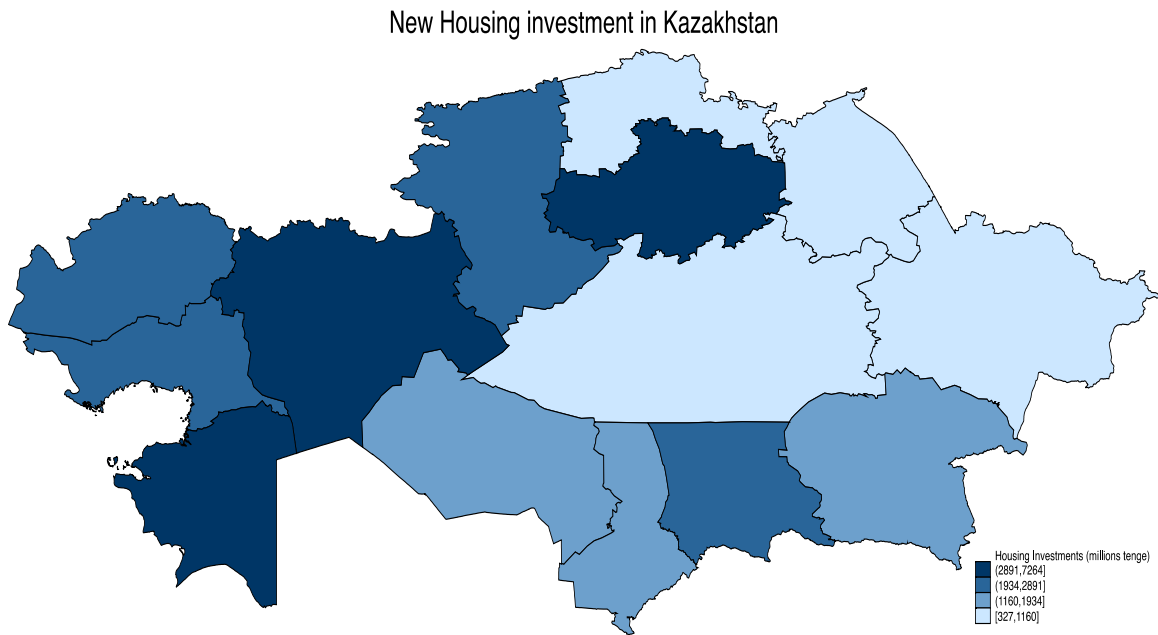
Source: Committee of Statistics of the Republic of Kazakhstan.

By any measure, Kazakhstan's private housing market has expanded rapidly and average prices, while fluctuating, have been rising even in the face of a somewhat flat economy. The Ministry of National Economy's Committee on Statistics (hereafter referred to by its acronym, Kazstat) reports that, as of 2015, the regional average minimum price for new "economy class" real estate in Kazakhstan was 170,000 KZT/m², or roughly USD \$600 per square meter, which is substantial for an emerging market economy with no land constraints. The cheapest housing options appear in Zhezkazgan, Karaganda region and Taldykorgan in Almaty region, whereas the most expensive housing prices are in Shymkent, South Kazakhstan region, and Nur-Sultan.

It is important to note this growth in housing prices has occurred despite substantial supply increases, with the general growth of residential housing increasing around 5 percent annually.⁷ However, as Figures 2 and 3 indicate, two urban centers, Almaty and Nur-Sultan, dominate new housing investment and construction. This concentration distorts unweighted average new construction costs and prices, since land costs and wages are far lower elsewhere, with the exception of the oil regions of Aktau, Atyrau, and Aktobe. The urban centers and oil regions account for a vastly disproportionate share of new construction and have far higher housing prices relative to other local housing markets.

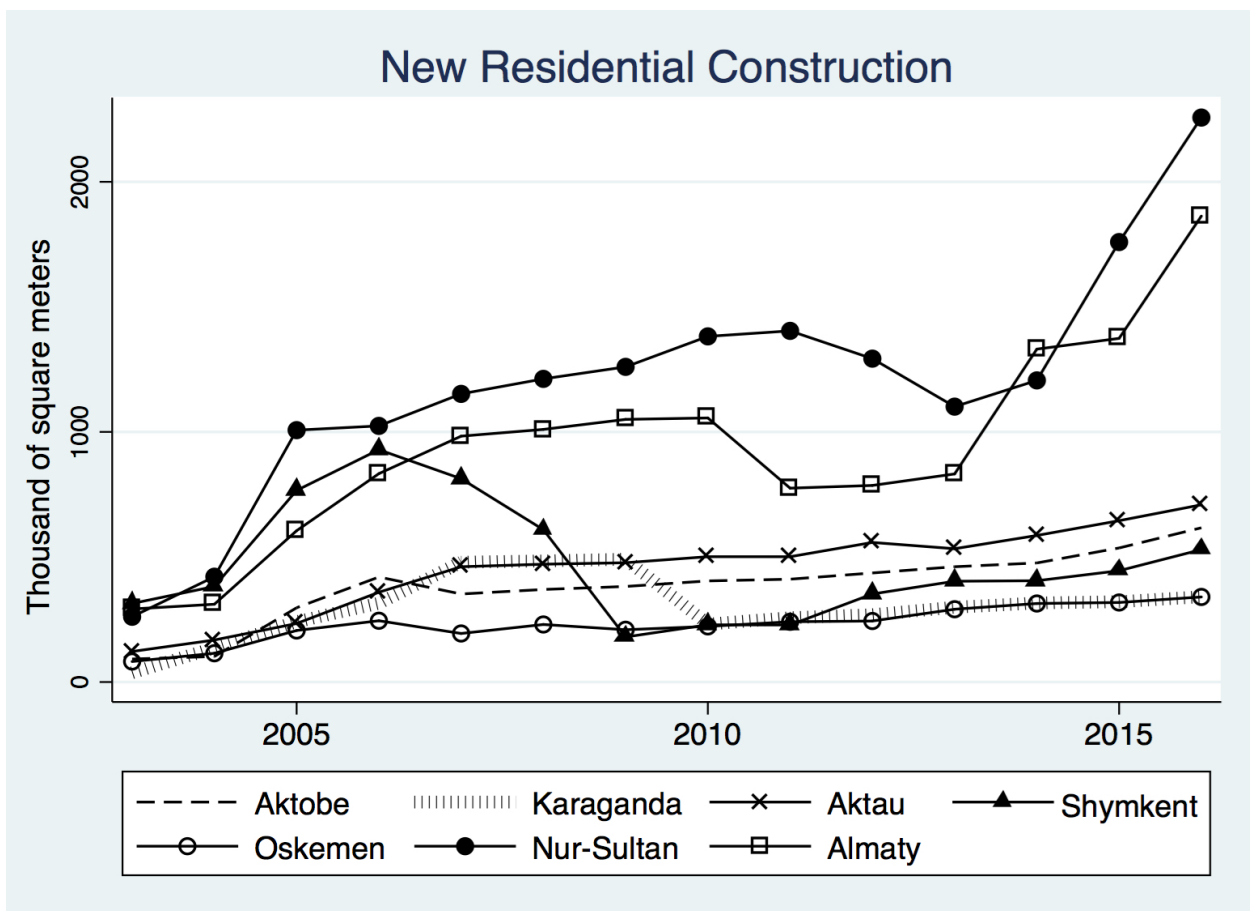
⁷ Detailed regional data on housing construction are published monthly by Kazstat: http://stat.gov.kz/faces/wcnav_externalId/homeNumbersConstruction?_afLoop=3197734920812623#%40%3F_afLoop%3D3197734920812623%26_adf.ctrl-state%3Dg2zmmk0ts_84.

Figure 2. New housing investments



Source: Committee of Statistics of the Republic of Kazakhstan.

Figure 3. New residential Construction in Kazakhstan by city, 2003-2016



Source: Committee of Statistics of the Republic of Kazakhstan.

Indeed, despite large housing supply increases, the low quality of initial housing stock and the concentration of new construction means that housing conditions remain poor in many smaller cities, and inadequate and substandard housing remains a political issue. Specifically, there remains a substantial urban population that does not have access to adequate housing as the term is commonly understood in Kazakhstan. While real wages have stagnated throughout the nation in recent years in response to low oil and other minerals' prices, making mortgage credit increasingly difficult to obtain, the large wage disparities across cities make residents of smaller, poorer cities particularly vulnerable.

The economic slowdown occasioned by low oil prices also has given rise to increasing construction costs. Kazakhstan's domestic housing materials market is small and hence construction is dependent on imported building materials. Substantial KZT depreciation has meant new construction cost increases, while growing spatial concentration has meant that land development costs have not fallen. On the positive side, the Government has built road, electricity, and sewerage infrastructure to allow a substantial expansion of the Almaty and Nur-Sultan outskirts. These projects, including a ring road around much of Almaty, have resulted in substantial suburbanization, and likely contributing to containing the cost of upper class housing in these cities.

3. Data and methodology

We use monthly resale house-price data from the web-based advertisement site Krisha over the period May 2014 - March 2017. May 2014 is the earliest time for which we have data on multiple cities, and hence can determine whether housing prices for specific cities exhibit a long run relationship. Focus on resale data enables us to avoid the considerable biases created by incorporating newly constructed units, which tend to be of higher quality and in relatively desirable locations.

The indices we use are preferable to the unadjusted average sale price per square meter data reported by the statistical agencies of most emerging market economies, including Kazakhstan, which actually provides unweighted averages in considerable detail (and which are used in An *et al.*, 2017), though not at the degree of refinement provided by Krisha. Nonetheless, there are significant limitations to the aggregate data.

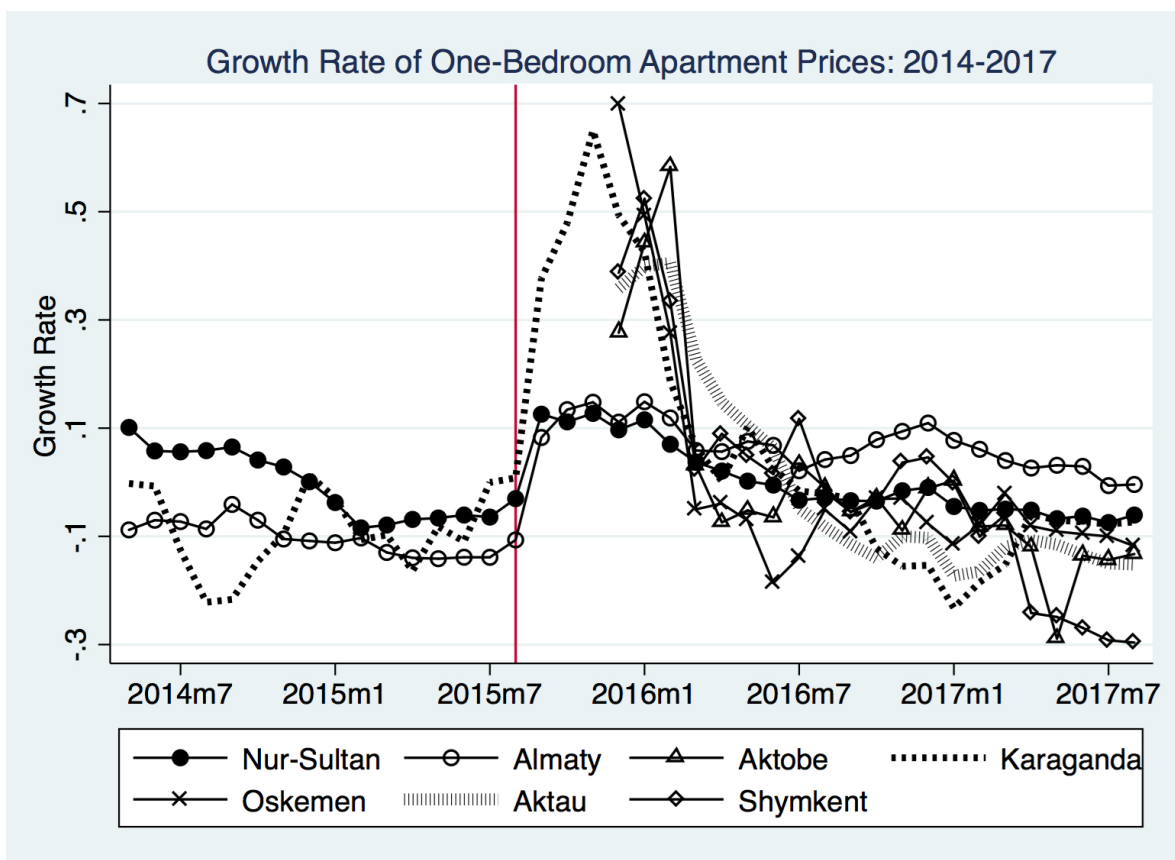
On the positive side, Krisha's indices exclude new structures. In addition, they are divided by type. These divisions include number of bedrooms ranging from one to five, structure type – brick, panel, or monolith – and for larger cities, the district. Thus, Almaty is divided into eight districts (*raiony*); Nur-Sultan and Shymkent have three each, and Karaganda has two.

On the negative side, indices are not based on repeat sales and are not generated by time coefficients taken from hedonic regressions, as in Ye and Becker (2017). Thus, while there is substantially more comparability and quality control than when using simple indices, the control is imperfect, and there is some risk that compositional changes correlated with changes in explanatory variables will bias estimated coefficients.

Krisha's indexes are a weighted average of house prices in Kazakhstani cities or, depending on the data, provinces (oblasts) containing multiple small cities. For each city/oblast, nominal prices are deflated using the 2015 CPI, which allows for differences in regional prices. Figure 4 shows real housing prices of one-bedroom apartments for seven cities: Nur-Sultan, Almaty, Karaganda, Shymkent, Aktobe, Aktau, and Oskemen. These cities represent largest urban centers and geographically cover the most of the country. Figures 5 and 6 provide the same information for

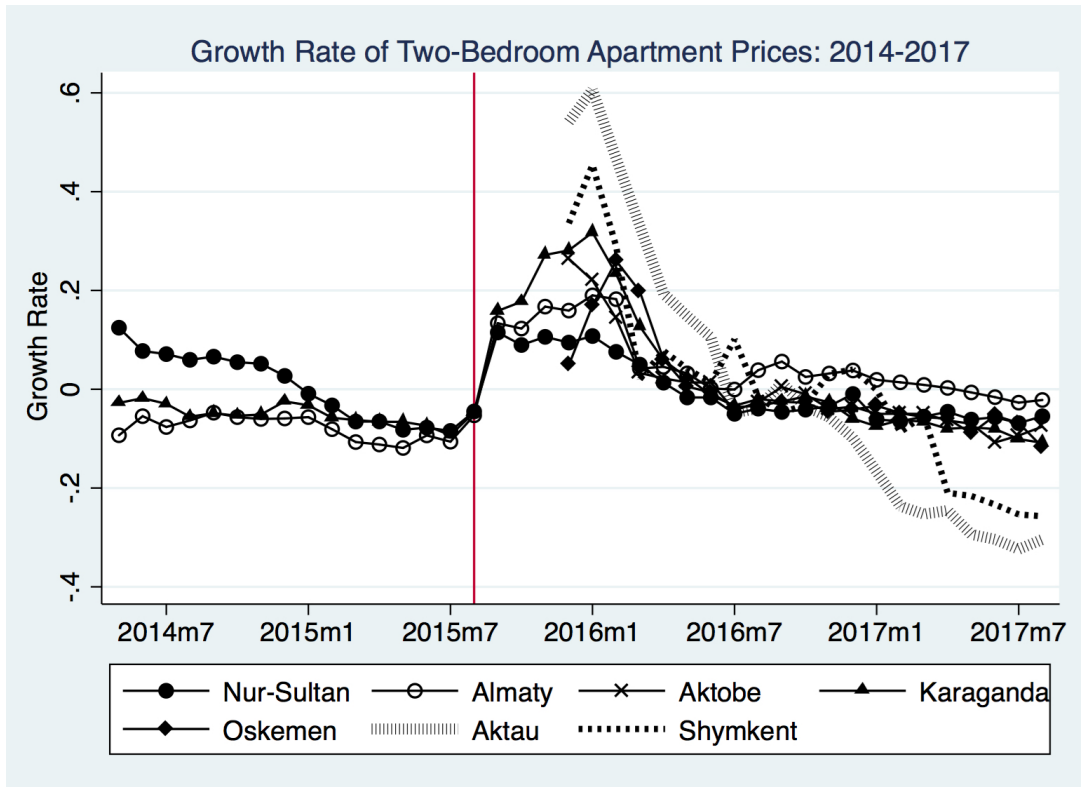
two- and three-bedroom apartments, respectively. From the descriptive statistics in Figures 1 and city-level housing dynamics in Figures from 4 to 8, it is clear that there is a great variability among different city prices, especially one-bedroom apartments. Also noteworthy is the stagnation period before the quick and widespread upsurge in 2015 and a sharp decline just after the introduction of inflation-targeting monetary policy and the KZT's free float in August of 2015. The largest drop over all three categories of housing is observed in Aktau city, which played a large role earlier in driving up average country prices. Moreover, the fluctuation dynamics are greatest in one-bedroom housing segment, likely reflecting the fact that such units are the most liquid, and the dynamics moderate with increases in numbers of bedroom and hence unit size.

Figure 4. One-bedroom housing prices in seven-city sample: 2014-2017



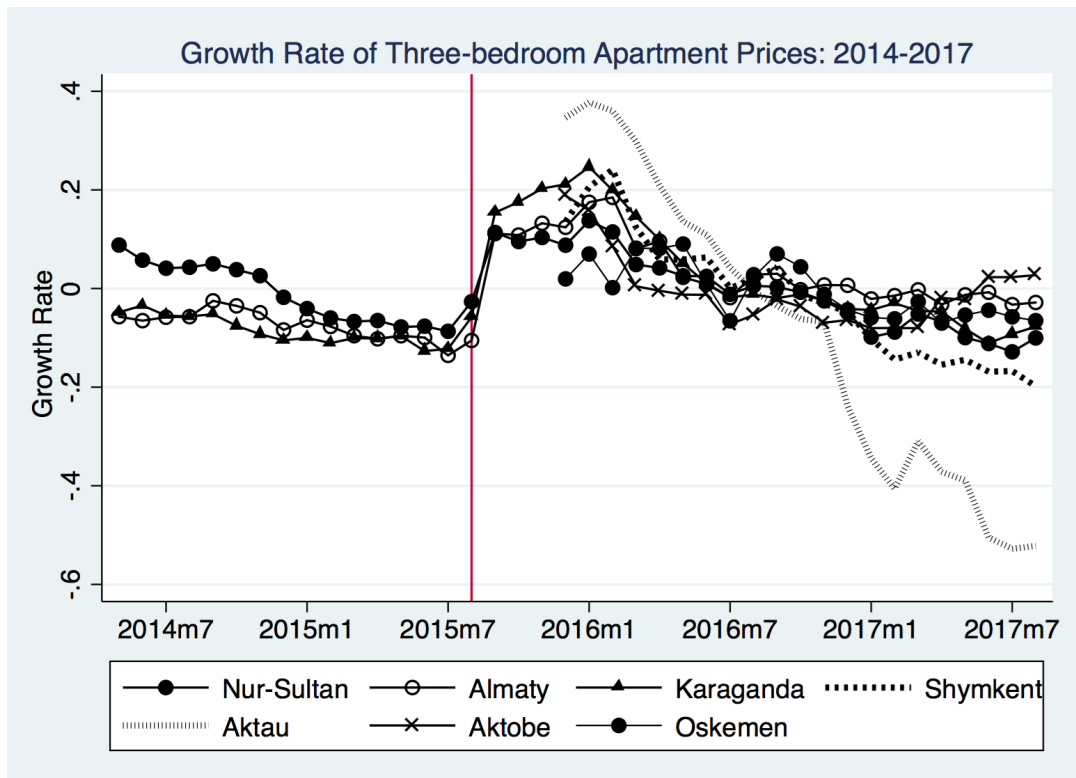
Source: www.krisha.kz

Figure 5. Two-bedroom housing prices in seven-city sample: 2014-2017



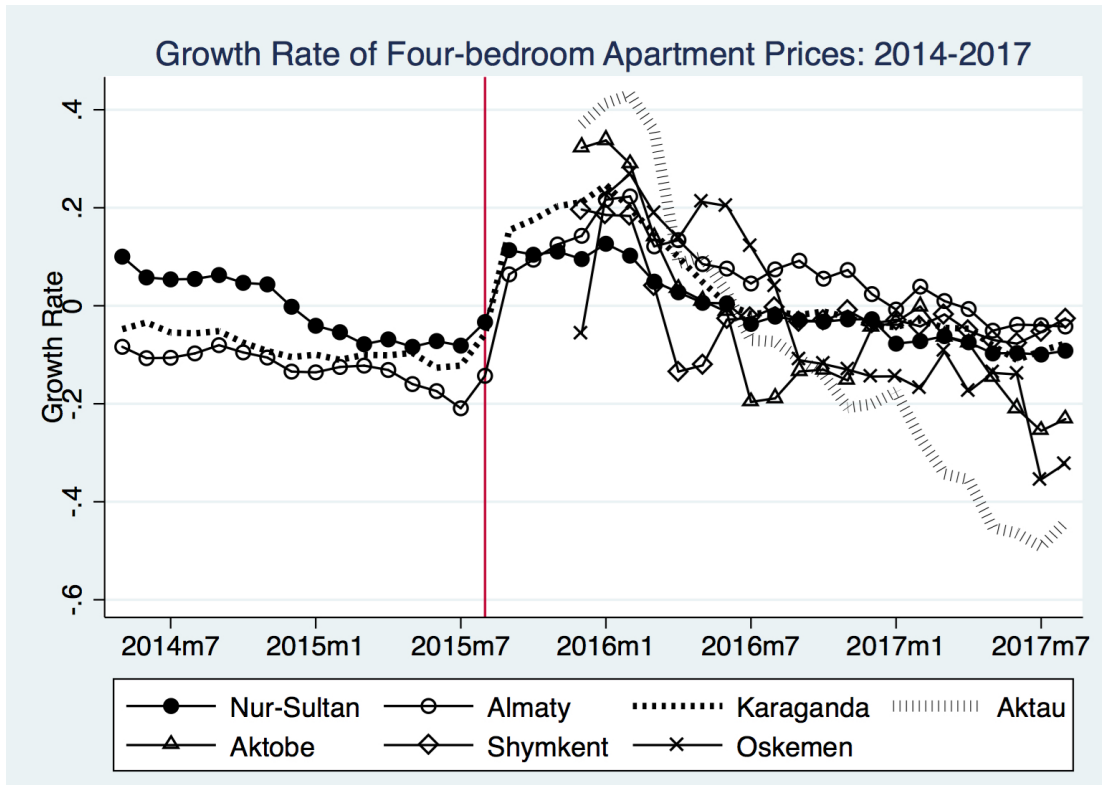
Source: www.krisha.kz

Figure 6. Three-bedroom housing prices in seven-city sample: 2014-2017



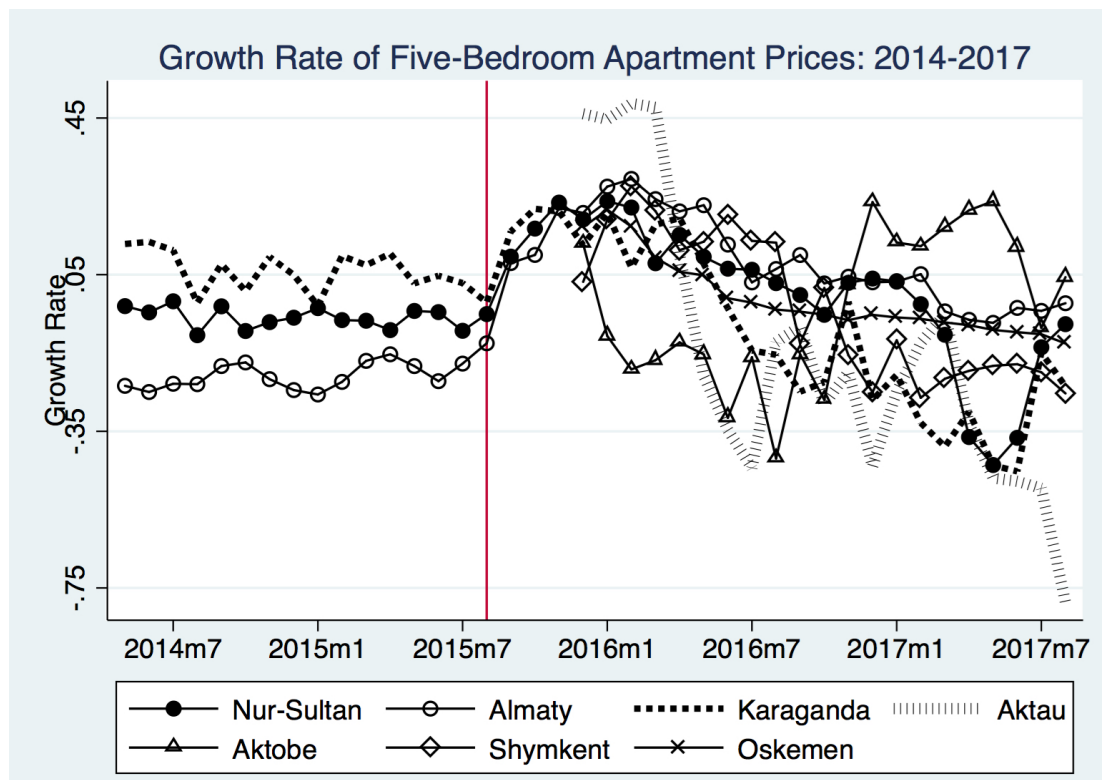
Source: www.krisha.kz

Figure 7. Four-bedroom housing prices in seven-city sample: 2014-2017



Source: www.krisha.kz

Figure 8. Five-bedroom housing prices in seven-city sample: 2014-2017



Source: www.krisha.kz

Next, we test whether the city housing prices series for these seven cities contain unit roots by performing an Augmented Dickey and Fuller (ADF) test. For all cases, we cannot reject null hypothesis of a unit root at standard levels, which means that the series are $I(1)$. Based on these results (Table 2), we can further conduct cointegration tests developed by Johansen (1988) to detect if there is a long-run relationship between the seven city housing series.

Table 2. ADF test of city housing prices

City	p-value	First-difference p-value
Nur-Sultan (Astana)	0.1854	2.829
Almaty	0.5058	2.952
Aktau	0.0000	1.548
Aktobe	0.0000	3.520
Shymkent	0.0002	3.198
Oskemen	0.0000	4.505
Karaganda	0.0366	3.722
Astana	0.1854	2.829
Almaty	0.5058	2.952
Aktau	0.0000	1.548

If city real estate markets are linked in low frequencies, it means that one could suggest that the whole housing market could be driven by one vector only. Conversely, if there is no such cointegration between given series, then it is potential evidence of highly disintegrated local housing markets, and it is appropriate to study individual real estate markets, or, alternatively, a subgroup of cities. It also important to notice that ADF and Johansen-type tests for cointegration are tend to under-reject and over-reject, respectively, the null hypothesis of no integration in favor of cointegration alternatives in a finite sample. Johansen-type tests tend to exhibit an incorrect rank number, particularly in cases when the number of variables is greater than the number of observations. As the seven-city sample is rather short, it is important to keep this problem in mind and seek a solution to address that limitation in future work.

Table 3 provides cointegration results for one-bedroom housing units. They suggest that housing prices are very weakly correlated and that the overall Kazakhstani real estate market is highly dis-integrated. In addition, we obtain similar results across the other segments of housing market (that is, for different numbers of rooms.) The lack of cointegration primarily implies that the cities' average real estate prices in the highly liquid segment of one-bedroom apartments are not determined by a single national pricing model that links all the local markets into unified housing market. This lack of cointegration raises issues with virtually all prior work on housing markets in transition economies, as it has presumed a unified aggregate housing market index. On the other hand, the lack of cointegration strengthens the importance of understanding price evolution.

Table 3. Johansen tests for cointegration

	(1)	(2)	(3)	(4)
Maximum rank	Parameters	LL	Eigenvalue	5% critical value
0	0	-35.868	.	109.99
1	13	8.205	0.998	82.49
2	24	30.096	0.956	59.46*
3	33	44.747	0.876	39.89
4	40	57.934	0.84	24.31
5	45	63.34	0.53	12.53
6	48	66.888	0.39	3.84
7	49	67.9	0.13	

In sum, initial analysis indicates that housing prices are not strongly interconnected across cities. These results are not entirely unexpected, since Kazakhstan's regions are diverse, and regional housing prices reflect growth differentials. We next explore how various regional components affect each city's housing price series individually, and also test whether the interest rate channel is effective in influencing asset prices, including housing.

4. City level determinants and the interest rate channel

The preceding section finds that Kazakhstani urban housing prices are largely fragmented, thereby inspiring city-level research. This section also tries to identify whether interest rates play a significant role in directing housing prices. Mortgage interest rates generally follow the regular NBK discount rate. Since consistent mortgage interest rate data are unavailable, we use the NBK rate as a proxy to assess the impact of the interest rate channel on city housing prices.

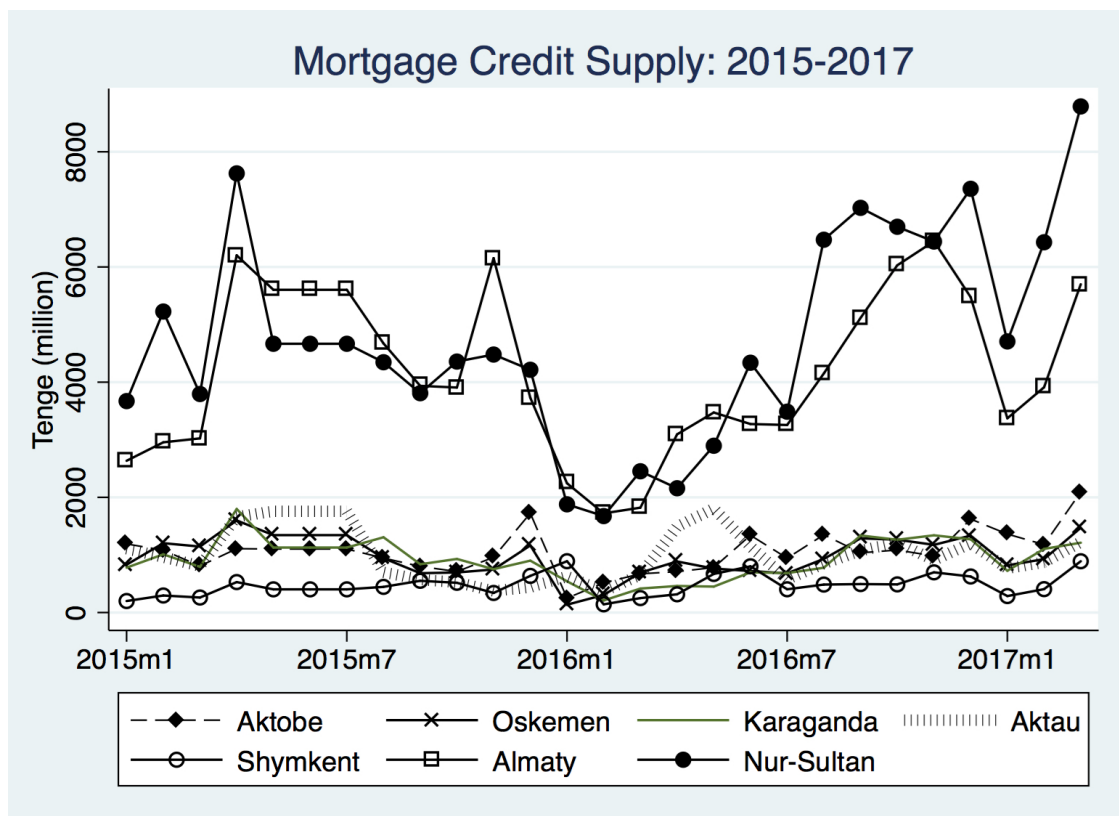
Changes in the central bank's discount rate have a large effect on the ability of economic agents to purchase big-ticket items, and housing units in particular. Increases in the NBK discount rate cause mortgage interest rates to rise, leading to larger mortgage payments and a decrease in housing demand. Additionally, Case (2000) argues that higher mortgage debt implies higher leverage through which interest rate fluctuations affect consumer spending.

Another set of literature emphasizes how household balance sheet effects affect the transmission mechanisms of domestic monetary policy. For instance, Di Maggio *et al.* (2014) show a considerable effect of monetary policy on consumption. They emphasize that the marginal propensity to consume is larger for low-income groups and highly indebted borrowers and also note that the monetary policy effect is larger in countries with a greater share of adjustable rate mortgages.⁸ Keys *et al.* (2014) further find that regions more exposed to mortgage rate declines generally experience faster recovery of real estate prices, as well as consumption and employment, and specifically in the non-tradable sector. In sum, those papers emphasize the point that effective monetary policy crucially depends on the distributive channel of liquid wealth and mortgage debt.

⁸ See (Paragiotidis, Bampinas and Panagiotidis 2017, Calomiris, Longhofer and Miles 2009, Case, Shiller and Quigley 2005, Chen and Wen 2017, Cloyne, et al. 2017, Czerski, Gluszak and Zygmunt 2017, Dong, Hui and ShengHua 2017, Gan 2010, Glaeser 2014, Iacoviello 2011) (Banai, Nikolett and Winkler 2017).

Exploring these mechanisms in Kazakhstan, Figure 9 reports the actual amount of mortgage credit supply among our seven-city sample. As it appears given the natural logarithmic scale, the bulk of all the credit supply within the country goes only to Nur-Sultan and Almaty. Given this pattern, which should greatly affect our regression analysis on regional factors and the importance of interest rate channel, we expect to find much stronger sensitivity of housing demand to monetary policy in the two dominant urban areas. Nur-Sultan and Almaty combined account for about 66 percent of total mortgage credit supply within the seven major cities over the given period. Also noteworthy is the sudden drop following the monetary regime switch at the beginning of 2016, when Nur-Sultan and Almaty registered a 70 percent decrease from their peak values. Despite a nearly 90 percent plunge in credit supply in the remaining cities, housing values nevertheless recovered to previous levels by the beginning of 2017.

Figure 9. Mortgage credit supply: 2015-2017



Source: Committee of Statistics of the Republic of Kazakhstan.

While the interest rate is a main policy tool for combating inflationary pressures, inflation itself might have a strong effect on the dynamics of housing prices. Based on the US housing market, Feldstein (1992) argues that a decline in the inflation rate markedly affects real estate investment incentives. His reasoning is that the decline in inflation rate in 1980s distorted the tax code, which affected the user cost of capital, both for homeowners and rental property owners. At the same time, Kearl (1979) points out that inflation rate produces cash-flow effects that negatively influence housing demand, as the stream of real payments is directly proportional to present nominal monthly mortgage payments. Thus, in the 1970s, when the overwhelming majority of US housing investments was financed through fixed-rate mortgage payments, an increase in ex-

pected inflation and corresponding periods of rapid increases in interest rate actually raised nominal cash expenditures, which finally led to a decrease in household savings and a decrease in overall housing demand. In addition, Summers (1981) finds that inflation forecasts based on past inflation dynamics explain why housing prices rose more rapidly than the general prices in the US between 1958 and 1978, changing the composition of capital stock.

Conventional variables that might explain differences in regional housing patterns and cycles include variation in construction costs, employment levels, and income growth. We obtain available data from the Kazstat and NBK websites. Specifically, we use a city-specific real wage index (*RWI*), the regional labor force participation rate change (*LF*), the cost of financing (*R*), proxied by the main policy interest rate, an amount of actual mortgage credit issued in every region (*MORT*), and a measure of overall economic activity, real regional gross domestic product (*RGDP*), as our main explanatory variables. Then, controlling for regional heterogeneity, we focus first on whether the common interest rate plays any role in driving of city housing prices. As expected, each of selected variables are non-stationary, but in all cases the first difference is stationary. Using quadratic spline interpolation we convert real regional gross domestic product (*RGDP*) and the regional labor force participation rate (*LF*) from quarterly to monthly data, as is standard practice in the macroeconomic literature to make the data consistent with other variables. In many countries, *MORT* would be endogenous. However, in Kazakhstan, government policy has a heavy hand in directing regional credit and mortgage providers look to government for approval before extending or curbing lending activities.

On the supply side, real wage indices (*RWI*) captures the labor costs of building new housing or improvement of existing ones. Thus, an increase in wages, which creates both an income effect and a cost effect associated with the wage of construction workers, should lead to an increase in current housing prices as well as to demand growth if the former effect dominates. Changes in the cost of materials, which are largely imported, are driven by changes in the tenge/dollar exchange rate (*EKZT*). As defined, an increase in the exchange rate means depreciation of the domestic currency.

Labor force participation rate or population growth also is a standard variable in the housing demand literature. An increase in city's labor force participation rate should lead to an increase in housing demand as the market bids up housing prices. Other variables include interest rate as a measure of interest cost of owning the house, and regional gross domestic product. The ideal measure of the latter is city-level GDP. While such data are unavailable, since the dominant urban center in a given oblast invariably accounts for the major part of economic activity, we regard real regional GDP as a suitable proxy for city-level economic activity.

Our model consists of standard demand, supply and central bank's response functions. We assume that in the short-run, the supply of housing is fixed and equal to the existing housing stock. However, long-run housing supply is likely to respond to the cost of construction, the prices of competing goods (including goods and services that compete with housing, as well as housing in other locations), and the central bank's interest rate. In addition, *EKZT* changes will be important, as imported goods constitute a major proportion of housing costs. Correspondingly, current price levels, regional labor force participation rate, mortgage interest rate, and city level gross domestic product determine the demand function. Finally, our Central Bank's response function – the interest rate – follows a typical Taylor-type rule, and primarily includes inflation dynamics and output growth:

$D = f(\text{Price, Labor Force Participation Rate, Interest Rate, Regional Output})$

$S = g(\text{Price, Construction Cost, Wages, Exchange rate})$

$R = r(\text{Inflation, Output})$

The first step is to test if the variables in each set of city-specific series are cointegrated. Our results indicate that for all individual cities, there is indeed cointegration among explanatory variables. Thus, to make correct conclusions from a reduced form regression, taking into account the long-run nature of each regressor with each of the city housing prices, we need to use an FM-OLS technique that allows making inferences within the cointegrating framework. Hence, setting demand and supply equal to one another above, solving for *Price*, and substituting in the NBK's response function, our base reduced-form econometric model follows:

$$\log \text{Prices}(t) = a_0 + a_1 \text{lag}(P) + a_2 \text{RWI}(t) + a_3 \text{GDP}(t) + a_4 R(t) + a_5 \text{LF}(t) + a_6 \text{EKZT}(t) + a_7 \text{Dummy}(\text{Room}) + a_8 R(t+3) + u(t), \quad (1)$$

Results, again restricting observations to the seven urban areas for which the most observations exist, appear in Table 4. The findings are quite mixed, but key patterns do emerge. Our main policy objective, the short-term interest rate, is positive and statistically significant in those cities with the highest level of credit supply: Nur-Sultan, Almaty and Karaganda. In the remaining cities (Aktobe, Shymkent, Aktau, Oskemen), interest rate coefficients are negative and insignificant.

Table 4. City-specific regression estimates

VARIABLES	(1) Nur-Sultan	(2) Almaty	(3) Karaganda	(4) Aktobe	(5) Shymkent	(6) Aktau	(7) Oskemen
Lag(t-1)	-0.115*** (0.0408)	-0.152*** (0.0394)	-0.167*** (0.0488)	-0.403*** (0.143)	-0.295 (0.194)	-0.0274 (0.107)	-0.378*** (0.0755)
ΔWage	0.00254 (0.00161)	0.00322* (0.00191)	0.000881 (0.00259)	-0.000870 (0.0147)	0.00229 (0.00863)	0.00685 (0.0116)	0.00210 (0.00932)
ΔGDP	0.216 (0.479)	-1.334 (2.739)	-0.943 (1.064)	-8.202 (15.04)	-37.51 (54.34)	10.41 (14.40)	-7.061 (14.85)
ΔInterest rate	0.0153*** (0.00224)	0.0164*** (0.00274)	0.0218*** (0.00417)	-0.00554 (0.0190)	0.0104 (0.0253)	-0.0103 (0.0193)	-0.0129 (0.0129)
ΔExch.rate	-0.000442** (0.000175)	-0.000119 (0.000199)	-0.000555* (0.000324)	0.00223** (0.00103)	0.00244 (0.00149)	0.00102 (0.00109)	4.25e-05 (0.000710)
Room=1	-0.0359** (0.0140)	-0.0924*** (0.0254)	-0.0457** (0.0224)	0.230** (0.0878)	-0.0161 (0.0662)	-0.0893 (0.0695)	-0.0202 (0.0248)
Room=2	-0.00464 (0.00884)	-0.0549*** (0.0172)	-0.0130 (0.0165)	-0.0725 (0.0446)	0.0322 (0.0500)	-0.00462 (0.0408)	-0.0256 (0.0262)
Room=3	-0.0303** (0.0121)	-0.0523*** (0.0157)	-0.0250 (0.0195)	0.241*** (0.0870)	-0.00186 (0.0513)	-0.0614 (0.0370)	0.0453* (0.0254)
Room=4	-0.0325** (0.0129)	-0.0178* (0.0107)	-0.0251 (0.0195)	0.314*** (0.111)	-0.0416 (0.0638)	-0.0774** (0.0368)	0.0791** (0.0304)
Int.rate(t+3)	0.00108 (0.000921)	0.00371*** (0.00113)	0.00259 (0.00188)	-0.00421 (0.0274)	-0.0338 (0.0330)	0.0125 (0.0253)	0.00414 (0.0184)
Constant	1.488*** (0.527)	1.997*** (0.514)	2.074*** (0.606)	4.806*** (1.660)	4.594 (2.790)	0.0516 (1.523)	4.668*** (1.081)
Observations	150	150	150	55	55	55	55
R-squared	0.419	0.469	0.346	0.305	0.247	0.345	0.432

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In a reduced form setting, the coefficient a_4 is in principal indeterminate, since current interest rates in part reflect anticipated future demand levels, and consumers borrow in part based on expected future incomes and asset values. At the same time, borrowers cannot completely insulate their expenditures from shocks to credit availability and mortgage interest rates. However, the positive effect of a_4 in the dominant cities plus Karaganda (and it is important to note that Karaganda is not far from Nur-Sultan) along with its insignificance elsewhere together indicate that the interest rate channel of monetary policy is an ineffective instrument in regulating housing demand.

Exchange rate shocks also have inconsistent effects. Upward movement (tenge devaluation) in the exchange rate is associated with declining housing prices in Nur-Sultan and Karaganda, but rising prices in Aktobe. The anomaly is Karaganda, an industrial city that refines metals and produces import-competing goods: one would expect a cheap tenge to result in increased economic growth in the city.

A more expected finding is that wage indices are generally positively associated with city housing prices. The result holds true in all cases and is statistically significant in most of them, so we have some confidence that wage growth rates are strong predictor of local housing price changes. The labor force participation rate variable is inconsistent, quite likely because of the short time span considered, so that it mainly reflects structural factors rather than labor market tightness. Regression results including the labor force participation variable are in Table 5.

Table 5. City-specific regression estimates

VARIABLES	(1) Nur-Sultan	(2) Almaty	(3) Karaganda	(4) Aktobe	(5) Shymkent	(6) Aktau	(7) Oskemen
Lagt-1	-0.0959 (0.0866)	0.144 (0.104)	-0.134*** (0.0505)	0.309** (0.143)	-0.206 (0.201)	0.0297 (0.113)	-0.389*** (0.0773)
Δ Wage	0.00292* (0.00172)	0.00201 (0.00201)	0.00184 (0.00281)	0.0764*** (0.0233)	0.0112** (0.00491)	0.0170 (0.0189)	0.0175* (0.00979)
Δ Labor Force	0.360 (0.995)	0.563 (1.185)	1.856 (1.596)	801.0*** (280.2)	-1.266** (568.1)	-7.827 (154.4)	-262.7 (533.1)
Δ GDP	-0.273 (0.541)	-0.331 (2.794)	0.136 (1.196)	293.6*** (103.9)	147.2** (69.63)	-3.985 (85.71)	-28.21 (37.27)
Δ Interest rate	0.0179*** (0.00200)	0.0226*** (0.00230)	0.0263*** (0.00364)	-0.0396** (0.0192)	-0.0179 (0.0229)	-0.0143 (0.0195)	-0.0274 (0.0198)
Δ Exch.rate	-0.000477*** (0.000178)	-0.000177 (0.000209)	-0.000606* (0.000330)	0.00293*** (0.00106)	0.00232* (0.00117)	0.000790 (0.00102)	-8.47e-05 (0.000841)
Room=1	-0.00570 (0.00873)	-0.00146 (0.0104)	0.00684 (0.0162)	3.71e-05 (0.0373)	0.0583 (0.0459)	-0.0454 (0.0378)	-0.0308 (0.0344)
Room=2	0.000174 (0.00873)	0.000990 (0.0104)	-0.00128 (0.0162)	-0.00133 (0.0373)	0.00903 (0.0459)	0.00841 (0.0378)	-0.000816 (0.0344)
Room=3	-0.00680 (0.00873)	-0.00578 (0.0104)	0.0123 (0.0162)	-0.00124 (0.0373)	0.0286 (0.0459)	-0.0269 (0.0378)	0.0148 (0.0344)
Room=4	-0.00656 (0.00873)	-0.00440 (0.0104)	0.0123 (0.0162)	9.69e-05 (0.0373)	0.0281 (0.0459)	-0.0470 (0.0378)	0.0133 (0.0344)
Observations	155	155	155	60	60	60	60
R-squared	0.381	0.407	0.295	0.197	0.219	0.222	0.141

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Monetary policy does not occur in a vacuum, but is often anticipated by markets, especially in countries like Kazakhstan where policymaking is openly discussed and reasonably transparent. Therefore, we introduce a three-period lead operator on the interest rate. This interest rate anticipation coefficient is mostly positive, except for in Shymkent and Aktobe, and is strongly significant in Almaty, suggesting that interest rate setting does play some role in guiding of housing prices, increasing current demand when there is an expectation of future cost increases.

We also include housing size dummy variables in our analysis, with five-bedroom housing as our reference group. The regression results imply that the price per square meter (strongly correlated with number of bedrooms) declines slightly with apartment or house size, since these terms tend to be only modestly negative when not insignificant. A superficial analysis would be that urban Kazakhstanis do not value housing space. A more plausible explanation is that housing size is inversely correlated with distance from city centers. Absent location estimates in the aggregated data, the insignificant coefficients reflect omitted variable bias and are consistent with a model in which $P_H H$, the price of housing times quantity of quality adjusted housing units, forms a rectangular hyperbola as one moves from the CBD. The approximate constancy of $P_H H$ also reflects a negative correlation between space and housing quality (that is, quality adjusted H varies less than proportionately with space).

4.1. Regional price contagion

There are reasons to believe that housing price dynamics from larger urban areas might have spillover effects to economically smaller housing markets. To address this, we investigate regional contagion effects of Nur-Sultan and Almaty, representing the largest economic centers of the country, to the other cities in our sample. As a result, the regional contagion model for a particular type (“monolithic”) of housing includes lagged prices of housing in Nur-Sultan and Almaty, in addition to the standard set of economic variables. Most recently constructed buildings in Kazakhstan are built through monolithic construction technique (where a single layer of concrete is poured at the same time, forming a new segment of the apartment complex or, occasionally, independent house). That means that contagious price effects could be efficiently tracked within the most common and popular type of housing. Consequently, two regressions are required to trace out the effect for each category of the housing. The first equation is our basic model, while the second equation has lagged prices of each region substituted by the lagged house prices of Nur-Sultan and Almaty. The intuition is to test if the lagged housing price in Nur-Sultan and Almaty can predict a regional housing price variable better than the region’s own lagged values. The following equation is our specification to examine the existence of regional price contagion.

$$\log Prices(t) = a_0 + a_1 \log Price_{AST, t-1} + a_2 GDP(t) + a_3 LF(t) + a_4 RWI(t) + a_5 R(t) + a_6 EKZT(t) + u(t) \quad (2)$$

The results from Table 6 demonstrate that contagion effects are consistently insignificant that there is no evidence of cascading effects. The exception to this statement is the strong effect of lagged Almaty process on current monolithic housing prices in Shymkent.

Table 6. Regional price contagion

VARIABLES	(1) Nur-Sultan	(2) Almaty	(3) Karaganda	(4) Aktobe	(5) Shymkent	(6) Aktau	(7) Oskemen
Lag (Nur-Sultan)	-	0.144 (0.104)	0.208 (0.163)	0.0247 (0.538)	0.269 (0.700)	-0.800 (0.522)	0.106 (0.379)
Lag (Almaty)	0.00261 (0.0699)	-	-0.146 (0.131)	0.533 (0.347)	-0.719* (0.428)	-0.110 (0.363)	-0.0695 (0.238)
Lag (t-1) ΔGDP	-0.0959 (0.0866)	-0.188** (0.0845)	-0.134*** (0.0505)	0.309** (0.143)	-0.206 (0.201)	0.0297 (0.113)	-0.389*** (0.0773)
ΔLabor Force	-0.635 (0.545)	0.430 (2.842)	0.519 (1.215)	241.9* (134.7)	92.39 (96.83)	-80.32 (89.22)	-44.51 (30.35)
ΔWage	1.396 (1.589)	-3.674 (2.309)	-0.946 (2.590)	637.4* (348.9)	-878.1 (605.0)	-134.8 (156.5)	-512.2 (384.1)
ΔInterest rate	0.00307* (0.00172)	0.00230 (0.00202)	0.000146 (0.00288)	0.0495 (0.0322)	0.000646 (0.00797)	-0.00639 (0.0213)	-0.00143 (0.00930)
ΔExch.rate	0.0165*** (0.00207)	0.0207*** (0.00239)	0.0243*** (0.00377)	-0.0255 (0.0216)	0.00495 (0.0248)	0.00713 (0.0202)	-0.0217 (0.0146)
Room=1	-0.000516*** (0.000178)	-0.000195 (0.000212)	-0.000696** (0.000334)	0.004*** (0.00139)	0.00167 (0.00167)	-1.67e-05 (0.001)	-6.56e-05 (0.000803)
Room=2	-0.0292 (0.0242)	-0.0751** (0.0292)	-0.0655 (0.0448)	0.559** (0.238)	-0.406 (0.274)	-0.410* (0.227)	-0.0324 (0.151)
Room=3	-0.00292 (0.0233)	-0.0618** (0.0281)	-0.0537 (0.0433)	0.166 (0.146)	-0.257 (0.167)	-0.0825 (0.139)	-0.0499 (0.0948)
Room=4	-0.0255** (0.0126)	-0.0334** (0.0152)	-0.0187 (0.0234)	0.427** (0.167)	-0.235 (0.186)	-0.316* (0.159)	0.0441 (0.103)
Observations	-0.0278 (0.0171)	0.0126 (0.0206)	0.0177 (0.0321)	0.338* (0.173)	-0.0551 (0.197)	-0.333** (0.147)	0.103 (0.108)
R-squared	150	150	150	55	55	55	55
	0.420	0.439	0.348	0.368	0.321	0.394	0.455

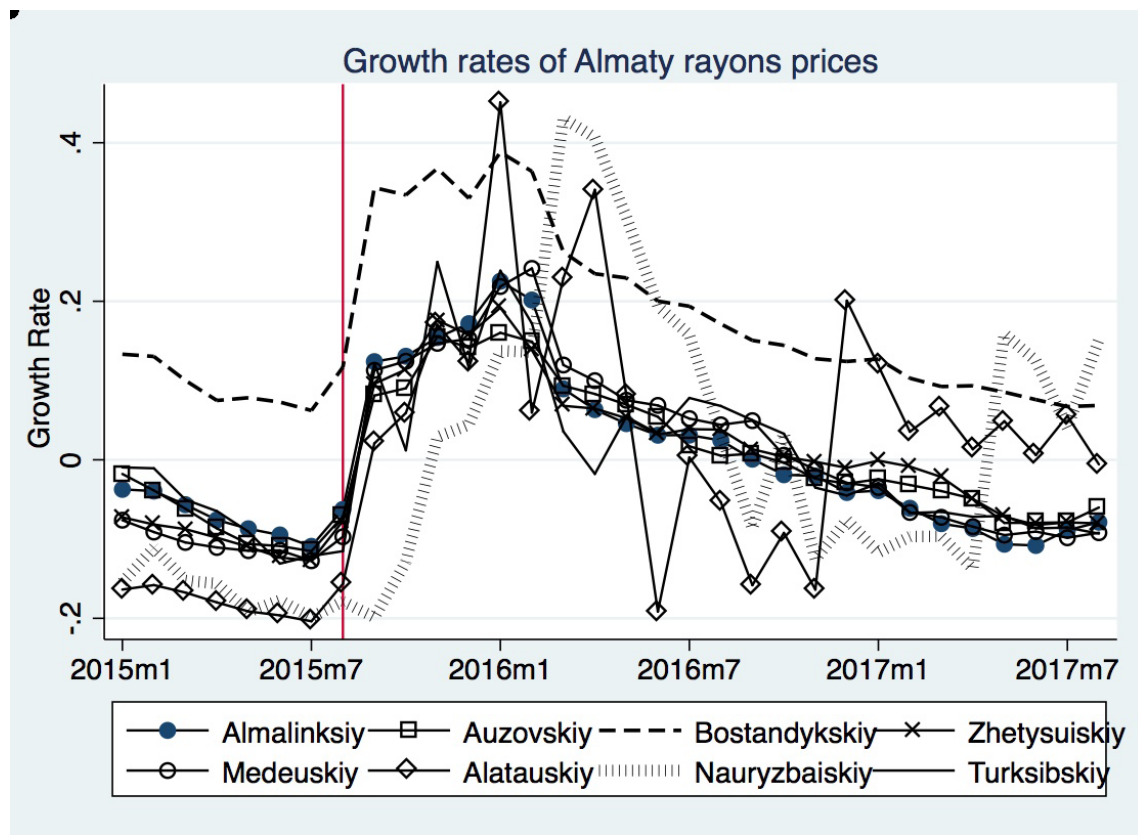
Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.2. Almaty intra-city price dynamics

Beyond exploring the consequences of exchange rate devaluation shock across cities, it is also valuable to examine intra-city housing price differentials. Thus far, we have focused on housing market segmentation across cities; it is natural to ask whether neighborhoods within a large city are also poorly integrated. Thus, we specifically analyze the price dynamics in seven raions of Almaty.

The first point to note (Figure 10) is modest growth in 2016 prices in all raions compared to the first seven months of 2015. However, while the jump in *EKZT* from roughly 180 in July 2015 to 350 in January 2016 was associated with rising housing prices in tenge, they then gradually receded across the board, and fell sharply in dollar terms. This price reversion raises questions about the nature of the relationship between asset price fluctuations and consumption patterns. Most plausibly, tenge prices rose to absorb some of the shock of devaluations; as demand continued to shrink in the face of the real wealth decline, further housing prices declines occurred both in tenge and dollar terms.

Figure 10. One-bedroom apartment price in Almaty raions: 2015-2017

Source: www.krisha.kz

Second, the highest price shock occurred in Nauryzbaiskiy raion and prices continued to oscillate sharply there in the following two years. Nauryzbaiskiy raion, located on the city's southwest fringe and far from the center, traditionally had Almaty's lowest cost housing. A plausible though purely speculative explanation is that housing in Nauryzbaiskiy raion is an inferior good relative to central city housing or that in the generally prosperous eastern outskirts, so that a negative wealth shock would lead to increased demand in the poorest areas. This explanation then leads to questions of income distribution and social vulnerability of lower-income group of people facing unexpected surges in inflation and rising costs of living.

Finally, Figure 3 indicates that housing prices do not converge across neighborhoods over the prolonged period, and, in particular, a stable gap between the urban/suburban divide persists. These differences are consistent with standard monocentric city models; the convergence that does occur is consistent with large income effects.

4.3. Policy implications

This paper explores regional housing price movements but with particular attention to how interest rate and exchange rate policies affect housing wealth and, through it, aggregate demand. Of course, these policies are not the only ones implemented to respond to macro shocks (largely minerals' price shocks in the Kazakhstani context), and are not the only policies to affect housing wealth. In the context of a small open economy, rapid economic and financial liberalization effec-

tively contribute to the increased level of capital inflows from abroad that can ultimately lead to the rising asset values, especially real estate prices. The main concern for general asset price volatility is their important and strong effects on the real economy, and especially in emerging market countries such as Kazakhstan. In particular, asset price swings are likely to affect consumption spending through the effects on household wealth. A huge shock to the system happened in August 2015, with the tenge's decline immediately cutting household wealth, then followed by an almost comparable housing wealth decline that should have cut aggregate demand further.

The main policy goal for the monetary policy in Kazakhstan and other emerging market economies typically is a combined strategy of preserving both price and financial stability. The dominant monetary framework of central banks, including the NBK, is inflation targeting, which declares that some specific level of inflation is an "overriding" long-run policy goal. As periods of asset price increases (decreases) generally lead to increases (decreases) in aggregate demand, then automatic counter-cyclical changes in interest rate are supposed to stabilize the economy in the short-run. However, it is unclear that central banks can distinguish between movements in inflation-generating asset prices (notably, housing), and the underlying "fundamental" factors moving the prices. It also seems unlikely that central banks worry about housing wealth effects of their policies, or calculate these second round effects on demand that their policies engender. While this paper is just an initial exploration into these effects in the contexts of transition economies, it would appear that the second round effects of macro stabilization policies are substantial. In the absence of precise measures of second-round effects, a prudent policy would seem to be the adoption of flexible rather than rigid inflation targeting, along with greater collaboration with countries' fiscal programs.

5. Conclusion

This paper explores determinants of city-level housing prices. The key focus is to test whether there is a single, integrated Kazakhstani housing market, and hence to examine potential long-run relationships among the seven city housing prices series for which we have monthly data during the period 2014-2017. We further investigate how monetary and exchange rate shocks affect housing values. The results suggest that real estate prices are almost unrelated across cities, but that they do tend to move together within the one urban area that had a sufficient number of regions to explore co-movement. We further find evidence of an impact of the interest rate channel of monetary policy currently on housing wealth, but also that it is surprisingly weak, perhaps because of many other policy lurches that affected both demand and supply. One of our main conclusions is that local factors largely drive Kazakhstan's housing prices. Exchange rate movements also matter, in large part because prices tend to be quoted in dollars – in other words, because local housing is a substitute for international assets.

The weak relationship between price movements across different cities is unsurprising. A hierarchical model in which influence flows are largely unidirectional (from Almaty and Nur-Sultan to secondary cities) does not perform well. Kazakhstan is a vast country, and housing markets are likely to be only tangentially connected due to labor market flows. Just as few New Yorkers head to Fargo (North Dakota) or Lubbock (Texas) during oil booms, and few head the other direction during oil slumps, it is unlikely that many Kazakhstanis will move from Nur-Sultan to Aktau, or *vice-versa*. Cultural and climatic differences may further deter migration and lead to market segmentation. However, the vastness of the nation may present the greatest challenge: <https://yandex.ru/maps> indicates a driving distance of 3600 km from Aktau to Oskemen, and a predicted

driving time of 2 days, 5 hours and 43 minutes (in the absence of traffic jams). That is 100 km further than a drive from Atlanta to Los Angeles, or about the same distance as the drive from Memphis, Tennessee, to Guatemala City.

The lack of housing market integration and its apparent imperviousness to policy tools should be a matter of concern to the NBK and Kazakhstani economic policymakers. Housing wealth has risen almost explosively in Kazakhstan in the past two decades, likely pressuring aggregate demand. The apparent imperviousness of housing markets to government policy instruments limits demand management, thereby adding to the problems of managing an already highly cyclical economy.

The rise in housing wealth and its concentration in a few major cities (Almaty, Nur-Sultan, and the oil city of Aktau) that were already wealthy or favored by other policies has exacerbated inequality. The Kazakhstan government is acutely aware of this and has taken steps to spread benefits of development more broadly, but it remains a sensitive political issue. (Becker 2012)

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