The rental dynamics of the West German market for newly build apartments

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Abstract

Internationally Germany has a low owner occupation rate of only about 43 percent. Therefore the rented apartment sector is traditionally of great importance. Nevertheless only a limited number of empirical studies for the German residential sector exist. This study wants to give insight in the rental dynamics of the market for newly build apartments by examining the factors that influence rental change. The empirical results show, that real rental growth of newly build apartments is strongly influenced by income growth, migration patterns and past growth in real construction costs. The results also support the assumption of a backward looking expectation formation process from the developers when applying for the building permit and the structurally higher rental growth rate in southern Germany.

Keywords: residential sector, Germany, regional performance, cycles
JEL-classification: E31, R21, R23

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I. Introduction

Internationally Germany has a low owner occupation rate of only about 43 percent. Therefore the rented apartment sector is traditionally of great importance. The factors affecting apartment rents and their movement are of interest for urban planners, developers, financing institutions and real estate professionals. Additionally the demographic changes in the future (Deutsche Bank 2003a and 2003b) require a good understanding of the functioning of the rented apartment sector from developers and investors to deal with the upcoming challenges. Nevertheless only a limited number of empirical studies for the German residential sector exist.

This study wants to give insight in the functioning of the market for newly build apartments by examining the factors that influence the real rental change of newly build apartments in 44 West German cities. In comparison to the existing research the study uses time series data of a broad sample of West German cities to investigate the factors influencing the real rental change of newly build apartments, to get a better understanding of this part of the German residential sector.

The rest of the paper is as follows. Section two reviews recent studies on the German residential sector and shows the differences of these studies from the approach taken in this paper. Section three describes the underlying model structure used for the estimation and the variable specification. Section four reports the empirical results and their interpretations before section five concludes.

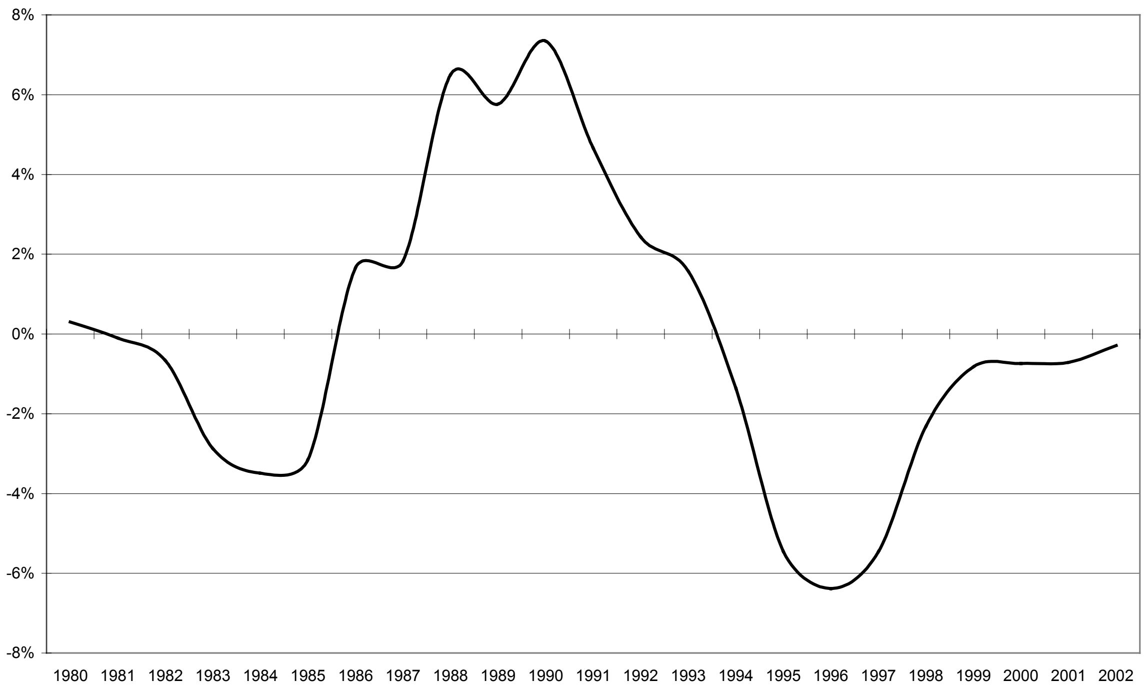
II. Past Studies on the German Residential Sector

There have been few empirical studies of the determinants of rents and prices in the German residential sector. One of the main reasons might be the lack of reliable statistical information from official sources about rents and prices in the German real estate market. Nevertheless two recent examples of studies are the working papers of Hoffmann/Kurz (2002) and Schultz/Werwatz (2001). Hoffmann/Kurz use data from the German Socio-Economic Panel to perform hedonic analyses of housing rents.[1] Based on their hedonic regression results Hoffmann/Kurz compute different price indices to measure rent inflation. Comparing their results with the official rent index for West Germany for the period 1985 to 1998 they find, that there is some evidence of an understatement of rent inflation in the official rent index for West Germany at the beginning of the 1990ies, whereas the difference in the adjacent

[1] A similar approach was taken by Voß (2001) within an overall simulation model of the West German residential market.

periods is close to zero. Schultz/Werwatz (2001) use a present value relation to derive a model that explains the formation and the movement of real estate prices. Based on this model, they come up with implicit hedonic prices for different characteristics of single family houses in Berlin for the districts of Zehlendorf, Wilmersdorf, Steglitz and Charlottenburg in the south of Berlin.

Figure 1 Real rental growth for newly build apartments in West Germany[2]



This paper takes a different approach from these 2 studies described, by using times series data for a panel of 44 West German cities. By using a panel approach this study goes a step further than Dopfer (2001) who used time series analysis to model a rent index constructed from rental data of 39 West German cities. The aim is to describe and test empirically the behaviour of the market for newly build apartments. Based on the common features of 44 West German cities the cyclical characteristics of the market for newly build residential apartments are investigated to come up with a model for the real rental growth rate based on the behaviour of the developers to explain the general rental cycle that can be seen in the 44 West German cities (Figure 1).

III. Model and Specification

Demand for newly built residential apartments in any city i at time t is given by

$$Q_{i,t}^{d,new} \quad d \; r_{i,t}, y_{t \; j}, in/out \; mig_{i,t \; j}, m_{t \; j} \qquad (1)$$

Where:

$R_{i,t}$ = = real rent for new built apartments

y_t = = Income[3]

in/out $mig_{i,t}$ = absolute number of persons who migrate in and out of a city

$m_{i,t}$ = = situation in the rented apartment market

Looking at the theoretical and empirical literature on the determinants influencing real rental movements, actual and lagged values of the vacancy rate should be included in the model as a proxy for the situation on the rental market. Typically in these models the change in real rents is given among other things as a function of deviations in the observed vacancy rate from its equilibrium level (e.g. Chinloy (1996), Jud/Benjamin/ Sirmans (1996), Gabriel/Nothaft (2001)). Unfortunately there is no time series data on residential vacancy rates in the German cities to use the vacancy rate in the empirical model or even calculate the natural vacancy rate of the cities in the sample. Hence the vacancy rate was dropped from the model as it could not be included in the empirical testing.

As newly build apartments and existing apartments are substitutes, albeit imperfect ones, the relation of the average rents in these two markets was used to proxy for the situation in the rented apartment sector. The variable was normalized by subtracting 1 from the calculated relation to secure that values below zero represent a situation where rents for new apartments are below rents on existing apartments and a value above one represents the opposite situation. Coming from a tenants perspective existing apartments are usually in locations that are historically grown and are located in general nearer to the city centre so that they have a location advantage in comparison with newly build apartments. On the opposite newly build apartments have a quality advantage in comparison with existing apartments. As these effects operate in different directions it can be assumed that they act in a balancing way that keeps the two average rental levels in line with each other. However this does not mean, that the two rents equalize in equilibrium, as no assumptions about the valuation of the two above mentioned characteristics by the tenants is made. It is only assumed that both rental level can not go in opposite directions for an indefinite time, as the character of imperfect substitutes secures that the rental levels revert to each other when there is a great difference between the two.

The supply at time t in city i is depended on the price in period t, the decisions taken by the developers some time ago, at the time applying for the building pemit and the building costs during planning and building of the project. Market supply can therefore be defined as:

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2 The graph shows the average rental growth rate for the 44 cities, not weighted by city size.

3 Due to the lack of long time series on a regional basis for income in Germany, the national gdp was used as a proxy.

$$Q_{i,t}^{s,new} = s\left(r_{i,t}, per_{i,t-j}, c_{t-j}\right) \tag{2}$$

Where:

- $per_{i,t}$ = number of building permits issued in period t-j for apartments in buildings with more than 3 apartments (for the estimation the variable is defined as number of permits issued per 1,000 residents)[4]
- c_t = real construction costs

Equilibrium in each city is given by

$$Q_{i,t}^{d,new} = Q_{i,t}^{s,new} \tag{3}$$

Substituting equation (1) and (2) into equation (3) and using the relation of rents for newly build apartments to rents of existing apartments to represent the market situation in the rented apartment sector the reduced form equation for the rent is given by:

$$r_{i,t} = f\left(y_t, in/out\ mig_{i,t-j}, \frac{r_{i,t-j}^{new}}{r_{i,t-j}^{existing}}, per_{i,t-j}, c_{t-j}\right) \tag{4}$$

Theoretically the coefficients of income and in migration should be positive as they increase demand and the coefficient on out migration should be negative as demand decreases. Higher construction costs should lead to higher rents and the number of building permits should have a negative effect on rents as supply increases. Given the coherences described above, the sign of the rent relation coefficient is unclear.

The central feature of the model used is the modelling of the decision process of the developer at the time applying for the building permit and starting the project. The assumption made is, that the developer builds his expectations solely on market data available at the time starting the project and projects this data into the future to judge the opportunities given in the market for newly build residential apartments. Technically speaking, it is assumed that the developer forms backward looking expectations at the time deciding to start the project.

In detail it is assumed that the developer uses rental data on newly build and existing apartments, income data, migration data and construction cost data when calculating the project and applying for the building permit. The number of building permits in city i in period t-j is therefore given by

[4] It is important to note, that in some cities in Germany, e.g. Munich, not all permits translate to completions.

$$per_{i,t\ \ j} \quad p\ \ r_{i,t\ \ j\ \ h}, y_{t\ \ j\ \ h}, in/out\ mig_{t\ \ j\ \ h}, c_{t\ \ j\ \ h}, \frac{r^{new}_{i,t\ \ j}}{r^{existing}_{i,t\ \ j}} \tag{5}$$

Based on these assumptions, the percentage change in real rents of newly build apartments in each period $\%\Delta r_{t,i}$, given by $(r_{t,i} - r_{t,i-1})/r_{t,i-1}$, is

$$\%\ \ r_{i,t} \quad f\ \ \%\ \ r_{i,t\ \ j}, y_{t\ \ j}, \%in/out\ mig_{t\ \ j}, c_{t\ \ j}, \frac{r^{new}_{i,t\ \ j}}{r^{existing}_{i,t\ \ j}}, e_{i,t} \tag{6}$$

Equation (6) is estimated using a pooled time-series model with a common constant and regional fixed effects in the first step and with no common constant and city fixed effects in the second step. Regional effects in the first estimation are accounted for by dummies for the German states. It is assumed that they capture regional differences in the economic structure that lead to structurally higher or lower real rental growth rates. The common constant reflects the influences of the institutional framework in Germany on the residential market. In the second specification it is assumed that the city specific fixed effects account for city specific cost factors and regulations, influencing the real rental growth potential over the sample period. The sample covers the residential apartment markets of 44 cities in West Germany with annual data for the period between 1979 and 2002.[5]

The data to calculate rental growth for newly build and existing apartments was taken from Bulwien AG's regional database Riwis, deflated by the German wide inflation rate to come up with the real rental growth rate. The data on in and out migration and the population figures where also taken from the Riwis database. Like the rents, the increase in the German wide construction cost index was deflated by the inflation rate to come up with the increase in real building costs and real income growth is given by the real gdp growth rate for Germany, as reliable long time series data on a broad regional basis is hard to come up with.

IV. Empirical Results

Table 1 shows the estimation results of equation (6) with regional effects and a German wide "regulatory" dummy. All coefficients are significant, the adjusted R^2 is 58% and the overall regression model is statistically significant. The Durbin-Watson statistic indicates that the autocorrelation effects have been removed to a large extend.

The market equilibrium variables give the expected mixed results. On one side there is a mechanism in the rented apartment sector that keeps rents of newly build and existing apartments close to each other, reflected in the negative sign of the coefficient of their relation in period t-1 and t-5. Every time the rents for newly build apartments are higher than the rents on existing apartments there is a tendency for the rents on newly build apartments to revert to the rent of existing apartments, to a small part caused by the building activity of the developers as the time lag suggests. Note that this does not mean, that there is a German wide equilibrium level of rents of newly build and existing apartments. It only secures an equilibrium relationship between rents, that can be at significantly different rental levels across the German cities. On the other side the positive coefficient of the current relation of the two rents reinforces the imbalances seen in the current period, driving rents further apart, showing the importance of the quality effect.

Table 1 Determinants of real rental change of new build apartments with common constant and regional effects

Independent Variable	Coefficient	Std. Error	t-value
Constant	-0.0538	0.0083	-6.45
%Δrent new apt. (t-3)	-0.1211	0.0293	-4.13
%Δrent new apt. (t-4)	-0.1179	0.0269	-4.38
(Rent new apt./rent existing apt.)-1 (t)	0.2793	0.0182	15.36
(Rent new apt./rent existing apt.)-1 (t-1)	-0.2404	0.0180	-13.38
(Rent new apt./rent existing apt.)-1 (t-5)	-0.0245	0.0095	-2.59
Avg. in migration (t, t-1)	1.4236	0.2563	5.56
In migration (t-4)	-0.6695	0.2060	-3.25
Avg. out migration (t, t-1)	-1.6211	0.2878	-5.63
Out migration (t-4)	0.8125	0.2244	3.62
%Δgdp (t)	1.0670	0.1106	9.65
Avg. %Δgdp (t-2, t-3)	1.3673	0.1825	7.49
Avg. %Δbuild. Cost (t-1, t-3)	0.7592	0.1859	4.08
Regional Dummy (southern Germany*)	0.0087	0.0031	2.75
Adj. R^2	0.58		
F-statistic	82.07		
D.W.	2.05		
n	778		
*. Southern Germany consists of Bavaria, Baden Wurttemberg, Hesse and Rhineland Palatinate.			

The results for the migration variables are all highly significant and have the expected signs. Average in or out migration of 1 percent of the existing residents in period t and t-1 leads to an real rental increase of 1.4 percent or a real rental decline of 1.6 percent, respectively. Stressing the influence of migration patterns in Germany on the performance of the rented apartment sector (Deutsche Bank 2003a). Additionally the in and out migration in period t-4 influences the rental change to a lesser degree and in the opposite way. This is the expected influence, as one keeps in mind the way permits influence rents in equation (4) and how the permits are influenced by the migration variables in equation (5).

As well there is a strong positive effect of current real gdp growth on real rental growth. The increase in real gpd in period t translates to an roughly equal increase in real rents for newly

[5] A list of the cities can be found in the appendix.

build apartments. The interesting finding is, that the same average real gdp growth in period t-2 and t-3 translates to an even bigger real rental growth of 1.4 percent today. This can be seen as a fact, that the decision to move to a newly build apartment is based on a longer decision process from the potential tenants of newly build apartments. The empirical results suggest, that the tenants take a longer term view when deciding to move to a newly build apartment. When a real income growth is perceived as “permanent” and secure because it happened in the past (period t-2 and t-3) they use it for the calculation of their willingness to pay for a newly build apartment. These willingness to pay is than reflected in the demand for newly build apartments and translates ultimately to real rental growth.

The decision process of the developer when applying for the building permit, expressed in equation (5), is also seen in the lag structure of past real rental growth rates of newly build apartments. The negative and significant coefficients on the lag of 3 and 4 years is a strong indication for backward looking expectation formation when applying for the building permit, as modelled in equation (4). These leads to a boom in the applications for building permits when rental growth rates are high, because they are projected to the future. This causes a strong rental decline at the time when the projects are finished due to overbuilding. This in turn leads to a halt of applications for new projects leading to a new period of high real rental growth later on.

Table 2 Determinants of real rental change of newly build apartments with city specific fixed effects

Independent Variable	Coefficient	Std. Error	t-value
%∆rent new apt. (t-3)	-0.1389	0.0299	-4.64
%∆rent new apt. (t-4)	-0.1283	0.0273	-4.70
(Rent new apt./rent existing apt.)-1 (t)	0.2850	0.0186	15.31
(Rent new apt./rent existing apt.)-1 (t-1)	-0.2372	0.0183	-12.98
(Rent new apt./rent existing apt.)-1 (t-5)	-00288	0.0112	-2.57
Avg. in migration (t, t-1)	1.4883	0.2876	5.17
In migration (t-4)	-0.5209	0.2258	-2.31
Avg. out migration (t, t-1)	-1.7907	0.3210	-5.58
Out migration (t-4)	0.5507	0.2490	2.21
%∆gdp (t)	1.0342	0.1132	9.13
Avg. %∆gdp (t-2, t-3)	1.3681	0.1847	7.41
Avg. %∆build. Cost (t-1, t-3)	0.7145	0.1962	3.64
Adj. R^2	0.57		
F-statistic	19.64		
D.W.	2.14		
n	778		

The long planning and construction process is also reflected in the highly significant positive coefficient of the average real growth rate of construction costs of period t-1and t-3. While the period t-1 represents the real increase in construction costs during the construction period, the period t-3 can be seen as the increase in real construction costs, that was accounted for on the planning process. A 1 percentage point increase in this average increase in real construction costs is passed on to the tenants to around 75 percent, as the real rental growth rate today increases by 76 basis points.

In addition to the results reported above a strong positive regional effect for southern Germany could be identified. On average the real rental growth rate in Bavaria, Baden Wurttemberg, Hesse and Rhineland Palatinate is 0.8 percentage points higher than in the rest of West Germany. The common constant is highly significant and has a negative sign, suggesting that the institutional framework, which is represented by the constant, has a limiting effect on real rental growth in Germany. This seams reasonable when looking at the regulations in the residential sector in Germany.

Table 2 shows the estimates of equation (6) with city specific fixed effects. In comparison to the first model the adjusted R^2 is nearly equal with 57%. All variables from model 1 are still significant and the signs of the coefficients are the same and the effect of the variables on real rental growth changes are only slightly different from the first model. The Durbin-Watson statistic indicates that most of the autocorrelation effects have been removed, although they are a little more important than in the first specification.

Table 3 City fixed effects for the 44 West German Cities

City	Coefficient		City	Coefficient
Berlin***	-0.0749		Bonn**	-0.0361
Hamburg***	-0.0541		Munster**	-0.0360
Wuppertal***	-0.0534		Ulm**	-0.0359
Bremen***	-0.0507		Trier**	-0.0356
Bochum***	-0.0496		Augsburg**	-0.0353
Hannover***	-0.0490		Koblenz**	-0.0350
Aachen***	-0.0485		Stuttgart**	-0.0348
Bielefeld***	-0.0480		Freiburg*	-0.0335
Krefeld***	-0.0474		Wurzburg*	-0.0329
Passau***	-0.0469		Ludwigshafen**	-0.0328
Nuremberg***	-0.0467		Cologne**	-0.0323
Essen***	-0.0467		Mainz*	-0.0321
Duisburg***	-0.0464		Bamberg**	-0.0319
Dusseldorf***	-0.0460		Darmstadt**	-0.0314
Karlsruhe***	-0.0453		Wiesbaden**	-0.0292
Oldenburg***	-0.0445		Osnabruck	-0.0282
Dortmund***	-0.0438		Frankfurt*	-0.0268
Braunschweig***	-0.0420		Tuebingen	-0.0237
Kassel***	-0.0412		Heidelberg	-0.0209
Kiel***	-0.0404		Munich	-0.0180
Kaiserslautern***	-0.0404		Regensburg	-0.0177
Mannheim**	-0.0380		Rosenheim	-0.0139

* → Significant at the 10 percent level
** → Significant at the 5 percent level
*** → Significant at the 1 percent level

Table 3 shows the city specific fixed effects for the 44 West German cities, with the coefficients ranked from lowest to highest. The fixed effects for all cities are negative, further supporting the negative "regulatory" effect seen in the common constant in the first model. The findings also indicate that rental growth would have been substantially below inflation in all 44 West German cities during the sample period, were it not for the influence of in migration and national gdp growth, as the rise in real building costs was on average nearly zero and therefore had no positive effect on real rental growth.

The empirical results of both model specifications seem reasonable in comparison with economic theory. Therefore the basic model appears to be well specified and gives support to the assumption that the backward looking expectation formation from the developers expressed in equation (5) is one major reason for the cyclical behaviour seen in the residential real estate markets in West Germany.

V. Conclusions

In this study the real rental growth dynamics of newly build apartments in a cross section of 44 West Germany Cities was examined. The empirical results show, that real rental growth is strongly influenced by income and past rental growth, the migration patterns observed in West Germany, the situation in the rented apartment sector and past growth in real construction costs, although over the sample period the rise in real construction costs did not contribute very much to rising real rents, as it was nearly zero.

The lag structure in the model strongly supports the assumption of a backward looking expectation formation process on the side of the developers when applying for the building permit. In doing so, this behaviour of the developers can be seen as one of the reasons for the cyclical movement, as it leads to similar reactions of all developers to positive or negative market signals.

The common constant in the first model and the city specific fixed effects in the second model suggest, that in Germany the institutional framework has in general a negative (limiting) effect on real rental growth. The findings also indicate that rental growth would have been substantially below the inflation rate in the period 1980 to 2002 in all 44 West German cities, were it not for the influence of in migration and national gdp growth. Additionally the empirical results support the perceived north south divide in the West German residential markets, as the real rental growth in a city in southern Germany tends to be 0.8 percentage points higher than in the rest of Germany.

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VII. Appendix

44 Cities in the Sample:

Aachen	Bielefeld	Bremen	Duisburg
Augsburg	Bochum	Cologne	Dusseldorf
Bamberg	Bonn	Darmstadt	Essen
Berlin	Braunschweig	Dortmund	Frankfurt

Freiburg
Hamburg
Hannover
Heidelberg
Kaiserslautern
Karlsruhe
Kassel
Kiel
Koblenz
Krefeld
Ludwigshafen
Mainz
Mannheim
Munich
Munster
Nuremberg
Oldenburg
Osnabruck
Passau
Regensburg
Rosenheim
Stuttgart
Trier
Tuebingen
Ulm
Wiesbaden
Wuppertal
Wurzburg