Office Market and Labour Market – The Case of Germany

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Abstract

In this contribution the link between the office market and the labour market in Germany is examined. In a first step the number of office employees is calculated by referring to occupational labour market statistics. Using a panel analysis with data for the biggest five German metropolises it is shown that office employment is a superior predictor for explaining adjustments in prime and average rents compared to total employment and unemployment rates. If vacancy rates are taken into account, the fit of the model can be further increased. In addition, it turns out that construction has only a minor impact on office rents. The study is supplemented with single regressions for the five cities. While adjustments in Berlin and Dusseldorf can hardly be ascribed to office employment, office rents in Frankfurt, Hamburg and Munich react strongly to changes in the labour market.

Key words: office employment, rental adjustment, panel analysis

Introduction

The office market is one of the most relevant markets for institutional investors like open-ended funds, insurances and pension funds. According to recent estimations the office space in Germany in the seven biggest metropolises is worth approximately 450 billion Euros (Junius, 2010). Changes in market conditions, like rents and vacancy rates, are therefore very important for investors. A plethora of articles have analysed the determinants of office indicators like Wheaton and Torto (1994), Hendershott (1996), Hendershott, MacGregor and Tse (2002) and Ling and Naranjo (2003). Rabianski and Gibler (2007) give an overview of this topic. However, typically the literature focuses on Anglo-Saxon countries like the United States, the United Kingdom or Australia. In contrast, analyses for the German market are scarce. Recently, Kurzrock, Rottke and Schiereck (2009) have explored the factors that determine the returns of office buildings. Nitsch (2006), too, has analyzed the relevance of location and building characteristics for the determination of rents in a German metropolis.

Unlike in these studies, however, drivers of changes in rents over time are focused in this contribution. For most economists and market players it is without question that labour market developments have an important impact on the office market. Since the demand for office space is determined by the number of employees and the office space per employee the importance of the labour market is directly obvious. Given that only about 30 percent of all employees work in offices it seems necessary to take into account only office employment in an analysis of the office market. Additionally, it is not reasonable to assume that macroeconomic shocks like recessions have the same impact on office workers and, for example, service agents. Typically office workers have a higher standard of

education and companies probably will be more cautious to hire and fire office workers. Yet, in contrast to the United States office employment data are not provided by official statistics.

Hence, in a first step the number of office workers in Germany is derived and than applied to an analysis of the office market. To the best of the author's knowledge this is a new approach to office market analyses for the German market. Data for the office market of the main five economic metropolises (Berlin, Dusseldorf, Frankfurt, Hamburg and Munich) on a quarterly basis has been provided by JonesLangLaSalle.

The contribution has two main aims: Firstly, by conducting a panel data analysis the explanatory power of office employment shall be analyzed and therefore compared with other employment market indicators like the unemployment rate. Secondly, single regressions are used in order to test if the German cities react differently to changes in employment. Given the different economic focus of the German metropolis – for instance, Berlin relies on public administration while Munich on export oriented industry – this is an important aspect for investors.

The article is structured as followed. In a first step the number of office workers in Germany is calculated by referring to occupational employment statistics provided by the Federal Agency for Employment (Bundesagentur für Arbeit). Furthermore, additionally used data are explained. Then panel regressions for the main office metropolises as well as single regressions for these cities are presented. Finally, the main results are summed up.

Office Employment in Germany

The Federal Agency for Employment provides quarterly occupational employment statistics for all cities and county districts with an own federal

employment agency. This statistic is the basis for calculating the number of office workers. In the literature two methods have been advocated for estimating office employment. Dobberstein (1997) analysed the micro-census, a detailed sample which among other things offers detailed information about working conditions, and reported for over 1,000 occupations ratios for office workers. Her work is very detailed but has not been updated since 1997. Another approach goes back to Troll (1994) who identified 48 occupational groups which work typically in offices. This approach is less sophisticated but as Dobberstein (1997) showed herself both calculations deliver comparable results. Therefore, in this analysis the approach of Troll was used, however with slight modifications. As the order of occupational statistics has changed since 1994, we include 51 occupational groups instead of 48.

The statistics of the Federal Agency for Employment only include employment within the scope of national insurance, so that office workers who are civil servants and who are self-employed are missing. With respect to civil servants this is only a minor drawback since their number is very stable over time. Self-employed office work is of greater interest but quarterly data is missing. Dobberstein computed the number of self-employed on a data basis that is available every four years. Consequently, this kind of office work has to be neglected.

Table 1 shows the number of office workers in Germany and in the 5 cities which are analysed in the following.

Table 1: Office Workers in Germany as of 30 June 2009

Occupational group	Classification No. according to Federal Agency for Employment	Germany	Top 5 Cities (Berlin, Dusseldorf, Frankfurt, Hamburg, Munich)
Managers of small enterprises in agriculture, hunting, forestry and fishing	031	2,356	98
Agronomists and related professionals	032	9,717	372
Mechanical engineers	601	153,008	18,455
Electrical engineers	602	156,113	25,542
Civil engineers	603	122,915	22,945
Cartographers and surveyors	604	9,220	1,165
Mining engineers, metallurgists and related professionals	605	5,620	338
Architects, engineers and related professionals not elsewhere classified	606	26,020	4,154
Research and development managers	607	217,463	31,111
Physicists, Mathematicians and astronomers	612	23,910	4,077
Mechanical engineering technicians	621	106,324	12,767
Production and operations managers in construction	623	50,023	6,371
Civil engineering technicians	624	23,389	1,949
Mining and metallurgical technicians	625	6,648	178
Chemical and physical science technicians	626	27,393	4,176
Physical and engineering science technicians	627	30,011	2,326
Technicians	628	368,374	46,917
Production and operations managers in wholesale and retail trade	681	514,509	62,089
Finance and sales associate professionals	683	27,996	5,701
Securities and finance dealers and brokers	691	578,528	126,53
Statistical, mathematical and related associate professionals	692	8,216	1,122
Statistical and finance clerks	693	34,399	6,437
Insurance representatives	694	187,499	54,263
Transport clerks	701	101,587	21,09
Travel attendants and travel stewards	702	66,467	19
Advertising and public relations managers	703	108,333	36,232
Securities, finance and estate dealers and brokers	704	15,298	4,788
Business services agents and trade brokers not elsewhere classified	705	28,705	6,118
Entrepreneurs and Business Managers	751	363,019	66,685
Business Consultants	752	148,926	40,955
Accountants	753	163,839	32,516
Legislators and senior government officials	761	3,607	219
Senior Administrators	762	132,917	28,265
Senior officials of humanitarian and other special-interest organisations	763	15,73	4,081
Accounting and book-keeping clerks	771	39,919	8,023

Bookkeepers	772	178,077	32,604
Cashiers and ticket clerks	773	127,938	11,978
Computer assistants	774	530,068	114,139
Office clerks	781	3,833,268	589,02
Stenographers and typists	782	261,261	52,324
Data entry operators	783	28,62	5,359
Other office clerks	784	188	32,83
Judges	811	7,005	1,405
Legal professionals not elswhere classified	812	683	186
Lawyers	813	43,558	16,7
Legal and related business associate professionals	814	2,349	288
Authors, journalists and other writers	821	66,769	21,468
Philologists, translators and interpreters	822	6,853	1,902
Librarians and related information professionals	823	44,353	9,734
Government social benefits officials	863	24,412	4,342
Economists	881	91,125	17,44
Housekeepers and related workers	922	5,251	597
Total		**9,317,588**	**1,619,371**

Source: Federal Agency for employment, own calculations

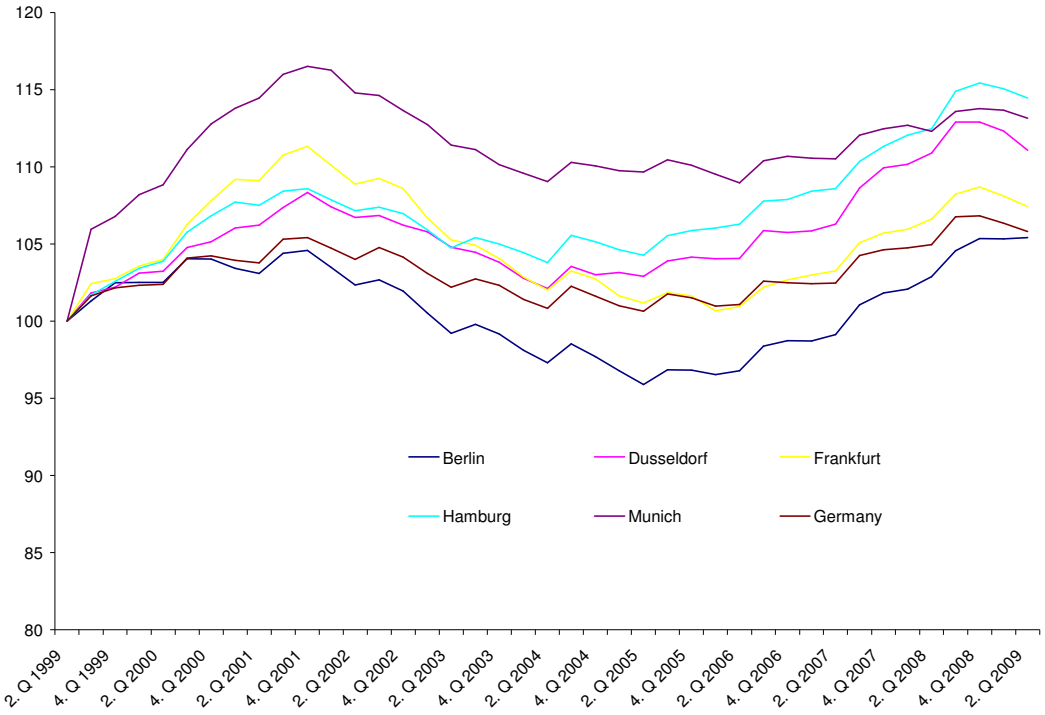
The table includes data for all relevant 51 occupational groups as well as the corresponding classification number of the Federal Agency for Employment. Office clerks constitute the largest group, followed by all kinds of computer assistants and wholesale and retail managers. All in all, in the second quarter of 2009 9,3 Million socially insured employees worked in offices. Among them, 1,6 Million or 17,4 percent worked in the 5 main office metropolis Berlin, Dusseldorf, Frankfurt, Hamburg and Munich which stresses the importance of these locations for investors. According to these figures, 34 percent of all socially secured employees in Germany work in offices. With regards to the five cities, the share varies between 39 percent (Berlin) and 54 percent (Frankfurt).

The data for office work covers the period of the second quarter 1999 to the second quarter 2009. During this 10 year period office employment has increased in Germany as well as in all regarded cities as figure 1 illustrates. Furthermore, the period covers a complete business cycle. At the beginning of the period employment spiralled upwards mainly because of the new chances in the IT-industry. With the burst of the new economy bubble,

however, employment plummeted. Since mid of the century, office employment has recovered and has reached a new peak at the end of 2008. Only recently employment stagnated because of the financial crisis.

On average office employment has increased by 5.4 percent in the corresponding period. All metropolis have outperformed this increase, although Berlin only slightly. Hamburg (+14.1 percent), Munich (13.1 percent) and Frankfurt (11.1 percent) are the locations with the most impressive employment growth.

Figure 1: Development of office employment (index: 2-1999=100)



Source: Federal Agency for employment, own calculations

Other data

In addition to office employment we also take into account total employment data and unemployment rate data which are both freely

provided by the Federal Agency for Employment. Office market data has been granted by JonesLangLaSalle, an international realtor. The office indicators cover prime rents, average rents and the vacancy rates. Furthermore, JonesLangLaSalle provided data on office building completions. All data cover the period of 2-1999 to 2-2009 on a quarterly basis.

Panel Data Regressions

Tests for unit roots indicate non-stationarity of all relevant variables. Therefore, first differences are used. The Fisher-Test as proposed by Maddala and Wu (1999) as well as the Hadri-Test (Hadri, 2000) for a restricted and hence balanced data set indicate stationarity for first differences. Additionally, the Hausman-Test suggests the application of random-effects models. However, regressions with fixed-effects have not delivered different results.

In a first step solely employment variables are used as regressors for changes in prime rents. The results are presented in table 2.

Table 2: Regression results for changes in prime rents

	Regressor (first difference)		
	Office employment	Total employment	Unemployment rate
t	.0000821 (0.001)	.0000314 (0.001)	-.2581492 (0.025)
t_{-2}	.0001782 (0.000)	.0000606 (0.000)	-.1549157 (0.200)
t_{-6}	-.0000954 (0.002)	-.000031 (0.084)	.0130688 (0.920)
R^2	0.2572	0.1549	0.0451
This table reports the results for a random-effects panel model with changes in prime rents as the dependent variables and changes in employment variables as independent variables. In all cases a contemporaneous and a lagged regressor were considered. P-values are in parenthesis.			

As it turns out, changes in employment have a contemporaneous as well as a time-shifted effect on prime rents. Given the fact that companies need time to adjust their office space demand on changes in their staff this is not surprising. According to the results, changes in employment two quarters ago have a greater impact than contemporaneous employment developments. Statistically significant is furthermore the change in employment six quarters ago, but with a change in the prefix. This argues for an overshooting in the office market. For instance, improvements in the labour market could stimulate construction activities which lead to excess supply a few quarters later. Such changes in prefixes are typical for markets with cyclical behaviour.

Compared to office employment, total employment is a worse predictor for changes in prime rents. Although all coefficients are significant, changes in office employment are generally more relevant in an economic sense since coefficients are greater. Additionally, the coefficient of determination is 10 percentage points higher. While total employment has some explanatory power for prime rents, changes in the unemployment rate fail as a predictor. Only the contemporaneous change in the unemployment rate has a significant effect on prime rents. Nevertheless, since unemployment rates are more timely available than employment data, researchers should not neglect this early indicator.

In addition, the model with office employment has been extended by a variable capturing the newly completed office space (in 1,000 square metres) and by considering different levels of vacancy rates. Inspired by Brounen and Jennen (2009) who analyse the asymmetric behaviour of the rental adjustment process, the model differentiates whether the vacancy

rate is above or below the corresponding vacancy rate. Results are reported in table 3.

Table 3: Regression results for an extended model for changes in prime rents

	(I)	(II)	(III) $vac_t<vac_{mean}$	(IV) $vac_t>vac_{mean}$
Office employment (t)	.0000821 (0.001)	.0000835 (0.001)	.0001323 (0.032)	.0000505 (0.004)
Office employment (t_{-2})	.0001782 (0.000)	.0001792 (0.000)	.0002505 (0.002)	.000082 (0.006)
Office employment (t_{-6})	-.0000954 (0.002)	-.000093 (0.002)	-.0000704 (0.336)	-.0000241 (0.450)
Construction (t)		.0015208 (0.167)		
Construction (t_{-1})		-.0003126 (0.779)		
Constant	-.1761639 (0.028)	-.1776245 (0.006)		
R^2	0.2572	0.2710	0.3543	0.1843
This table reports the results for a random-effects panel model with changes in prime rents as the dependent variables. All variables are in first differences and t stands for the considered time period of the independent variable. vact represents the current vacancy rate while vacmean stands for the mean of the vacancy rate for each regarded city. P-values of the coefficients are in parenthesis.				

As to simplify the comparison, model (I) just repeats the results of table 2. Considering construction in the regression does not improve the fit of the model clearly. The coefficient of determination solely increases by 2 percentage points. Furthermore, the construction activity is not a significant variable for explaining changes in prime rents. At first, this result seems to contradict economic wisdom since an increase in supply should have a negative impact on rents. However, office rents are not corrected for different qualities. As newly constructed office space typically has a higher

quality and therefore a higher rental price, a positive impact on prime rents can be ascertained. Both effects superimpose each other, so that construction has seemingly no significance for explaining rental price adjustments. It is worth to point out, however, that the coefficients for office employment do not alter if construction is included into the model. This suggests a robust relationship between changes in office employment and rental adjustments.

Differentiating between cases in which the vacancy rate is above and below the average rate alters the results significantly. Given vacancy rates below mean level, the coefficient of determination increases to a value of 0.3542 which is remarkably high for a regression with first differences. On the other hand, for vacancy rates above the mean level the coefficient of determination is considerably lower. This confirms the results of Brounen and Jennen (2009) for the U.S. market. If vacancy rates are low, additional demand for office space will put pressure on rents while in a setting with high vacancy rates additional demand can be absorbed by existing office space.

So far the analysis concentrated on prime rents. In addition, the analysis was also carried out for average rents. Economically, one could expect that fundamental factors like office employment have a greater explanatory power for average rents than for prime rents. Since prime rents are more volatile, it seems likely that speculation and short-term effects, like location decisions of major enterprises, have a greater impact on this market indicator. However, as the results in table 4 and table 5 report, the regression results are on the whole comparable to the ones for prime rents. Only three points are remarkable. First of all, the time-lag between rental adjustments and changes in office employment is shorter, i.e. prime rents react later to labour market developments. Thus, they are easier to predict.

Secondly, in contrast to the regression analysis with prime rents, construction is a significant regressor for average rents but with positive prefixes. Hence, quality driven rent increases dominate the effect of an additional supply. Finally, with regards to the employment regressors a change of sign is missing. While prime rents react negatively to an increase in employment six quarters ago, average rents react positively. Accordingly, the broad market does not overshoot to demand changes but the smaller prime market. This is in line with the fact that the prime rent cycle is much more pronounced than the cycle for the whole market.

Table 3: Regression results for changes in average rents

	Regressor (first difference)		
	Office employment	Total employment	Unemployment rate
t	.0002817 (0.000)	0.2220 (0.000)	-.329452 (0.341)
t_{-1}	.0002668 (0.000)	.0000739 (0.006)	-.6163455 (0.075)
t_{-6}	.0001523 (0.015)	.0000895 (0.002)	-.89267 (0.015)
R^2	0.2220	0.1598	0.0547
This table reports the results for a random-effects panel model with changes in average rents as the dependent variables and changes in employment variables as independent variables. In all cases a contemporaneous and a lagged regressor were considered. P-values are in parenthesis.			

Table 4: Regression results for an extended model for changes in average rents

	(I)	(II)	(III) $vac_t<vac_{mean}$	(IV) $vac_t>vac_{mean}$
Office employment (t)	.0002817 (0.000)	.000274 (0.000)	.000292 (0.085)	.0002581 (0.002)
Office employment (t_{-1})	.0002668 (0.000)	.000253 (0.001)	.0003893 (0.025)	.0002151 (0.008)
Office employment (t_{-6})	.0001523 (0.015)	.0001595 (0.009)	.0000831 (0.548)	.0001459 (0.080)
Construction (t)		.0099844 (0.003)		
Construction (t_{-1})		.0058075 (0.086)		
Constant	-.3865476 (0.052)	-.3696617 (0.058)	-.009689 (0.987)	-.4408775 (0.045)
R^2	0.2220	0.2654	0.2862	0.1830
This table reports the results for a random-effects panel model with changes in average rents as the dependent variables. All variables are in first differences and t stands for the considered time period of the independent variable. vac_t represents the current vacancy rate while vac_{mean} stands for the mean of the vacancy rate for each regarded city. P-values of the coefficients are in parenthesis.				

Single Regressions

The most important advantage of a panel analysis is the possibility to make use of a broader data base. Hence, results are more robust and reliable. However, for investors and practitioners panel analyses are only of limited interest since they want to invest in specific locations. Therefore, in the following single regressions for the relationship between office employment and office rents are presented. These regressions give also information about the similarity of the big five German cities. Results for prime rents are summarized in table 5.

Table 5: Single regressions for prime rents

	Berlin	Dusseldorf	Frankfurt	Hamburg	Munich
Office employment (t)	.0000542 (0.127)	.000103 (0.267)	.0002122 (0.010)	.0000125 (0.823)	.0000417 (0.127)
Office employment (t_{-2})	.0000978 (0.105)	.0002009 (0.092)	.0003613 (0.001)	.0003427 (0.000)	.0000602 (0.000)
Office employment (t_{-6})	-.0000648 (0.315)	-.0000388 (0.752)	-.0002199 (0.027)	-.0002775 (0.003)	-.0000003 (0.854)
Constant	-.2921952 (0.022)	-.1117053 (0.442)	-.3138825 (0.079)	-.1344514 (0.416)	-.0422727 (0.530)
R^2	0.2066	0.1786	0.5421	0.4048	0.2976
This table reports the results for single regressions with changes in prime rents as the dependent variable and changes in office employment as the independent variable whereby t stands for the considered time period of the independent variable. P-values of the coefficients are in parenthesis.					

First of all, the signs of the coefficients for the cities are all equal which stresses the robustness of the regressions. Nevertheless, the range of values is relatively wide. As one can conclude from the coefficient of determination, changes in prime rents are not mainly driven by office employment in Berlin and Dusseldorf. With above average and persisting high vacancy rates the office market in these cities reacts hardly to changes in market demand. Unfortunately, time series are too short to account for time periods with above and below average rates of vacancy, respectively. By contrast, more than 50 percent of prime rent fluctuations in Frankfurt can be explained by changes in office employment. In Frankfurt the vacancy rate is high, too, but it is much more volatile over time which allows for rental adjustments to market demand. With respect to the lagged independent variables, Frankfurt and Hamburg exhibit quite similar coefficients. Consequently, the regression for Hamburg shows the second

highest coefficient of determination. Munich comes third but with low values for coefficients indicating a minor economic relevance.

Regressions were also conducted for average rents. Since panel regressions indicated a significance of construction activities, this variable was additionally taken into account. Nevertheless, as table 6 shows, the coefficients of determination are generally lower compared to regressions for prime rents. In addition, fewer coefficients are significant. Munich and Frankfurt show the most convincing results with coefficients of determination above 0.38. Regarding Dusseldorf, however, only a small fraction of rental adjustments can be explained by office employment and construction activity.

Table 6: Single regressions for average rents

	Berlin	Dusseldorf	Frankfurt	Hamburg	Munich
Office employment (t)	.0002712 (0.140)	.0002363 (0.400)	.0002335 (0.282)	.0003419 (0.045)	.0002742 (0.095)
Office employment (t_{-2})	.0002221 (0.203)	.0001106 (0.679)	.000447 (0.036)	.0001731 (0.294)	.0003737 (0.021)
Office employment (t_{-6})	.0002763 (0.140)	.0002452 (0.412)	.0000579 (0.743)	.0002828 (0.097)	.0000665 (0.463)
Construction (t)	.0051596 (0.782)	-.0008838 (0.944)	.0100988 (0.132)	.004408 (0.674)	.013672 (0.004)
Construction (t_{-1})	-.0012177 (0.947)	-.0024342 (0.866)	.0106051 (0.116)	-.0031207 (0.760)	.0082035 (0.080)
Constant	-.2542433 (0.676)	-.4294606 (0.310)	-.4901778 (0.282)	-.5319752 (0.291)	-.0501541 (0.897)
R^2	0.2279	0.0727	0.3849	0.2743	0.5223

This table reports the results for single regressions with changes in average rents as the dependent variable and changes in office employment and construction as the independent variables whereby t stands for the considered time period of the independent variable. P-values of the coefficients are in parenthesis.

Conclusion

In this analysis the linkage between the labour market and the office market has been explored for the main five German metropolises. Not surprisingly, office employment is a better predictor for changes in office rents than the unemployment rate or total employment. Models with office employment can explain up to 10 percentage points more of the fluctuations in office rents. In cities like Frankfurt and Munich, movements in office employment can explain more than 50 percent of rental adjustments. Furthermore, the analysis shows that changes in employment affect the office market with a time lag whereby the time lag is shorter for average rents than for prime rents. For researchers who want to predict office market indicators the labour market, therefore, gives valuable information. The analysis also demonstrates that construction activity is of minor importance for explaining rental adjustments. Probably construction has overlapping effects on rental prices: On the one hand additional supply puts downward pressure on prices, on the other hand newly built offices have a higher standard and hence higher prices. As a consequence, construction is in most models not a significant regressor. Vacancy rates, however, are an important factor for rental adjustments. If vacancy rates are low, rental adjustments are significantly stronger if office employment increases. Seemingly, if vacancy rates are high additional demand is absorbed by vacant office space. Thus, this analysis confirms a recent study by Brounen and Jennen (2009) for the U.S. market.

Given the relevance of labour market developments for the office market and the lack of reliable office market indicators in Germany – especially with respect to other major cities - real estate research should put more effort in the uitilisation of labour market data.

References

Brounnen, Dirk / Jennen, Marten (2009), Asymmetric Properties of Office Rent Adjustment, in: Journal of Real Estate Finance and Economics, 39, pp. 336-358

Dobberstein, Monika (1997), Bürobeschäftigte - Empirische Ermittlung von Bürobeschäftigtenquoten für Büroflächenanalysen, in: Grundstücksmarkt und Grundstückswert, 6/ 1997

Hadri, Kaddour (2000), Testing for stationarity in heterogeneous panel data, in: The Econometrics Journal, 3, pp. 148-161.

Herndershott, Patric H. (1996), Rental Adjustment and Valuation in Overbuilt Markets: Evidence from the Sydney Market: in: Journal of Urban Economics, 39, pp. 51-67

Hendershott, Patric / MacGregor, Bryan / Tse, Raymond (2002), Estimation of the Rental Adjustment Process, Real Estate Economics, 30, pp. 184

Junius, Karsten (2010), Risikostreuung mit Immobilien, in: Rottke, Nico / Voigtländer, Michael (eds.), Immobilienwirtschaftslehre Band II: Immobilienökonomie, Cologne (forthcoming)

Kurzrock, Björn-Martin / Rottke, Nico B. / Schiereck, Dirk (2009), Factors that Influence the Performance of Office Properties, in: Journal of Real Estate Portfolio Management, 15/1, 2009, pp. 59-73

Ling, David C. / Naranjo, Andy (2002), Commercial Real Estate Return Performance: A Cross-Country Analysis, in: Journal of Real Estate Finance and Economics, 24/1-2, pp. 119–142

Maddala, Gangadharrao S. / Wu, Shaowen, 1999. A comparative study of unit root tests with panel data and a new simple test, in: Oxford Bulletin for Economics and Statistics, 61, pp. 631-652

Nitsch, Harald (2006), Pricing Location: A Case Study of the Munich Office Market, in: Journal of Property Research, 23/2, pp. 93 - 107

Rabianski, Joseph S. / Gibler, Karen M. (2007), Office Market Demand Analysis and Estimation Techniques: A Literature Review, Synthesis and Commentary, in: Journal of Real Estate Literature, 15/1, pp. 37-56

Troll, Lothar (1994), Beschäftigungsmagnet Büro – ein gesamtdeutscher Befund, Institut für Arbeitsmarktforschung (IAB), Materialien aus der Arbeitsmarkt- und Berufsforschung – Nr. 1/1994, Nurnberg

Wheaton, William C. / Torto, Raymond (1994), Office Rent Indices and their Behaviour over Time, in: Journal of Urban Economics, 35/2, pp. 121-139