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SHRINKING AND GROWING CITIES – ASYMMETRIC REAL ESTATE PRICE REACTIONS? THE CASE OF GERMAN SINGLE-FAMILY HOUSES

Lisa Dust

Abstract

The population of Germany will be one of the first in the western hemisphere to undergo considerable permanent shrinkage. In view of the relatively low elasticities of supply and demand significant negative price reactions might be expected, and these price reactions are assessed for the first time in this paper. This work supplements existing studies by estimating real estate prices for single-family homes on the disaggregated level of Germany's urban districts and explicitly examines the differing effects of population growth and decline. It also highlights asymmetric price reactions: growths in population numbers have no significant price effects, whereas declines in population numbers lead to significant negative price effects.

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1 Introduction

Numerous studies[1] have been published on the future demographic development of European societies, all of which, whilst differing in detail, come to the general conclusion that by the year 2050 not only will the populations age significantly, but also that in numeric terms they will decline considerably. The decline in the case of Germany, due as it is to a very low fertility

[1] Cf. for a global comparison and literature sources, United Nations Organisation (2003) as well as Mc Morrow/ Roeger (2004). Cf. also Institut der Deutschen Wirtschaft (2004) for information on the subject of our paper, Germany

rate not compensated for by an adequate degree of net immigration, could prove to be particularly dramatic. Whilst the tenth coordinated German population projection assumes that a medium scenario would see a reduction of population numbers by around 10% to some 75 million inhabitants by the year 2050, this process of decline intensifies to around 18% in the minimal variant (Statistisches Bundesamt, 2003a). The pessimistic variant of Institut für Bevölkerungsforschung und Sozialpolitik (2005) even arrives at a figure as low as 58.7 million inhabitants, or a decline of 28% as compared with the present level. Furthermore, these average figures tend to hide the fact that these processes of population shrinkage will affect the German regions to differing degrees of intensity. In general the regions in southern Germany will be affected less, whilst those in eastern Germany will bear the brunt of the decline (Bundesamt für Bauwesen und Raumordnung (referred to below as BBR) 2003, 2004c and d, and also Röhl 2004).

The fact that these envisaged demographic developments will have a significant effect on the pensions, health and nursing care insurance systems, and will hence heavily influence the lives of people in Germany, has not only been extensively underpinned with quantitative data but has also generally been recognised by the population at large, even if the emphasis tends to be on the ageing phenomenon rather than population decline. By contrast, awareness of the effects of projected population decline and ageing on adjacent areas of greater or lesser importance such as the real estate economy, remains in its infancy.

DiPASQUALE/WHEATON (1996) demonstrate a significant positive influence of growth in the absolute number of households on real estate prices for 20 US-American Consolidated Metropolitan Statistical Areas (CMSAs) over the period 1980 to 1990. Terrones and Otrok (2004) estimate the growth in house prices in a multivariate model and arrive at a significant influence of population growth on a highly aggregated national level. Fratantoni et. al. (2005) evaluate a positive correlation between population growth and increased house prices at the level of the US states. Neither studies examine separately the effects of population declines, since decreases in population numbers in the regions they analyse have hardly ever been previously recorded. Finally Cerny, Miles und Schmidt (2005) use a calibration to simulate the impacts of ageing and social security reform upon the demand for housing, but fail to undertake an empirical assessment of the relevant parameters.

As far as the authors are aware, no differentiated modelling of population growth and decline, or of their effects on real estate prices, currently exists, although such a task could certainly be worth performing: Leaving aside any regional restrictions on land available for building, the chronic underutilisation of European building production capacities means that an increase in demand could largely be satisfied without positive price impulses. By contrast, if demand were to be reduced there is a possibility of a relatively inelastic supply reaction: In view of the typical constructions methods prevalent in the European economies, the assumption of downward rigidity in supply quantities in the short and medium term seems to be confirmed by these results. The example of eastern Germany, one of the regions in the world most affected by population decline, shows that in spite of considerable levels of unoccupied buildings – up to 20% in some areas (Dascher, 2005) – capacity reductions by demolition are only being induced by cost-covering state demolition subsidies that in some cases even include debt repayments.[2]

Given that demand – both in the rental and the property sectors – also reacts with low price elasticity,[3] significant price decreases in the real estate sector could result. The dominant position of real estates assets in private household portfolios in most western economies[4] means that significant complications could arise e.g. for consumption and growth.

This work supplements existing studies by examining real estate prices for single-family houses on the disaggregated level of German urban districts (*kreisfreie Städte*) and explicitly studying the differing effects of population growth and decline. At the same time, checks are made for other potentially relevant factors influencing real estate prices such as household income, building costs and regional urban residential structures.

[2] For details of the "Stadtumbau Ost" (City Reconstruction East) programme, cf. GdW (2001, 1f.) and Kofner (2001, 9).

[3] Cf. For example Haurin, Hendershott, Kim (1993), Ermisch, Findlay and Gibb (1996) as well as Börsch-Supan, Heiss, Seko (2002).

[4] Cf. Deutsche Bundesbank (2002) and also RADY /RUßIG (2004, 17), who arrive at a value percentage of up to 88% for real estate in relation to national economic assets.

2 Methodology and Data

This paper examines the house prices in urban districts in Germany in the year 2002. The real estate prices (PRICE) are taken from the real estate price index for residential real estate published by RDM (2003), whereby the total property prices for ready-to-inhabit detached houses of medium housing quality[5] are used. Most residential property in Germany takes the form of owner-occupier homes (BBR 2004b, p. 79), the majority of which are homes of medium housing quality (RDM 2005). The arithmetic mean of the house prices is €231,239.

The cross-section analysis covers 98 of the 118 urban districts in Germany. Of these, 78 are in western Germany and 20 in eastern Germany. Their geographical position can be seen in Figure 1. No price data is available for the cities not included in our study. Berlin is excluded from the analysis because house prices are reported separately for the East and West Berlin, whilst the other data for Berlin is published for the city as a whole.

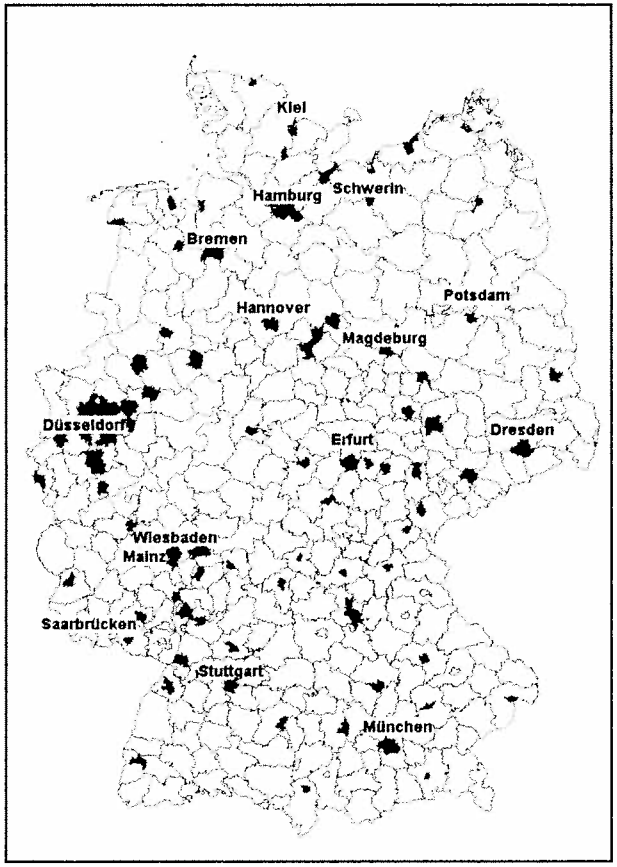
Taking the above-mentioned estimating equation by DIPASQUALE/WHEATON (1996) as our starting point, it also appears appropriate for Germany to test the absolute population of the urban districts (cf. Figure 2 and BBR 2004b, p. 103) as well as their growth in the previous 10 years as determinants. Figure 2 would seem to indicate a positive relation. Given that no data is available at district level for the number of households, the size of the population (Pop and PopGrowth)[6] is taken from the INKAR PRO database from BBR (2003), whereby only projected values are available from the year 2000. Over the observation period (1992-2002) the population declined in 76 of the 98 examined cities (56 in western Germany, and 20 in the east). Overall the population in all the examined cities fell by just under 4%. In order to accommodate for this peculiarity of the German cities and to be able to explicitly estimate the potential consequences of a general reduction in population levels in the future, as an extension to the analysis by DiPasquale and Wheaton (1996) two dummy variables are introduced that are multiplicatively linked with the PopGrowth variable. The variable INCREASE takes

[5] Medium housing quality is defined (RDM 2003) as: single family house in a central residential area with a balanced population structure, approx 125 m^2 living area, central heating, bathroom and WC. Grounds and garage included (RDM 2003).

[6] Population size and number of households do not develop in a completely parallel manner. Whilst the German population over the observation period 1992 to 2002 grew slightly (+1.5%), the number of households grew by +6.2%, as the proportion of smaller households increased (BBR 2004b, p. 20).

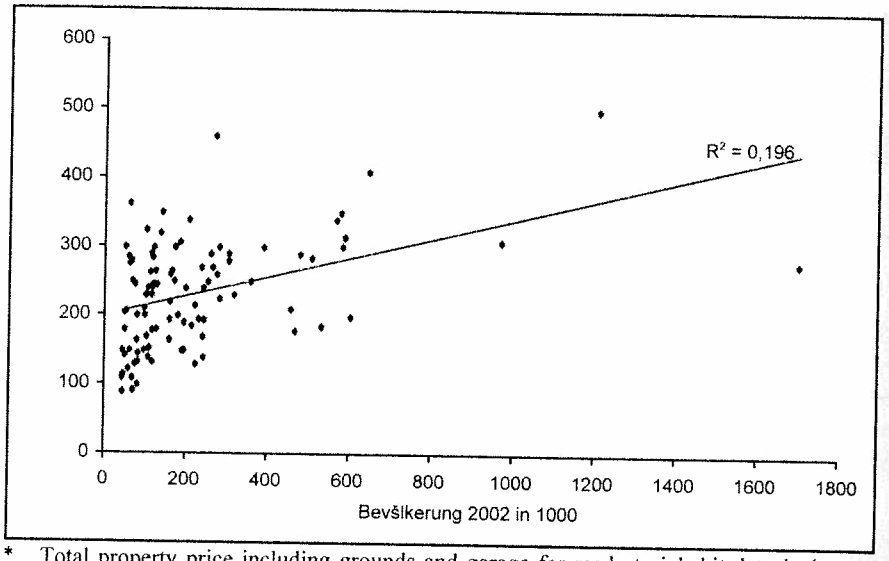
the value of 1 if a city grew between 1992 and 2002, and otherwise takes a value of 0. Analogously, the variable SHRINK takes the value of 1 if the city in question had negative population growth between 1992 and 2002, and otherwise takes a value of 0.

Figure 1 Cities included in the analysis



Source: BBR (2003), authors' own illustration.

Figure 2: Population size and house prices * in German cities



* Total property price including grounds and garage for ready-to-inhabit detached owner-occupier houses of medium housing quality.

Source: RDM (2003), BBR (2003), authors' own illustration.

The COST variable (construction costs) is made up of the regional costs for new residential buildings per square meter as estimated by BBR (2004b).[7] The arithmetic mean of the construction costs per square meter is €1.214.

Finally, in the case of Germany – and once again as an extension to DiPasquale and Wheaton (1996) - it seems appropriate to test the regionally available annual per capita income (INCOME) as delimited by the regional Offices of Statistics as an influencing factor.[8] The arithmetic mean of the sample for this value is €16,547.

[7] The construction costs include the expenditure for building works as listed in the cost estimate, including excavation work, installation and utilities at the time of the granting of building permission. Cf. on this and the influence of building costs on real estate prices (BBR 2004b, p. 31).

[8] Available income = primary income of the private households (income from employment and assets) + monetary fringe benefits and other current transfers – income and property taxes, social security contributions and other current transfers (ARBEITSKREIS "VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER" 2004).

The estimating equation on which it is based is as follows:[9]

$$PRICE = \beta_1 POP + \beta_2 INCREASE^* POPGROWTH + \beta_3 SHRINK^* POPGROWTH + \beta_4 COST + \beta_5 INCOME + \phi \quad (1)$$

whereby ϕ is the residual.

3 Results

Since the White test rejected homoscedasticity, the White correction was used here and in the following regressions.[10] Table 1 starts by depicting the results of estimating the model by DiPasquale und Wheaton (1996) for the German data (model 1). Apart from the constants all the coefficients are statistically significant and have the expected sign. An increase in urban population of one percent over 10 years results in an average increase in house prices of approximately €4.887. If the building costs rise by one euro per square meter, that produces an average price increase of €114 for a house with approximately 125 square meters of living space. The total cost increase of €125 can thus almost entirely be passed on to the end price.

Column 3 in Table 1 displays the results of the estimate from equation (1). Absolute population size is no longer significant. An increase in per capita income of €1 leads to an increase in house prices of around €9.8, which compares well to the greater ability to finance credits resulting from the rise in incomes. The previously highly significant population growth is only statistically significant when it is negative.[11] However, a growing population has no significantly positive influence. This asymmetry or ratchet effect[12] could be explained by the fact that a sufficient level of construction capacity (high supply elasticity) could produce an adjustment to increasing demand in

[9] No logarithms are used. Apart from the possibly asymmetrical effects of population increases and decreases – no indications of a non-linear relation exist. In any case, negative growth rates cannot be logarithmised. When avoiding this problem with the aid of dummies, near singular matrixes occur.

[10] Multicollinearity can be excluded; the EVIEWS programme used would notify an error. In addition the correlation coefficients between the explanatory variables were consistently below 0.6.

[11] The variable SHRINK*INCREASE has a negative leading sign due to the negativity of the variable INCREASE. If the (positive) coefficient is multiplied with SHRINK*INCREASE, the expression as a whole becomes negative. The result is thus a negative influence on the explanatory variable PRICE.

[12] Cf. Just (2003) for a relevant hypothesis.

the medium term without price effects. In shrinking cities by contrast, the more permanent construction methods favoured in central Europe mean that no adequate reductions in capacity can occur, resulting in vacancy or falling prices. R^2_{adj} takes a value of 0.53 and indexes an increased goodness of fit of the estimation.[13]

Table 1: Influencing factors for single-family house prices

	Model 1	Model 2	Model 3
Const	90,703.70	-17,279.11	-45,365.78
POP	0.1108*	0.09	0.05
POPCHANGE	4,887.43**		
SHRINK*POPCHANGE		5,111.98*	4,097.72**
INCREASE*POPCHANGE		-484.91	3043.82
COST	113.41*	75.30	92.02**
INCOME		9.831*	9.233**
CORE			50,251.86**
R2adj	0.48	0.53	0.60
DW	2.10		

* = significant at the 5% error level

** = significant at the 1% error level

For the purpose of a sensitivity analysis the estimation was subjected to several modifications. Firstly, to depict possible influences of regional residential development structures on real estate purchase prices (BBR 2004b, p. 103), the types of urban district were taken into consideration. The 98 cities in the sample are distributed as follows among the district types:

41	core cities in agglomeration areas (type 1)
1	district with high population density in agglomeration areas (type 2)
1	dense district in agglomeration areas (type 3)
1	rural district in agglomeration areas (type 4)
27	core cities in urban areas (type 5)
11	dense districts in urban areas (type 6)
0	rural districts in urban areas (type 7)
14	dense rural districts (type 8)
2	low-density rural districts (type 9).

[13] The Akaike and Schwarz information criteria also become smaller, pointing towards an improvement in the model.

Different estimates showed that merely the first district type (core cities in agglomeration areas) has a significant influence on housing prices. The results of the estimate including a dummy variable for core cities in agglomeration areas (model 3) are displayed in column 4 of table 1.

The absolute population size POP is no longer significant in this model, which may be due to the fact that the cities with the higher population numbers are mainly to be found among the core cities in agglomeration areas. Membership of a city in the district category of "core cities in agglomeration areas" had the effect of increasing housing prices by €50,000. Otherwise the results of the estimate of model 2 are essentially confirmed: population decline (1% over ten years) brings about a reduction in price of over €4,000, whereas population increase has no influence on purchase price. Construction costs are highly significant in this context, even if the coefficient shows that the incidence of increased construction costs does not only fall on the demand side. It is only possible to pass on around 74% of the cost increases for the type of house examined here with approx. 125 square meters of living area. The coefficient of the variable INCOME hardly changes with regard to the previously described estimate.

Since the dynamic variable POPGROWTH in model 1 and the variable SHRINK*POPGROWTH in models 2 and 3 have a more significant influence on the price than the absolute variable POP, the growth rates were also tested as influencing factors for the parameters COST and INCOME. These dynamic variables prove however to be insignificant. Likewise a dummy showing membership of an urban district to a state in eastern or western Germany was also insignificant. Apparently the structural differences between the western and eastern states are already sufficiently depicted by the variables used (income, construction costs, varying population development, residential structure). Nor did the designation of a city as the state capital of one of the 16 *Länder* have any significant influence on house prices.

4 Summary and Conclusions

This examination of the prices of single-family houses in 98 of the 118 urban districts in Germany in the year 2002 initially confirms existing empirical results that the absolute population size (or membership of the "core cities in agglomeration areas" district type, i.e. relatively large cities) leads to higher purchase prices. Significant positive effects were also shown for disposable income and construction costs. The differentiation of population growth by shrinkage and increase revealed an asymmetrical supply reaction: population growth and the resulting increases in demand have no significant price effects. However, population declines lead to significantly negative price effects.

BBR (2003) forecasts that 74 of the 98 cities considered here would lose population by the year 2020, with cities in eastern Germany, but also North Rhein-Westphalia, particularly affected. The greatest decline is predicted for Jena in Thuringia at -25%. Although the available per capita income of the households looks set to rise by 1.7% in real terms (EITENMÜLLER ET AL. 2002, p. 101), construction costs will probably tend to fall BBR (2004a, p. 10).

Whilst these generally foreseeable recessive price developments are strongly divergent at regional level, they are nevertheless to be expected, and further examination of these developments and their effects on consumption and growth in the economy as a whole could be a fruitful area of research. It is probably also worthwhile examining whether the asymmetries noted in this case also occur in other contexts, e.g. housing rents. From the point of view of the potential consequences for economic policy in particular, an analysis could also be made of tax-related influencing factors such as the recently abolished Home Owner Allowance.[14] The degree of take-up of the Home Owner Allowance differed from region to region BBR (2002, S. 16), although no data has yet been made available at district level. Attention should also be paid to the financing conditions. This was not possible in the cross-section analysis carried out here due to the fact that – in as much as it is possible for regionally differing values to exist at all - no data was available for lending limits etc. at district level.

[14] The Home Owner Allowance provided an opportunity to acquire a tax concession of not more than €1,250 p.a. for the construction or purchase of owner-occupied residential property. The subsidy also applied in part to modernisation and renovation measures and was only available below a certain income limit. Extra tax credits were awarded for children (BMVBW 2005). In the year 2002, the national and state governments suffered a shortfall of some €6.5 million in tax revenues due to the Home Owner Allowance law, making the allowance the most important of the tax concessions (BMF 2004, p. 18 and 21). Cf. FÄRBER (2003, p. 104) for the presumption of the inflationary effect of the Home Owner Allowance.

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