Does Relationship Specific Investment Depend on Asset Ownership? Evidence from a Natural Experiment in the Housing Market

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Abstract

In this paper, I test the most basic prediction of Grossman and Hart (1986): Allocations of asset ownership that expose a party to ex-post expropriation reduce this party's ex-ante relationship specific investments. In the empirical context of the German housing market, I find that relationship specific investments, such as bathroom renovations, are more frequent if the occupant is protected against expropriation because he owns his home. To avoid the endogeneity of the homeownership allocation, I rely on the natural experiment of the German reunification: Under the communist regime, ownership existed but was economically meaningless; yet after reunification, ownership unexpectedly reacquired legal force.

Keywords: Relationship Specific Investment, Hold-Up, Natural Experiment

JEL-Classification: D23, D86, C23

1 Introduction

If the parties to a contract have to make relationship specific investments, they face a hold-up problem (Williamson 1975) that induces them to underinvest. In a classic paper, Grossman and Hart (1986) argue that the parties can mitigate this problem through the allocation of ownership rights. Ownership of an asset improves investment incentives because it improves the bargaining position of the investor when he negotiates his share of the surplus from the investment. A large theoretical literature explores the implications of this argument, but it is difficult to empirically test its most basic prediction that asset ownership affects investment decisions. The reason is an endogeneity problem: The hold-up model not only predicts asset ownership to determine investment, but also investment opportunities to determine asset ownership, as the parties allocate assets to mitigate underinvestment. In this paper, I address this problem by using the exogenous variation of homeownership that resulted from the abrupt fall of communism in East Germany and the subsequent reunification with West Germany. Under communism, private ownership of property existed but was devoid of economic content; after reunification, however, homeownership unexpectedly re-acquired its full legal force. I show that households who became homeowners during communism undertake more relationship specific investments, such as bathroom renovations, than households who became tenants.

I apply the argument of Grossman and Hart (1986) to the context of the housing market. The model predicts underinvestment in dwelling specific fixtures (bathrooms, kitchens) in rental housing but not in owner occupied housing.[1] Often landlords let houses largely unfurnished, as they anticipate that tenants will overuse leased furniture. But there should be no inefficiency as tenants can buy their own furniture. Similarly landlords let houses with a varying degree of kitchen, bathroom, and other fixtures. As in the case of furniture, landlords should be ex-

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[1] Why there is rental housing even though it induces underinvestment is beyond the scope of this paper; most likely, the allocation of ownership serves more than one role in the housing markets; e.g., financial market imperfections may require that ownership sometimes rests with the landlord.

pected to underinvest as they anticipate a moral hazard problem. But, unlike in the case of furniture, tenants may not make up for the lack of investment by the landlord because they fear that the landlord will expropriate them. Under German tenancy law, the tenant is protected against expropriation by rent control and eviction protection laws as long as he stays in the dwelling; if he has to move out, however, the tenant is not entitled to compensation. Typically the landlord chooses the new tenant, who then negotiates with the old tenant to buy the investment. Because the old tenant has a low threat point (removing the investment and selling it separately), he will receive only a share of the surplus. Anticipating this outcome, he should underinvest.[2] In contrast, an owner occupier is protected by his asset ownership; he can always sell or rent the apartment on a competitive market.

To establish empirically that owner occupancy causes an increase in the renovation frequency, I instrument homeownership in later years by home ownership immediately after the reunification of the East German "German Democratic Republic" (GDR) and the West German "Federal Republic of Germany" (FRG). The instrument induces an exogenous variation of the ownership structure because the East German state diluted ownership rights to a degree that homeownership was acquired quasi randomly as a by-product of dwelling choice. Only after the German reunification, the full range of ownership rights of the West German legal system was suddenly and unexpectedly awarded to East German homeowners. Using the natural experiment of the German reunification is by now a well established practice in economics; see e.g., Fuchs-Schündeln and Schündeln (2005), Alesina and Fuchs-Schündeln (2007) or Redding and Sturm (2008).

Using data on home renovations in East Germany for the years 1997–2002 from the German Socioeconomic Panel (GSOEP), a rich household panel data set, I find an effect of ownership on investment that is both statistically significant

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[2]It is in the interest of the landlord to first choose a new tenant, who then negotiates with the old tenant. In this way, the new tenant can acquire the fixtures at a lower price. Because the new tenant anticipates this outcome, he has a higher willingness to pay for the dwelling. The landlord can extract this willingness to pay by relying on competition between potential new tenants.

and large. The yearly renovation probability for bathrooms drops by approximately 6 percentage points if a household rents, controlling for many household and building characteristics. I add controls for potential alternative effects of GDR homeownership on the investment probability, such as the fact that owners are wealthier or anticipate to stay longer in their home. The introduction of these controls has little effect on the size or statistical significance of the coefficient of ownership. I apply three robustness checks: (1) I use as dependent variables TV-set and car purchases; i.e., not dwelling specific investments, on which ownership should not have a positive effect. This is exactly what I find in the data. (2) I confirm that a comparable relationship between ownership and investment exists in the West German housing market. (3) I replicate the analysis for the early years after the reunification (1992–1996) and get almost exactly the same coefficient on ownership.

There is a small but growing literature that tests comparative static predictions of applied hold-up models for contract and organizational forms in different industries. These papers, by and large, confirm the predictions in several industries such as trucking (Baker and Hubbard 2003, Baker and Hubbard 2004), defense (Crocker and Reynolds 1993), footwear (Woodruff 2002), and biotechnology (Lerner and Malmendier 2005). A related literature (Besley 1995, Jacoby and Mansuri 2008) studies the role of property rights in developing countries. Most closely related is Field (2005, 2007) who studies the impact of property rights on investment in urban housing. In contrast to these papers, I focus on a large and mature market in an industrialized country and I do not study contracts or organizational forms but directly the impact of asset ownership on investment.

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2 A Theoretical Framework

2.1 The German Housing Market

In Germany landlords and tenants are bound by rent control and eviction protection laws. In a new lease as well as in an ongoing tenancy, tenants and landlords can set the rent essentially at any level by mutual agreement. Unilaterally, however, the landlord can adjust the rent only within very tight limits. She is constrained, according to Section 558 of the German Civil Code (Lützenkirchen 2003, pp. 540–594), by the average rent paid for comparable dwellings; moreover, she must not increase the rent by more than 20 percent within three years (Lützenkirchen 2003, p. 543). If the landlord upgrades the dwelling, she can charge a markup over the comparison rent according to Section 559 of the German Civil Code (Lützenkirchen 2003, pp. 594–620). Unless the tenant is in breach of contract, it is nearly impossible for the landlord to unilaterally terminate the lease (Lützenkirchen 2003, pp. 1281–1383). The landlord may evict the tenant if she moves in herself, but such owner move-ins are difficult in practice.

The legal default leaves investments by tenants largely unregulated. To invest, the tenant must obtain the permission of the landlord, but the tenant owns the investment and can decide to remove it. The landlord can try to expropriate the tenant by raising the rent, but typically she cannot do so as long as the tenant stays in the dwelling due to rent control and eviction protection. If the tenant moves out, however, he is not entitled to a compensation under the legal default (Lützenkirchen 2003, pp. 964–968).

The tenant and the landlord can conclude a standard contract that protects the tenant against expropriation. In such a contract, called modernization agreement (Lützenkirchen 2003, pp. 968–973), the tenant agrees to undertake a specific investment, and the landlord gives her permission. The landlord can forego, for a fixed period of time, the right to rent increases according to Sections 558 and 559 of the German Civil Code and the right to terminate the lease. In particular, she can give up the right to move into the dwelling herself. The landlord can commit

to pay a redemption sum to the tenant if the latter moves out. Usually this sum declines over time, but there is no mechanism to condition the transfer on the actual value of the investment at the time of the move.

To analyze the investment incentives in the housing market, I develop a model that reflects the stylized facts of German tenancy law. I assume that the landlord fails to make at least some investments that an owner occupier would make, e.g., because she anticipates moral hazard problems. I only model the additional investments by the occupant, comparing owner occupiers with tenants. Assuming that the landlord underinvests seems plausible; still, I will test this assumption as part of a joint null hypothesis in the empirical part. The null hypothesis will be that investment in rented and owner occupied dwellings is the same. This hypothesis includes the case that landlords have the same investment incentives as owner occupiers to begin with. The only contract I consider in my model is the standard modernization agreement. This restriction can be justified because the modernization agreement is the only contract found in standard legal texts; however, this assumption, too, will be tested as part of the null hypothesis. If there are other contracts, unknown to me, that solve the hold-up problem, investment will be the same in owner occupied and rental housing. In this case I will not be able to reject the null hypothesis that asset ownership does not matter for investment.

2.2 Setup

An occupant of a dwelling, which either he or a landlord owns, has to decide on an investment that is specific to the dwelling; e.g, a new kitchen or bathroom. With some probability, the occupant has to move out of his home before he can enjoy the investment. In this case a new occupant moves in, and the original occupant must decide whether to leave the investment in the dwelling or not.

The exact timing is as follows: At time 1, the original occupant must decide whether to invest or not.[3] His investment decision is expressed by the indicator

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[3]In the case of a rental unit, legally the landlord has to consent. But without additional ex-ante contracting that increases consensually the rent, she cannot hold-up the tenant by denying

variable $I \in \{0,1\}$, where I equals 1 if the original occupant invests. In this case he incurs an investment cost of K. At time 2, a state of the world $\theta \in \{\theta_S, \theta_M\}$ is realized, which indicates whether the occupant stays (θ_S) or moves out of the dwelling (θ_M). The probability that the original occupant moves out is denoted by q. In state θ_M, the original occupant can remove the investment (if there is one). His removal decision is expressed by the indicator variable $R \in \{0,1\}$, where R equals 1 if the occupant removes the investment.

All agents are risk neutral, have quasi linear (in money) utility functions, and do not discount. If the original occupant has invested and stays ($\theta = \theta_S$), he enjoys a utility of x_S from the investment. The utility from no investment is 0. If the original occupant moves out ($\theta = \theta_M$), he can remove the investment and take it with him, which gives him a utility of x_M; in the case of a bathroom or kitchen x_M is likely to be small and may be zero. Alternatively, the original occupant can leave the investment in the dwelling; in this case there is a competitive rental or housing market market, on which potential new occupants are willing to pay y for the investment. As $y > x_M$, efficiency requires that the original occupant leave the investment in the dwelling.

2.3 Results

Owner Occupancy vs. Tenancy

In this section, I compare the investment incentives of an owner occupier with those of a tenant. An owner occupier can always extract all the surplus generated by the investment. Thus, he takes the investment and removal decision I^O and R^O

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permission because she cannot extract payments. The landlord may, on the other hand, profit from the investment if the tenant has to move out; therefore, the landlord would always consent, and I model investment directly as the tenant's choice.

given by

$$I^O(q, x_S, y) = \begin{cases} 1 & \text{if } K \le (1-q)x_S + qy; \\ 0 & \text{if } K > (1-q)x_S + qy; \end{cases} \quad \text{and}$$

$$R^O = 0.$$

If the original occupant is a tenant and the dwelling is owned by a landlord, the occupant's investment incentives are different. Suppose that the landlord cannot extract a share of the surplus generated by the investment as long as the tenant stays in the dwelling;[4] then the tenant enjoys a utility of x_S from the investment in state θ_S. If he moves out, he can get a utility of x_M if he takes the investment with him, while the landlord could get y if the investment remains in the dwelling. To induce the tenant not to remove the investment, the landlord can offer him a transfer T. I assume that the landlord and the tenant negotiate T at time 2, after they have learned θ, but before the tenant decides on removal. To model the negotiation process, I use a Nash bargaining solution in which each party gets half of the surplus.[5]

If the tenant stays, he keeps the whole return on his investment. If the tenant has to move, he prefers to take the investment with him unless the landlord compensates him. Because this decision is inefficient, the tenant negotiates a transfer with the landlord and leaves the investment in the dwelling. According to my assumption on the bargaining outcome, the transfer equals the tenant's outside option plus half of the surplus; i.e.,

$$T = \frac{y + x_M}{2}.$$

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[4]This assumption reflects that the tenant is protected by rent control and eviction protection laws so that the landlord can neither raise the rent unilaterally nor force the tenant to accept a higher rent by threat of eviction. The main result of this section, that the tenant underinvests, holds a fortiori if the landlord extracts a share of the surplus while the tenant stays in the dwelling.

[5]For simplicity, I assume that the tenant negotiates with the landlord, who then sells the investment under competition to the new occupant. In reality, the old occupant is more likely to negotiate directly with the new occupant, while the landlord extracts the surplus beforehand. The resulting payment streams are identical.

Because he does not get the whole surplus in state θ_M, the tenant sometimes does not invest even though an owner occupier would invest in the same situation; i.e., the tenant takes the following investment and removal decisions I^T and R^T:

$$I^T(q, x_S, y) = \begin{cases} 1 & \text{if } K \leq (1-q)x_S + q\frac{y+x_M}{2}; \\ 0 & \text{if } K > (1-q)x_S + q\frac{y+x_M}{2}; \end{cases} \text{ and}$$
$$R^T = 0.$$

I obtain the following proposition:

Proposition 1 (Owner occupancy vs tenancy) *If*

$$(1-q)x_S + q\frac{y+x_M}{2} < K < (1-q)x_S + qy,$$

the investment does not pay off for a tenant, but it is profitable for an owner occupier. For any other value of K, a tenant takes the same investment decision as an owner occupier.

The Modernization Agreement

So far, I have assumed that the parties cannot write an ex-ante contract to mitigate the hold up problem. There is, however, a standard ex-ante contract in German tenancy law, the modernization agreement. In a short theoretical analysis, I high-light what could be the main drawback of this contract.

In contrast to the last section, the landlord now can make a contract offer to the tenant at time 0 before the tenant can invest. In line with the stylized facts of the modernization agreement, the landlord can commit himself to pay a compensation for any investment if the tenant moves out.[6] Furthermore, the parties can contract any ex-ante transfer; this assumption reflects the fact that the parties can always set the rent consensually at any level.

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[6]The landlord may also contractually forego any remaining right to unilateral rent increases or termination by notice. But for my analysis these options do not matter, as I anyway abstract from potential expropriation while the tenant stays.

Referring to *y* as the market value of the investment, I get the following result:

Proposition 2 (Modernization agreement) *Suppose the parties can ex-ante condition the transfer upon the market value of the investment. Then there exists a modernization agreement that replicates the investment incentives of an owner occupier.*

If the parties can tie the compensation to the ex-post market value of the investment, they can solve the hold-up problem. The landlord offers the tenant a modernization agreement that allows the tenant to decide whether to invest and stipulates that the landlord must redeem the investment according to its market value. Such a contract replicates an owner's payment stream and implements an owner's investment and removal decisions.[7]

Thus, there is a simple solution to the hold-up problem if the contract can condition on the market value of the investment. Yet the standard modernization agreement does not seem to provide a mechanism to do so. If landlords and tenants do not use more comprehensive contracts, even though there is underinvestment, it must be because it is difficult to contract on the market value of an investment. As the market value of investment is an observable variable, the contracting parties seem to face an instance of the of the observable-but-unverifiable-information problem.

In the next section, I study empirically how the investment probability depends on ownership allocation. I compare the yearly investment probability in owner occupied houses and in rental houses. The null hypothesis is that landlords and tenants manage to solve the hold-up problem by means of formal or informal contracting; hence asset ownership does not play a role in protecting investment incentives and there is no difference in investment probabilities between rental and owner occupied housing.[8] The alternative hypothesis is that the landlords and

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[7]This result is robust to an uncertain *y* or an x_S that is private information of the old occupant. Even if removal was efficient in some states of the world, or the moving choice was endogenous, the tenant would always choose efficiently given the suggested contract.

[8]The null also includes the hypothesis that there is no contracting problem in the first place, e.g., because landlords have enough incentives to renovate.

tenants fail to solve the hold-up problem by formal or informal contracts so that they have to rely on asset ownership to protect investment incentives. In this case I should observe an investment probability that is higher in owner occupied housing than in rental housing.

3   Institutional Setting and Data

In this section, I present the data that I use to investigate whether homeownership increases the probability of relationship specific investments or not. To establish a causal relationship, I must deal with the potential endogeneity of homeownership. An unobservable omitted variable could drive a positive correlation of investment probability and homeownership; e.g., many households that have secure and stable employment prospects in one place may find it worthwhile and can afford to incur the fixed costs associated with buying a house. For the same reason, they may be able and willing to customize their home by investing in renovations. Even if there is a contracting problem, the coefficient in a regression analysis could exaggerate its size due to reverse causality; e.g., if households anticipate the contracting problems in rental housing, households with a preference for frequent renovations will be more inclined to buy.

To obtain an exogenous variation of homeownership, I use the homeownership allocation in East Germany immediately after the fall of the wall as an instrument for the homeownership allocation in later years. To justify my choice of instrument, I present an outline of the legal situation and the historic development of the housing market in the GDR.

3.1   Housing in the GDR

Tenancy and Real Estate Law in the GDR

For the whole of its existence, the communist regime of the GDR pursued the goal of abolishing private property. In the 1970s the GDR implemented property leg-

islation that abolished private ownership of investment goods but allowed private ownership of consumption goods, including owner occupied housing (Bundesministerium für innerdeutsche Beziehungen 2000, entry "Eigentum"). Privately owned rental housing continued to exist in a legal grey area: Regulations diluted the property rights of landlords to a degree that ownership became meaningless for all practical purposes, while it raised the rights of tenants to a level that equalled those of owner occupants.

Once an East German had signed a lease, he was almost completely protected against interference by the landlord. The landlord needed a court order to evict a tenant, which was near to impossible to obtain (Buck 2004, p. 363). De jure, the state could evict owners and tenants alike if they occupied too much space (Hoffmann 1972, p. 323). De facto, in the 1980s tenants often paid rents for apartments but left them empty to retain control over them for future use; they did so without consequences (Herbst, Ranke, and Winkler 1994, entry "Wohnraumlenkung").

East Germans could conclude a (standardized) rental contract only if they had a permit from the government (Buck 2004, p. 363). If an East German bought a vacated dwelling or if her tenant moved out, she still needed a government permit to move in (Hoffmann 1972, p. 319). To build a home, GDR citizens needed a permit as well (Buck 2004, p. 160). Permits allocated East Germans to dwellings because government regulation had dismantled the price mechanism in all but in name. In all markets, East Germans faced prices that were set by the state; often the state set prices too low to reflect scarcity. Rents and real estate prices were frozen at the levels of the year 1936 (Häußermann, Glock, and Keller 2000, p.7). Prices for new construction and building materials were regulated as well. The state subsidized the construction of owner occupied homes by cheap credit and tax reductions for those who managed to get a permit (Buck 2004, pp. 159–164). At such low prices, East Germans demanded more housing than the communist economy could deliver: In 1989, East Germans paid only 3 percent of their net income for housing (Buck 2004, p. 372), but 778,352 households were waiting for

a unit (Buck 2004, p. 361).

Under the permit system households fared better if they conformed to explicit and implicit, political and social criteria (Herbst, Ranke, and Winkler 1994, entry "Wohnraumlenkung"); e.g., the state used permits to reward citizens who were loyal to the communist regime (Buck 2004, pp. 367–369). Such households were able to secure themselves systematically better housing than others. Whether housing quality was correlated with ownership remains a priori unclear. East Germans prized suburban single family homes, which were often owner occupied, but also newly built high rise apartments, which were always rented.

Most private landlords were unable to pay for renovations and let the houses decay (Buck 2004, pp. 365–366) because they received only the government set low rents. The state and cooperatives did hardly better because the communist regime focused on industrial scale new construction and neglected reconstruction (Buck 2004, p. 351).

Historic Development of Homeownership in the GDR

Private ownership of real estate continued to exist until reunification. Owners of real estate, unlike entrepreneurs or farmers, were never expropriated. They always owned whole buildings; i.e., either apartment buildings or single family homes. Condominiums did not exist in Germany before World War II and the GDR never introduced them. The regime did not allow private owners the construction of new rental buildings (Hoffmann 1972, p. 347). Private owners of existing apartment buildings had no effective control over their property, received the low government fixed rent payments, but had to maintain the buildings. As a consequence many owners gave away their houses to the state (Buck 2004, p. 245), which introduced permits to control the unwanted donations (Hoffmann 1972, p. 349 and pp. 352–353).

In the immediate post-war period, East Germans were allowed to build owner occupied single family homes; however, over time the state brought this construction to a virtual standstill (Buck 2004, p. 245). In a policy reversal starting from

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the mid 1970s and lasting until reunification, the communist regime did not only allow but even subsidized the private construction of owner occupied homes if it decided to grant a permission; however, the permissions were granted within strict limits (Häußermann, Glock, and Keller 2000, p. 7, Buck 2004, p. 331). The regime granted most permits on the countryside, where it could not construct housing on an industrial scale. With none of these initiatives, however, the communist regime halted the increase of public ownership of the housing stock in the GDR.

Summary

For all practical matters, there was little difference between owning or renting a house in the GDR. As the reunification and its implications for property rights was unforeseen, East Germans are unlikely to have cared whether they owned or rented. Given the notorious shortage of dwellings, few if any East Germans ever had the choice between two equivalent houses, one of them for rent the other one for sale. East Germans simply looked for the type of housing best suited to their needs no matter if it was for rent or for sale. Thus, the homeownership allocation in 1990 is independent of omitted variables that would simultaneously influence investment behavior and homeownership in a market economy.

3.2   The German Socioeconomic Panel

The data come from the German Socioeconomic Panel (GSOEP).[9] The SOEP is a representative longitudinal study of private households in Germany. It started in 1984 in what was then the Federal Republic of Germany (FRG) and was extended in 1990 (after the fall of the wall but before reunification) to the area of the former German Democratic Republic (GDR). Each year the the fieldwork organization TNS Infratest Sozialforschung returns to the same households. The sample is very stable: Of the 2 179 households with 4 453 members that were randomly

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[9]See Wagner, Frick, and Schupp (2007) for a description.

selected for the "SOEP East" sample in 1990, 1 592 households with 2 892 still participated 18 years later.

In its questionnaire the survey records on household level whether there have been certain renovations, e.g., of the bathroom or the kitchen, and whether the household rents or owns. In addition the survey contains information on a number of characteristics of the dwelling (e.g., condition, type, and building year) as well as on the household (e.g., income). Some of these variables the survey records on the person level. In this case I use the characteristics of the head of household as a proxy for the characteristics of the whole household.

For my analysis I use information on different household related investments. For my main results I use yearly data on bathroom renovations. The data is binary; i.e., it indicates whether the household reports a bathroom renovation in a particular year or not. It includes all renovations no matter whether owner, tenant, or landlord paid for them. Furthermore I have information on renovations of kitchens and data on household related investments that are not relationship specific to the dwelling, such as TV-set or car purchases.

I use the years from 1997 until 2002 in my main analysis. After reunification East German homeowners often faced restitution claims by former owners who were forced to sell houses when they left the GDR. For the years before 1997 I cannot rule out that the ownership of a house was disputed. Still I report the results for the years 1992–1996 in Section 4.4 as a robustness check; the results are virtually identical. I need the data of the years from 2002 to 2007 to construct a variable that indicates whether a particular household still lives in the same dwelling after five years.

In 1990, 2179 Households formed the East German sample of the GSOEP. They were interviewed beginning in June, 1990, one month before the currency union and four months before the reunification with West Germany. Only a few months earlier, on November 9, 1989, they had witnessed the fall of the wall but they still lived in the German Democratic Republic, a state separate from the Federal Republic of Germany. Of these households 626 or 28.8 percent owned

the unit they lived in.

Comparing owners and tenants, I find no indication that either group on average was favoured by the communist regime. To determine the closeness to the regime, I consider whether the household had a telephone. The East German state was unable to provide even a majority of households with phone connections. Typically households favoured by the regime were more likely to obtain a phone. In my data, I find that 22.5 percent of homeowners have a phone connection compared to 21.5 percent of tenants.

Because I instrument homeownership in later years by homeownership in 1990, I can use only households that were in the East German sample in 1990. (2179 households). I cannot include households that split from an existing household, e.g., because married couples divorce or children move out. Over the six years from 1997–2002 I should obtain a maximum of 13074 observations, but due to panel attrition and missing values I only have 8351 observations for which I have information on ownership and bathroom renovations.

In the data I observe an increase in homeownership that reverses the depressed homeownership levels in the GDR. In 1997, already 36 percent of East German households owned their home, and until 2002 this percentage rises to almost 42 percent. On average around 40 percent of households in my sample own the unit they live in.

For bathroom renovations, I observe a decrease over time in the data, which suggests that initially East German households were still in the process of upgrading their homes to Western standards. In 1997, around 10 percent of households renovated their bathrooms, equalling one renovation every 10 years. In 2002, only slightly more than 3 percent of households renovated their bathrooms, equalling one renovation every 31 years. On average around 6 percent of households in my sample renovate their bathrooms in any given year (once every 17 years).

4 Evidence from Regressions

4.1 Impact of Homeownership on Bathroom Renovations

For my regression analysis, I pool data from the years 1997–2002. An observation indexed by i is one household in one year. I compare households that own their home ($own_i = 1$) to households that do not ($own_i = 0$) and consider the impact of homeownership on bathroom renovations. The dependent variable is the binary variable $renov_i$, which takes the value 1 if a particular household has reported that its bathroom has been renovated in a particular year. The variable indicates renovations by the tenant as well as the landlord or an owner occupier. I estimate the following linear probability model with pooled OLS:[10]

$$renov_i = \alpha + \beta \, own_i + \Theta' year_i + \Gamma'_B C_{i,B} + \Gamma'_W C_{i,W} + \Gamma'_N C_{i,N} + \varepsilon_i \qquad (1)$$

In all specifications, I include a vector of year dummies ($year_i$) and a vector of baseline controls $C_{i,B}$ including income. In four specifications, I instrument ownership in a particular year by ownership in 1990. In three of the instrumental variable specifications, I control for wealth differences $C_{i,W}$. In one of these specifications, I add controls for other non-contracting effects of ownership in 1990 $C_{i,N}$. All standard errors are robust and clustered at the household level. See Table A-1 in the appendix for summary statistics of all variables.

OLS Regression

I first implement an OLS regression of equation (1), including only baseline controls C_i: dummies for new buildings (built after reunification), measures of the refurbishment need of the house[11] and the distance from the next city center (on a

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[10]The results are essentially identical with the probit specification reported in the appendix. See Table A-2 for the regressions and Table A-3 for the marginal effects of ownership on bathroom renovations.

[11]Refurbishment need contains the answer to the questionnaire question "What is the condition of your house?" on a scale from 1 ("in good condition") to 4 ("is ready for demolition"). I use the

scale from 1 to 6, 6 being the most distant), and household income ($\Gamma_W = \Gamma_N = 0$, column (1) in Table 2).

I calculate household income to include income from labor, government transfers (or taxes) and wealth, in particular an imputed rent for owner occupied housing. I use the yearly household income after taxes and government transfers provided by the survey and add to this income an imputed rental value if the households owns its home. The imputed rental values is provided in the SOEP and consists of a rent estimate minus operating costs. The rent estimates are derived from the information on tenant households in the panel. I use the consumer price index provided by the SOEP to to calculate year 2000 Euros and adjust the income for household size by dividing by the square root of the number of household members.

In the first line of Table 1, I report summary statistics of the my income variable for households that owned in 1990 and for those that rented. Households that owned have an income that is approximately 2000 Euros higher per year. This difference is almost entirely due to income from wealth, which I report in the second line. Income from wealth contains interest, dividends, asset flows and rental income and the imputed rental value. The difference in income from wealth plausibly results from the high return real estate owners derived from their investment in the GDR compared to other investments. Households who managed to buy or keep a house incidentally made the best investment choice possible, given that the reunification occurred. East Germans had only low return financial investment opportunities and, in 1990, they could convert only a limited amount of financial wealth into Deutsche Mark at a favorable exchange rate. If they invested in durable consumption goods like cars, they almost completely lost their money upon reunification when better products became available. But if they bought, built, or did not sell a house at the artificially low prices in the planned economy of the GDR, they should have earned a considerable return on their investment.

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value of the preceding year to avoid endogeneity. I have confirmed that the effect of this variable is almost perfectly linear so that I include the numerical value rather than three dummy variables.

Table 1: Descriptive Statistics Yearly Income and Wealth East German Households 1997–2002 (1000 €).

	Tenant 1990		Homewoner 1990	
	Mean	St. Dev.	Mean	St. Dev.
Income	16.1	6.8	18.2	7.0
Income from wealth	0.7	1.7	2.7	3.0
Wealth	29.8	58.4	88.7	71.2

Notes: An observation is one household in one year for which data on bath renovations is non-missing. All values in year 2000 Euros.

With these baseline controls homeownership increases the probability of a bathroom renovation in any given year by 5.7 percentage points. The standard error is 0.007; I am able to reject the null hypothesis that homeownership does not influence bathroom renovations at the 0.1 percent level. The size of the effect of homeownership is economically relevant — it roughly equals the sample mean of the renovation probability of 6 percent.

The sign and magnitude of the covariates in the regression seem sensible. A new dwelling, built after reunification, decreases the renovation probability by 1.9 percentage points. A one unit increase in the refurbishment need increases the renovation probability by 3 percentage points.[12]

Income has no significant effect on the renovation probability. As income does, however, have a significant positive effect on the purchase of cars and TV-sets (see Table 7) and, in most specifications, on kitchen renovations (see Table 5), the insignificance is unlikely to be due to measurement error, but rather reflects the preferences of East Germans in those years: They prefer to spend additional

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[12]One might be worried that refurbishment need is correlated with lagged bathroom renovations, which, in the presence of residual autocorrelation, could lead to biased estimates. To address this concern, I report in column (2) of Table A-4 in the appendix a specification that explicitly contains lagged renovations. The coefficient on ownership is highly significant and almost the same size as in the baseline specification. This specification is estimated consistently if it is dynamically complete (Wooldridge 2002, pp. 173–177). To verify that it is dynamically complete, I regress lagged residuals on residuals in column (3); the lagged residuals are not significant; there is no residual autocorrelation.

income on goods such as cars, TV-sets and kitchens rather than new bathrooms.

Instrumental Variable Regression — Baseline

I instrument homeownership in the years from 1997 to 2002 by homeownership in 1990, i.e., before reunification. In Table 3, I report the results of the first stage regression. These results indicate that homeownership in 1990 has strong predictive power for homeownership in the years 1997 to 2002. In the first three specifications a household that owned in 1990 is around 60 percentage points more likely to own in the years 1997 to 2002. Homeowners are wealthier and have higher incomes, too.

In the fourth specification the effect of ownership in 1990 shrinks to almost 40 percentage points; this decrease is driven almost completely by the inclusion of a dummy variable for single family homes that is highly correlated with both, ownership in 1990 and in 1997–2002; i.e. this is an important dimension, in addition to wealth, in which households that happened to own in the GDR differ from those who did not, and I need to control for it. Homeowners are more likely to stay for five more years in their house and to have children under the age of 18. Yet the coefficient on ownership in 1990 is hardly affected if I include these variables, as they are only weakly correlated with ownership in 1990.

The F-Statistic which tests the hypothesis that the instrument does not enter the first stage regression is above 10 — the threshold suggested by Staiger and Stock (1997) to rule out a weak instrument problem in the case of a single endogenous variable. This holds for all instrumental variable specifications that I implement.

The high predictive power of homeownership in 1990 for homeownership in later years suggests that households face sizable costs of switching from tenancy to ownership or vice versa. These switching costs result in a lot of persistence: In 2002, 53 percent of households live in the same unit as in 1990 and 80 percent have not changed ownership status.

In the baseline instrumental variable regression ($\Gamma_W = \Gamma_N = 0$, column (2) of Table 2), the estimate of the ownership coefficient increases slightly to 0.062.

Table 2: Estimates of the Probability of a Bathroom Renovation between 1997 and 2002; OLS and IV estimates

	OLS (1)	IV 1 (2)	IV 2 (3)	IV 3 (4)	IV 4 (5)
Homeownership	0.057 (0.0068)***	0.062 (0.011)***	0.066 (0.012)***	0.065 (0.014)***	0.068 (0.028)*
Refurbishment need	0.030 (0.0051)***	0.031 (0.0051)***	0.031 (0.0051)***	0.027 (0.0054)***	0.026 (0.0058)***
Built after reunification	−0.019 (0.0068)**	−0.019 (0.0067)**	−0.020 (0.0068)**	−0.020 (0.0073)**	−0.021 (0.0088)*
Income	−0.0005 (0.0004)	−0.0005 (0.0004)	−0.0004 (0.0004)	−0.0006 (0.0005)	−0.0004 (0.0005)
Income from wealth			−0.002 (0.001)		−0.002 (0.001)
Wealth				−0.00007 (0.00006)	
Single family home					−0.001 (0.02)
Distance from city center					−0.0010 (0.002)
Stay for five more years					−0.001 (0.010)
Age head of household					−0.001 (0.002)
Age head of household^2					0.00001 (0.00002)
Children under 18					0.005 (0.005)
Year Dummies	✓	✓	✓	✓	✓
N.obs.	8210	8195	8195	7334	6303
R^2	0.029	0.029	0.029	0.029	0.029

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. In columns (2)—(5) homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table 3: Estimates of the Probability of Homeownership between 1997 and 2002 (First Stage Regressions).

	IV 1 (1)	IV 2 (2)	IV 3 (3)	IV 4 (4)
Homeownership in 1990	0.673 (0.0200)***	0.635 (0.0235)***	0.573 (0.0339)***	0.386 (0.0308)***
Refurbishment need	−0.061 (0.010)***	−0.056 (0.010)***	−0.048 (0.013)***	−0.035 (0.0095)***
Built after reunification	0.149 (0.0345)***	0.155 (0.0341)***	0.165 (0.0332)***	0.0396 (0.0335)
Income	0.01 (0.001)***	0.008 (0.001)***	0.005 (0.002)*	0.005 (0.001)***
Income from wealth		0.02 (0.008)**		0.01 (0.007)*
Wealth			0.0020 (0.00049)***	
Single family home				0.397 (0.0306)***
Distance from city center				0.004 (0.005)
Stay for five more years				0.145 (0.0154)***
Age head of household				0.006 (0.005)
Age head of household^2				−0.00009 (0.00005)*
Children under 18				0.027 (0.012)*
Year Dummies	✓	✓	✓	✓
F-Statistic	1133.06	732.80	285.56	157.21
N.obs.	8195	8195	7334	6303
R^2	0.460	0.469	0.514	0.625

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that it owns its home in a given year. Robust standard errors clustered by household in parenthesis. The F-Statistic tests the null hypothesis that instrument (Homeownership in 1990) has a zero coefficient.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Its standard error is 0.011, and it remains significant at the 0.1 percent level. A Durbin-Wu-Hausman test cannot reject the hypothesis that ownership in later years is exogenous at any reasonable level; it yields a P-value of 0.58.

While the bias is not significant, its direction is not consistent with a model in which households become homeowners to protect their relationship specific investments. In such a model, households with a large desire for renovations own more often, and the OLS estimate overestimates the effect of ownership. Rather these results suggest that owner households want or need to renovate less. This could result from unobserved household characteristics: Suppose some households are more diligent or self disciplined; these households probably take better care of their interior decoration and exhibit a lower renovation frequency. If these households have to pay the same rents as the average tenant, they may prefer to become owner occupiers.

In Table A-5 in the appendix, I report the results of all specifications for a reduced sample that contains only households that remained in 2002 in the same unit as in 1990 and that kept their ownership status. The results are almost the same as the instrumental variable specifications for the full sample.

Instrumental Variable Regression — Controls for Wealth

Homeowners are wealthier than tenants; they may be less financially constraint than less wealthy tenants with the same income; hence, they may invest more frequently and this liquidity effect may not be captured by the income variable.

To control for differences in wealth, I use two different measures provided in the survey. For both measures, I use the consumer price index provided by the SOEP to to calculate year 2000 Euros and adjust the income for household size by dividing by the square root of the number of household members: First, I Ãnclude income from wealth, including the imputed rental value for owner occupiers. This is a component of the income variable, which remains in the regression. Like the other income components, this variable is collected every year. Second, I use household wealth in 2002 into the regression, the only year for which I have

comprehensive wealth data — this wealth variable is constant over time. For the 2002 wealth questionnaire all households reported not only financial assets but also their real estate holdings. For real estate, the survey contains the values given by the owners.

The two wealth measures are constructed in different ways: One measures a flow, the other one a stock; one contains an estimate of the imputed rental value, the other one self reported real estate wealth; one is a yearly measure, the other one is collected only once every few years. Yet, the two measures are consistent: As reported in Table 1, households that owned in 1990 are 59000 Euros (adjusted for household size) wealthier than those who rented, while their income from wealth is 2000 Euros higher. From these numbers I can calculate a 3 percent per year return for homeowners and a 2.4 percent return for households that rent. This seems plausible given that most of the wealth of non homeowners should be in very liquid, low interest paying assets.

In both specifications ($\Gamma_N = 0$, columns (3) and (4) of Table 2), the ownership coefficient changes little; it increases slightly to 0.066 and 0.065 respectively and the coefficient estimates are still significant at the 0.1 percent level. The effect neither of wealth nor of income from wealth is significant. Wealth, independent of the measure, has no effect beyond the income increase. That suggests that households do not face important financing constraints; they are able to borrow against their labor income.

Instrumental Variable Regression — Additional Controls

A household's ownership status in 1990, even if randomly assigned, may have effects on the renovation probability other than the contracting problem that I want to isolate. The history of the allocation of housing suggests that owner occupiers more often lived in single family homes and on the country side; this could also imply a different age structure and family composition of homeowners with associated different tastes for dwelling specific investment. In this section, I control for these potential alternative channels of homeownership on investment.

Although tenants are well protected against eviction by German tenancy law, a few tenants might expect to be evicted. Homeowners, on the other hand, face higher moving costs than tenants. Thus owners may expect to reside longer in a dwelling than tenants. A shorter expected duration of residence in a dwelling reduces investment if investment is customized and if markets are too thin to allocate the dwelling to new tenants with a similar taste. To control for differences in the expected length of stay, I include a dummy that is 1 if the household resides in the same dwelling five years later. I construct this dummy from the data for the years up to 2007. If households have rational expectations regarding their duration of residence, this dummy proxies for the expectation.

I include controls for other potential differences between households that own or rented in 1990. There are controls for single family homes and distance from the city center, as well as for family characteristics, such as the age of the head of household and the number of children under the age of 18 that live in the household.

Again the ownership coefficient remains almost unchanged (see column (5) of Table 2), it is 0.068; it is significant at the 5 percent level. Non of the covariates has a significant effect.

To investigate wether the dummy variable for the expected length of stay is insignificant only because its horizon is too short, I restrict my sample to the years from 1997 until 1999. For these years, I can extend the horizon of my residence dummy to eight years. In column (1) of Table 4, I repeat the regression of column (3) of Table 2 but only for the years 1997–1999. The coefficient on ownership remains significant at the 5 percent level and even increases to 0.088. This increase corresponds to a higher sample mean of the renovation probability (8 percent for 1997–1999 compared to 6 percent for 1997–2002), which reflects the more vigourous construction activity during those years. In column (2) of Table 4, I extend the horizon of the dummy to eight years; the dummy still is not significant; the size and significance of the coefficient of ownership remains virtually unchanged (0.087).

Table 4: Estimates of the Probability of a Bathroom Renovation between 1997 and 1999; IV estimates with additional controls for the expected duration of residence.

	Stay 5 Years (1)	Stay 8 Years (2)	Self-Reported (3)
Homeownership	0.088 (0.040)*	0.087 (0.041)*	0.088 (0.038)*
Refurbishment need	0.032 (0.0078)***	0.031 (0.0082)***	0.038 (0.0071)***
Built after reunification	−0.013 (0.015)	−0.0073 (0.016)	−0.011 (0.014)
Income	−0.0001 (0.0008)	−0.0001 (0.0009)	−0.00009 (0.0008)
Income from wealth	0.0005 (0.003)	0.0008 (0.003)	−0.00003 (0.003)
Single family home	0.002 (0.03)	0.0006 (0.03)	−0.005 (0.02)
Distance from city center	−0.002 (0.003)	0.0004 (0.003)	0.0007 (0.003)
Stay for five more years	−0.010 (0.01)		
Stay for eight more years		−0.02 (0.01)	
Self-reported relocation probability			0.003 (0.007)
Age head of household	−0.002 (0.003)	−0.004 (0.003)	−0.0010 (0.003)
Age head of household^2	0.00002 (0.00003)	0.00004 (0.00003)	0.000010 (0.00002)
Children under 18	0.005 (0.007)	0.00002 (0.007)	0.004 (0.007)
Year Dummies	✓	✓	✓
N.obs.	3466	3020	4197
R^2	0.031	0.029	0.031

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. Homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

The insignificant effect of the expected duration of stay on investment in rental housing is most likely a consequence of rent control. If the landlord invests, she typically cannot increase the rent by much in an ongoing tenancy; if, however, she concludes a new lease, she can freely negotiate the rent. Thus, landlords have an additional incentive to renovate in dwellings with a lot of turnover. This effect countervails investment incentives from customizing bathrooms, which reduces incentives to invest in dwellings with a lot of turnover and short durations of residence.

As an additional robustness check, I include a direct measure of expected duration of residence, which is only available for the years 1992–1996. The realized duration of residence is a good proxy for the expectation if households form expectations rationally and if they can forecast reasonably well for how much longer they are going to reside in their homes. If they are rational but cannot forecast, the duration of residence cannot be relevant for renovation decisions. Households may, however, form non-rational expectations of their duration of residence, which I cannot proxy by the realized duration of residence. To cover this case, I include a direct measure of the expected duration of residence: the answer to the question "Can you imagine moving away for family or professional reasons?". Households answer this question on a scale from 1 to 3: Yes (1), It depends (2), No, not at all, not even conceivable (3). In column (4) of Table 4, I report a regression that includes this measure; the coefficient is not significant; the size and significance of the coefficient of ownership remains unchanged (0.088).

All in all, the estimates of the effect of homeownership on the investment probability are around 6 percentage points for the years 1997–2002 in all specifications. If anything, the effect grows with instrumentation and additional controls.

4.2   Kitchens, TV-Sets, and Cars

In this section, I analyze the effect of homeownership on three additional types of household investments: Kitchen renovations, TV-sets, and cars. These investments differ in how specific they are to the dwelling. Kitchen renovations are

specific but less so than bathroom renovations; a built-in kitchen can be removed at lower costs than bathroom fixtures, and there are freestanding kitchen appliances, too.[13] Neither TV-sets nor cars are specific to a dwelling. If a hold-up problem drives my results, homeownership should increase kitchen renovations, albeit less than bathroom renovations; but homeownership should not increase purchases of TV-sets or cars. If, however, unobserved preference differences regarding interior decorations drive my results, I should find an increase for TV-sets as well. If unobserved differences in financing ability drive my results, I should find an increase for car purchases, too, as cars are investments on the same order of financial magnitude as bathroom or kitchen renovations.

Table 5: Estimates of the Probability of a Kitchen Renovation between 1997 and 2002.

	OLS (1)	IV 1 (2)	IV 2 (3)	IV 3 (4)
Homeownership	0.025 (0.0059)***	0.018 (0.0092)*	0.020 (0.010)	0.019 (0.012)
Refurbishment need	0.012 (0.0044)**	0.010 (0.0045)*	0.010 (0.0045)*	0.0095 (0.0048)*
Built after reunification	−0.0084 (0.0077)	−0.0089 (0.0077)	−0.0092 (0.0078)	−0.0070 (0.0083)
Income	0.0010 (0.0004)**	0.001 (0.0004)**	0.001 (0.0004)**	0.0009 (0.0004)*
Income from wealth			−0.0006 (0.001)	
Wealth				0.00004 (0.00006)
Year Dummies	✓	✓	✓	✓
N.obs.	8210	8195	8195	7334
R^2	0.010	0.010	0.010	0.011

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its kitchen was renovated in a given year. In columns (2)–(4) homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

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[13]Indeed anecdotal evidence suggests that German tenants sometimes own kitchens while they essentially never own bathroom fixtures.

Table 6: Difference of the Impact of Ownership on Kitchen and Bath Renovations

| | OLS | IV 1 | IV 2 | IV 3 |
	(1)	(2)	(3)	(4)
Bath–Kitchen	0.032	0.044	0.046	0.049
P-Value	(0.0000)***	(0.0004)***	(0.0008)***	(0.0047)***

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported the investment in a given year. In columns (2)–(4) homeownership is treated as endogenous and instrumented by homeownership in 1990. P-values in parenthesis.
 * significant at 5%; ** significant at 1%; *** significant at 0.1%;

Consistent with the hold-up hypothesis, the point estimates of the effect of ownership on kitchen renovations is positive but smaller than for bathroom renovations. In Table 5, I report the results for the OLS and IV 1–3 specifications. The point estimate is 0.025 for the OLS estimate and around 0.02 for the IV specifications. In the first two specifications, it is significant at least at the 5 percent level. In the IV 2 specification, the estimate is just outside the 5 percent threshold (the P-value is 0.057). In Table 6, I report cross equation tests of the difference between the coefficients of the impact of homeownership on bathroom and kitchen renovations. The differences are between 2 and 5 percentage points and always significant at the 0.1 percent level. The high level of significance obtains because the difference between bathroom and kitchen renovations is much less volatile than each single investment as both investments are often undertaken during the same year.

I estimate the impact of homeownership on two more investments, TV-sets and cars, and I obtain results consistent with the hold-up hypothesis. In Table 7, I report estimates of the coefficients on homeownership in a specification that is equivalent to IV 3. In the appendix in Tables A-6 und A-7, I report the OLS and the IV 1–3 specifications for TV-sets and cars. I have only bi-annual data on car and TV-set purchases.

Consistent with the hold-up hypothesis, the coefficients on TV-set and car purchases (columns (3) and (4)) are both negative. The coefficient for TV-sets is significant at the 1 percent level; the coefficient for cars is not significant in

Table 7: Probability of Investment; IV Estimates for Different Investments

	Bath (1)	Kitchen (2)	Car (3)	TV-Set (4)
Homeownership	0.063 (0.016)***	0.032 (0.015)*	−0.031 (0.018)	−0.047 (0.018)**
Refurbishment need	0.023 (0.0067)***	0.011 (0.0065)	−0.00031 (0.0080)	0.0081 (0.0081)
Built after reunification	−0.023 (0.0088)*	−0.012 (0.010)	0.024 (0.016)	0.055 (0.017)**
Income	−0.0004 (0.0005)	0.0003 (0.0005)	0.002 (0.0009)*	0.002 (0.0009)*
Income from wealth	−0.001 (0.001)	0.0005 (0.002)	−0.002 (0.002)	0.004 (0.002)
Year Dummies	✓	✓	✓	✓
N.obs.	4007	4007	3923	3893
R^2	0.024	0.013	0.003	0.009

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported the investment in a given year. Data on purchases of TV-Sets and cars are available only bi-annualy; to make the results comparable columns (1) and (2) include only even years for which data on TV-sets and cars is available, too. Homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.
 * significant at 5%; ** significant at 1%; *** significant at 0.1%;

this specification. In the fuller set of specifications, which I report in the appendix in Tables A-6 und A-7, I find that all point estimates for cars and TV-sets are negative; the estimates are each significant in two out of four specifications. The negative coefficients plausibly obtain because households face budget and financing constraints. Homeowners spend more on the dwelling specific parts of the interior decoration (e.g. bathroom fixtures) but less on movable items (TV-sets). They also finance more dwelling specific durables (kitchens) but less other durables (cars).

As a comparison, I include the data on bathroom and kitchen renovations only for the (even) years for which I have car and TV-set purchase data. The reduced sample estimates for bathroom renovations (column (1) of Table 7) are essentially identical to the full sample results (column (2) of Table 2). The estimate of the effect of homeownership on kitchen renovations (column (2) of Table 7) is 3.2 percentage points. It is significant at the 5 percent level. This point estimate is

somewhat higher than the full sample specifications reported in Table 5.

4.3 East-West Comparison

In this section, I compare the effect of homeownership on relationship specific investments in East Germany and West Germany. I cannot replicate the natural experiment for West Germany, but I can compare the OLS estimates with the significant baseline controls. I construct the West German sample in the same way as the original sample: I include all households that were in the West German sample in 1990 and follow them until 2002; i.e., a household that resided in West Germany in 1990 but moved to East Germany before 1997 is included in the West German sample. As in the East German sample, I do not include later expansions of the panel.

The coefficient estimate for West Germany (Table 8 column (2)) is positive and significant at the 1 percent level. Its magnitude of 1.9 percentage points is smaller than in the East German sample but still economically significant given that the mean renovation probability in the West Germany sample (3.2 percent) is only half the mean renovation probability in the East German sample (6.1 percent). The different mean renovation probabilities reflect the East German catch-up to West German housing standards.

4.4 The Years 1992–1996

In this section, I repeat my analysis of the effect of homeownership on relationship specific investments in East Germany for the years 1992–1996.[14] In these years, homeownership may have been disputed in some cases. Yet I should find, nevertheless, some effect of ownership on investment. I include all controls that were significant in one of the main specifications with the exception of the dummy for construction after reunification. I cannot construct such a dummy for the early

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[14]I start my analysis with the year 1992 because the questionnaire in 1991 did not record whether there was a bathroom renovation.

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Table 8: Probability of Investment; OLS Estimates for East and West Germany

	East Germany (1)	West Germany (2)
Homeownership	0.059 (0.0071)***	0.019 (0.0036)***
Refurbishment need	0.030 (0.0051)***	0.016 (0.0030)***
Built after reunification	−0.020 (0.0068)**	−0.014 (0.0041)***
Income	−0.0003 (0.0004)	0.0003 (0.0002)
Income from wealth	−0.001 (0.001)	−0.0004 (0.0005)
Year Dummies	✓	✓
N.obs.	8210	17318
R^2	0.029	0.007

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

years because the most recent category of the variable "year of construction" is "after 1981". I include a dummy for these years to control for new buildings.

In column (2) of Table 9, I present the regression results. The coefficients are essentially the same as in column (1), i.e., the same relationship between ownership and investment holds for the earlier years. The mean yearly renovation probability (6.8 percent) is also similar for this period compared to the later years.

5   Conclusion

In this paper, I have applied the canonical model of Grossman and Hart (1986) to the housing market. Under the assumption that landlords and tenants rely on ex-post negotiation to share the surplus of relationship specific investments, the

Table 9: Probability of Investment; IV Estimates for the years 1997–2002 and 1992–1996

	1997–2002 (1)	1992–1996 (2)
Homeownership	0.066 (0.012)***	0.062 (0.012)***
Refurbishment need	0.031 (0.0051)***	0.019 (0.0049)***
Built after reunification	−0.020 (0.0068)**	
Built after 1981		−0.028 (0.0067)***
Income	−0.0004 (0.0004)	0.001 (0.0007)
Income from wealth	−0.002 (0.001)	0.006 (0.004)
Year Dummies	✓	✓
N.obs.	8195	8438
R^2	0.029	0.027

 Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. Homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.
 * significant at 5%; ** significant at 1%; *** significant at 0.1%;

model predicts that renovations of fixtures should be less frequent in rented housing than in owner occupied housing. Empirically, this prediction is borne out by data from the German housing market. Bathroom renovations are less likely in rental than in owner occupied housing. I interpret this as evidence for a hold-up problem in the housing market: Tenants fear that they lose part of the return if they undertake relationship specific investments. I conclude that, at least in the German housing market, asset ownership determines relationship specific invests — just as Grossman and Hart's (1986) model predicts.

Thus, even though the German housing market is large and mature, mar-

ket participants seem to have failed to develop a contract that remedies under-investment. The modernization agreement solves the hold-up problem only if the transfer to the tenant can be conditioned on the market value of his investment. Yet modernization agreements do not routinely include mechanisms that allow the parties to do just that. As the market value of the investment can be observed by outsiders, I would argue that this is an instance of the observable-but-unverifiable-information problem often cited in support of the incomplete contracting paradigm (Bolton and Dewatripont 2005, p. 553).

Appendix

Table A-1: Descriptive statistics East German Households 1997–2002.

	N. Obs.	Mean	Std. Dev,	Min.	Max.
Bath renovation	8351	0.061	0.24	0	1
Kitchen renovation	8351	0.055	0.23	0	1
TV-set purchase	3962	0.11	0.31	0	1
Car purchase	3993	0.12	0.32	0	1
Homeownership	8351	0.40	0.49	0	1
Homeownership in 1990	8335	0.29	0.45	0	1
Refurbishment need	8263	1.54	0.66	1	4
Built after reunification	8291	0.12	0.33	0	1
Income	8351	16.7	6.95	0.036	165.5
Income from wealth	8351	1.27	2.33	0	55.0
Wealth	7463	47.1	67.9	-98.0	941.0
Single family home	8300	0.42	0.49	0	1
Distance from city center	7929	3.30	1.49	1	6
Stay for five more years	6725	0.83	0.38	0	1
Age head of household	8351	53.7	13.7	19	97
Children under 18	8351	0.52	0.84	0	5

Notes: An observation is one household in one year for which data on bath renovations is non-missing.

Table A-2: Estimates of the Probability of a Bathroom Renovation between 1997 and 2002. Probit and Bivariate Probit Estimates.

	Probit (1)	Bivariate Probit 1 (2)	Biv. Probit 2 (3)	Biv. Probit 3 (4)	Biv. Probit 4 (5)
Homeownership	0.48 (0.056)***	0.51 (0.079)***	0.48 (0.10)***	0.53 (0.084)***	0.52 (0.16)**
Refurbishment need	0.25 (0.038)***	0.25 (0.039)***	0.22 (0.041)***	0.25 (0.039)***	0.22 (0.044)***
Built after reunification	−0.28 (0.091)**	−0.28 (0.091)**	−0.29 (0.096)**	−0.28 (0.091)**	−0.28 (0.11)**
Income	−0.004 (0.004)	−0.004 (0.004)	−0.005 (0.004)	−0.003 (0.004)	−0.003 (0.005)
Income from wealth				−0.01 (0.01)	−0.01 (0.02)
Wealth			−0.0003 (0.0005)		
Single family home					0.02 (0.1)
Distance from city center					−0.008 (0.02)
Stay for five more years					−0.01 (0.09)
Age head of household					−0.01 (0.02)
Age head of household^2					0.0001 (0.0002)
Children under 18					0.05 (0.04)
Year Dummies	✓	✓	✓	✓	✓
N.obs.	8210	8195	7334	8195	6303
R^2					

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. In columns (2)–(5) the effect of homeownership in later years on renovations in those years is estimated jointly in a bivariate probit with the effect of homeownership in 1990 on homeownership in later years. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-3: Estimates of the Marginal Effects of Homeownership on the Probability of a Bathroom Renovation between 1997 and 2002. Probit and Bivariate Probit Estimates.

	Probit (1)	Bivariate Probit 1 (2)	Biv. Probit 2 (3)	Biv. Probit 3 (4)	Biv. Probit 4 (5)
Homeownership	0.055 (0.0067)***	0.058 (0.0100)***	0.054 (0.012)***	0.062 (0.011)***	0.060 (0.021)**

 Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. In columns (2)–(5) the effect of homeownership in later years on renovations in those years is estimated jointly in a bivariate probit with the effect of homeownership in 1990 on homeownership in later years. Robust standard errors clustered by household in parenthesis.

 * significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-4: Estimates of the Probability of a Bathroom Renovation between 1997 and 2002. OLS Estimates with lagged dependent variable.

	Bath		Residuals
	(1) OLS	(2) OLS Lag	(3) OLS Lag
Homeownership	0.059 (0.0071)***	0.052 (0.0064)***	−0.0039 (0.013)
Refurbishment need	0.030 (0.0051)***	0.032 (0.0048)***	0.0040 (0.0064)
Built after reunification	−0.020 (0.0068)**	−0.016 (0.0061)*	−0.0018 (0.0064)
Income	−0.00031 (0.00042)	−0.00029 (0.00038)	−0.00039 (0.00038)
Income from wealth	−0.0013 (0.0010)	−0.0013 (0.00096)	−0.00013 (0.00098)
Renovations$_{t-1}$		0.13 (0.017)***	−0.071 (0.18)
Residuals$_{t-1}$			0.039 (0.18)
Residuals$_{t-2}$			0.039 (0.028)
Year Dummies	✓	✓	✓
N.obs.	8210	8210	7994
R^2	0.029	0.048	0.003

Notes: An observation in the regression is one household in one year. In columns (1)–(2) the dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. In column (3) the dependent variable is the residual of the regression in column (2). Robust standard errors clustered by household in parenthesis.
 * significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-5: Estimates of the Probability of a Bathroom Renovation between 1997 and 2002 — Only Households that neither moved nor changed their Ownership Status between 1990 and 2002 ; OLS estimates

	OLS 1 (1)	OLS 2 (2)	OLS 3 (3)	OLS 4 (4)
Homeownership	0.060 (0.0086)***	0.062 (0.0088)***	0.059 (0.0096)***	0.054 (0.012)***
Refurbishment need	0.024 (0.0075)**	0.024 (0.0075)**	0.023 (0.0075)**	0.024 (0.0079)**
Built after reunification	−0.026 (0.013)*	−0.028 (0.013)*	−0.023 (0.014)	−0.027 (0.016)
Income	−0.0009 (0.0005)	−0.0007 (0.0006)	−0.001 (0.0006)	−0.0005 (0.0006)
Income from wealth		−0.001 (0.001)		−0.001 (0.001)
Wealth			0.00003 (0.00008)	
Single family home				0.02 (0.01)
Distance from city center				−0.003 (0.003)
Stay for five more years				−0.03 (0.02)
Age head of household				0.001 (0.003)
Age head of household^2				−0.00001 (0.00003)
Children under 18				0.010 (0.007)
Year Dummies	✓	✓	✓	✓
N.obs.	4882	4882	4751	4185
R^2	0.027	0.027	0.026	0.028

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-6: Estimates of the Probability of a TV-set purchase between 1998 and 2002 — Bi-annual data.

	OLS (1)	IV 1 (2)	IV 2 (3)	IV 3 (4)
Homeownership	−0.0011 (0.010)	−0.037 (0.016)*	−0.047 (0.018)**	−0.034 (0.021)
Refurbishment need	0.012 (0.0080)	0.0080 (0.0081)	0.0081 (0.0081)	0.011 (0.0086)
Built after reunification	0.054 (0.017)**	0.053 (0.017)**	0.055 (0.017)**	0.060 (0.018)**
Income	0.002 (0.0008)*	0.002 (0.0009)**	0.002 (0.0009)*	0.003 (0.0009)**
Income from wealth			0.004 (0.002)	
Wealth				0.00006 (0.0001)
Year Dummies	✓	✓	✓	✓
N.obs.	3900	3893	3893	3568
R^2	0.013	0.010	0.009	0.014

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that it bought a new TV-set in a given year. Data on purchases of TV-sets are available only bi-annualy. In columns (2)–(4) Homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.

* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-7: Estimates of the Probability of a car purchase between 1998 and 2002 — Bi-annual data.

	OLS (1)	IV 1 (2)	IV 2 (3)	IV 3 (4)
Homeownership	−0.0060 (0.011)	−0.035 (0.017)*	−0.031 (0.018)	−0.040 (0.023)
Refurbishment need	0.0029 (0.0079)	−0.00027 (0.0080)	−0.00031 (0.0080)	0.0054 (0.0084)
Built after reunification	0.026 (0.016)	0.025 (0.016)	0.024 (0.016)	0.030 (0.017)
Income	0.001 (0.0008)	0.002 (0.0008)*	0.002 (0.0009)*	0.002 (0.0009)*
Income from wealth			−0.002 (0.002)	
Wealth				0.00002 (0.0001)
Year Dummies	✓	✓	✓	✓
N.obs.	3930	3923	3923	3594
R^2	0.004	0.002	0.003	0.002

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that it bought a new car in a given year. Data on purchases of cars are available only bi-annualy. In columns (2)–(4) Homeownership is treated as endogenous and instrumented by homeownership in 1990. Robust standard errors clustered by household in parenthesis.

* significant at 5%; ** significant at 1%; *** significant at 0.1%;

Table A-8: Estimates of the Probability of a Bathroom Renovation between 1997 and 2002. OLS Estimates.

	(1) OLS 1	(2) OLS 2	(3) OLS 3	(4) OLS 4
Homeownership	0.057 (0.0068)***	0.059 (0.0071)***	0.059 (0.0076)***	0.057 (0.0098)***
Refurbishment need	0.030 (0.0051)***	0.030 (0.0051)***	0.026 (0.0053)***	0.026 (0.0057)***
Built after reunification	−0.019 (0.0068)**	−0.020 (0.0068)**	−0.020 (0.0072)**	−0.021 (0.0087)*
Income	−0.0005 (0.0004)	−0.0003 (0.0004)	−0.0006 (0.0005)	−0.0004 (0.0005)
Income from wealth		−0.001 (0.001)		−0.001 (0.001)
Wealth			−0.00005 (0.00005)	
Single family home				0.004 (0.009)
Distance from city center				−0.0008 (0.002)
Stay for five more years				0.0006 (0.009)
Age head of household				−0.001 (0.002)
Age head of household^2				0.00001 (0.00002)
Children under 18				0.005 (0.005)
Year Dummies	✓	✓	✓	✓
N.obs.	8210	8210	7346	6314
R^2	0.029	0.029	0.028	0.029

Notes: An observation in the regression is one household in one year. The dependent variable is a binary variable that is 1 if the household reported that its bathroom was renovated in a given year. Robust standard errors clustered by household in parenthesis.
* significant at 5%; ** significant at 1%; *** significant at 0.1%;

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