

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

Georg Gebhardt
University of Munich *

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Abstract

Real world contracts are simple but are they incomplete in the sense that including observable information would make them more efficient? In this paper I investigate a real world hold up problem: Tenants renovating their bathrooms. Using the home ownership allocation resulting from the communist regime in East Germany as an instrument, I compare the investment frequency in rented apartments with the one in owner occupied apartments and find 6 percentage point lower probability per year in rented apartments. I interpret this as indicating that there are large barriers to the introduction of more efficient contracts.

*Department of Economics, University of Munich, Ludwigstr. 28 (Rg.), D-80539 Munich, Tel.: +49 89 2180 2876, e-mail: Georg.Gebhardt@LRZ.uni-muenchen.de. Financial support by Deutsche Forschungsgemeinschaft through grant SFB TR 15 is gratefully acknowledged.

1 Introduction

Starting with Williamson (1975), Grossman and Hart (1986) and Hart and Moore (1990) economists have modeled real world institutions using the incomplete contracts paradigm, a paradigm that nevertheless has remained controversial. In contrast to standard contract theory it postulates that contracting parties employ only a restricted set of (simple) contracts and that these restrictions prevent them from achieving the outcome they desire. The relative merits of the two approaches depend on the interpretation of the simple contracts people use in reality. Do they implement the desired outcome, i.e. the second best as defined by standard contract theory, or not? This is the question I analyze empirically in this paper.

The incomplete contract paradigm originated in the theory of the firm (Williamson 1975, Grossman and Hart 1986) to explain the role of asset ownership. Suppose two parties can create surplus through trade at some point in time and the size of the potential surplus depends on relationship specific investments by the two parties at an earlier stage, then the investment incentives depend on how the parties share the surplus. Even if the parties can't contract on a sharing rule beforehand they can influence the distribution of surplus by simply allocating asset ownership. From this a theory of asset ownership and thus of the firm emerges.

To replace the ad hoc restriction of the contract space authors starting with Hart and Moore (1988) suggested a set of assumptions on the primitives of the contractual environment that generate incompleteness endogenously. A large literature has generated a number of results. On the one hand sometimes very simple contracts can achieve first best investments (Noeldeke and Schmidt 1995, Edlin and Reichelstein 1996) and even very restrictive assumptions regarding verifiability, foreseeability and commitment not to renegotiate can be overcome by clever contracting to achieve the first best (Maskin and Tirole 1999b). On the other hand there are contracting environments in which the first best can't be

implemented or even the best contract is as good as no contract at all (Che and Hausch 1999, Segal 1999, Hart and Moore 1999) or the allocation of ownership rights (Maskin and Tirole 1999a).

These results allow for a number of interpretations: The simple contracts we observe in reality are efficient, they are inefficient because the contracting environment falls into one of the known categories that make inefficient simple contracts optimal or even that real world contracts are inefficient due to aspects of the contracting environment that so far have not been properly modeled.

So far nobody has tried to empirically determine whether real world contracts give optimal incentives for relationship specific investments. There is, however, a small but growing empirical literature that confirms predictions of specific incomplete contracts models tailored to contracts in certain industries such as venture capital (Kaplan and Stromberg 2003, Kaplan and Stromberg 2004), trucking (Baker and Hubbard 2003, Baker and Hubbard 2004) and biotechnology (Lerner and Malmendier 2005). Still these studies don't answer the question whether or not the observed contractual arrangements implement the first best or not. In this paper I attempt to address this question.

To investigate the efficiency of real world contracts I consider a hold up problem in the German rental housing market concerning the investment in bathroom and kitchen renovations. The landlord can pay for these renovations but German law strictly limits the ability of the landlord to recoup her investment from the tenant so that there may be underinvestment. In this case the tenant has an incentive to invest, however, the investment is relationship specific. The investment is protected very well by German rent control laws as long as the tenant stays in the apartment. It is almost impossible for the landlord to either raise the rent or to threaten to evict the tenant to secure herself a share in the returns. If tenant has to move out, however, the legal default gives no compensation to the tenant, he can only try to extract a payment by threatening to remove the investment. Any contract or institution that guarantees the market value of the

investment to the tenant if he moves out, implements first best incentives and no legal restriction prevents the parties to write such a contract. Furthermore, as rents can be freely negotiated at the time of the conclusion of the contract the landlord can extract the whole surplus generated by an efficient agreement.

Given the broad range of potential solutions for this problem such as revelation mechanisms, reputation or fairness norms I don't attempt to investigate the employed institutions. Rather my empirical strategy is to directly test whether the resulting allocation is efficient. I obtain data on bathroom renovations from the German Socioeconomic Panel (GSOEP) a household panel data set that also contains data on other household characteristics. As a benchmark for the first best I use the renovation probability of bathrooms in owner occupied housing where no contractual problems arise. I compare this frequency to the frequency in rented housing. If the latter falls short of the former, the employed contracts provide the tenant with insufficient incentives for investment.

Using the East German sample of the GSOEP I can exploit the natural experiment of the German reunification to obtain a random allocation of home ownership.¹ The communist regime in East Germany tolerated private ownership of real estate but it strengthened the rights of tenants and the government to a degree that ownership became virtually meaningless. Because the reunification of Germany was unforeseen, East Germans didn't sort systematically into owning or renting but rather ended up randomly in one or the other at time of the reunification when suddenly property rights became meaningful again. Thus I avoid endogeneity problems such as households that buy a home because they enjoy well renovated bathrooms and anticipate the contractual problems in rented housing.

In my main regression I use house ownership in 1990, immediately after the Fall of the wall but before reunification, as an instrument for ownership in the

¹Researchers in other fields (Fuchs-Schuendeln and Schuendeln 2005, Redding and Sturm 2006) have employed this approach before.

years 1997-2002. An instrumental variable regression (pooled OLS) finds a negative effect of ownership on investment that is both highly significant and large: The yearly renovation probability is 7 percentage points lower in rented apartments.

I then apply several robustness checks. First I introduce a number of controls for potential weaknesses of my instrument. For example, I control for single family homes because those were disproportionately often owner occupied in the GDR. Second, I control for the length of stay in the dwelling and wealth because even if ownership has been acquired at random it could increase the likelihood of staying in the apartment or may make the owner wealthier; Both are potential explanations for more frequent renovations in owner occupied houses. Including these controls doesn't change the effect. Finally, I run the same regressions with kitchen renovations and purchase of tv sets and cars as dependent variable. If the results for bathroom renovations are indeed driven by the hold up problem we would expect the same (probably somewhat weaker) effect for kitchen renovations but neither for car nor for tv set purchases. This is exactly what I find.

What can we say about the validity of the incomplete contracts paradigm in the light of these results? To answer this question I would like to point out two additional stylized facts. First the German market for rental housing is large (about 60 % of Germans rent) and has operated in an virtually unchanged environment for decades. This implies that the detected inefficiency is large on aggregate and that the market participants had a lot of time to react to the inefficiencies with the development of appropriate contracts and institutions. Second there seem to be at least to the economic theorist straightforward institutions or mechanisms that would ensure adequate compensation for the tenant if he moves out. One would be a certified real estate appraiser who determines the compensation to tenant. Alternatively a simple revelation mechanism in the form of an auction of the dwelling to potential tenants with and without the bathroom or kitchen could elicit the market value of the investment. Upon which the old tenant can

decide whether he leaves the kitchen or bathroom in the dwelling and pockets the market value or takes it with him.

From this I would conclude that there is evidence that even large inefficiencies don't quickly bring about contractual innovations even if these could be judged as straightforward. I tentatively conclude that the incomplete contracts paradigm as a useful modeling shortcut is supported at least by this data and that the impediments to efficient contracting seem to be relatively large whatever their nature may be.

The remainder of the paper is organized as follows: Section 2 describes the institutional background of the German housing market before and after reunification. Section 3 provides a theoretical framework to describe the incentives to renovate under different contractual arrangements and derives formally the hypothesis that will be tested. Section 4 describes the data and section 5 contains the empirical results. Finally section 6 concludes.

2 Institutional Background

2.1 The German Housing Market

The German housing market is in some ways highly regulated. It is extremely difficult for landlords to terminate a lease unless the tenant is grossly negligent. The only possibility is so called "Eigenbedarf", i.e. the landlord herself wants to move in and even this involves a lengthy legal process. For corporations owning real estate there is nearly no way to terminate a lease.

Furthermore there is rent control. When signing a lease the landlord can ask pretty much whatever she wants but for existing leases rents can only increased within very tight limits. Even if the landlord refurbishes the apartment she can't necessarily raise the rent to be compensated for her investment. This implies that landlord has little incentive to renovate e.g. the bathroom. Essentially, the

only way to get the landlord to renovate is to negotiate a renovation in exchange for raise in the rent. Note that this negotiation, however, takes place under asymmetric information as the landlord has little or no information as to how much the tenant is willing to pay for the improvement. It follows that negotiations are likely to break down and renovations will be inefficiently rare.

There would seem to be scope for a revelation mechanism that solves this kind of problem and indeed there is a legal default that allows the tenant to pay for the renovation. Unfortunately the details of the regulation are obviously flawed. The tenant is allowed to remodel the apartment if the landlord agrees. However, there is a very disadvantageous rule in case the tenant has to move out. In this case the tenant has no rights whatsoever to compensation, quite to the contrary, the landlord has the right to force the tenant to put the apartment back into the same condition it was before the renovation. Any payment is left to negotiation.

To implement first best renovations by the tenant, he should get the market value of the renovations. Analyzing the negotiation we can see that in equilibrium he will get much less. Suppose negotiations break down then the best thing the tenant can do is to leave the apartment as it is. The landlord has the right to force him to put it back into the original condition but has no incentive to do so. Hence, the threat point is, the tenant gets nothing for his renovation and the landlord keeps the improved apartment without paying anything.

An obvious revelation mechanism is a contractual provision that allows the tenant to renovate the apartment and entitles him to a compensation at the level of the market value of the renovations. This contract induces truth telling on behalf of the tenant and implements first best renovations. When signing the lease there is no rent control and competition by potential tenants so that the landlord can extract the surplus created by the more efficient contract. Hence, she should have an incentive to implement such a contract.

Such a contract would be legally feasible under German law. It is allowed for tenants and landlords to write additional contracts regulating renovations. There

are even templates (albeit rarely used) that can be downloaded for free from the internet. In particular these contracts allow for a compensation of the tenant in case he moves out. The main difference between the theoretically optimal contract and these so called "Modernisierungsvereinbarungen" is that the compensation is usually fixed in advance. This allows the tenant if the investment is not perfectly contractible to choose an inefficient investment type (or maintenance effort) that reduces the market value of the investment but increases the personal benefit of the tenant. Hence, such a contract will still be inefficient (probably a reason why these contracts seem to be rarely used).

There is no legal reason that the market value is not included, rather it seems to be difficult to contract upon it. Why have no institutions arisen that make the market value contractible? There are clearly a number of theoretically plausible possibilities, the simplest being certified realtors that estimate the value of certain installations such as bathrooms or kitchens. One possible answer is that the fact that there is no such contract is simply a sign that there is no need for it, because the resulting inefficiency is so small. An alternative explanation could be that actually transaction cost play such a large role that although there are large inefficiencies, the first best contract doesn't arise.

We will try to discriminate between the two hypotheses in the following by comparing the bathroom renovation frequency in owner occupied homes to the frequency in rented homes.

2.2 Home Ownership in the GDR

Ideologically the GDR saw itself on the way to abolishing private property. Having not quite arrived there, the GDR had some rather complicated legislation regarding private property that boiled down to allowing private ownership of consumption goods and disallowing private ownership of investment goods. Durable consumption goods and real estate fell somewhere in the middle and the GDR had

settled on allowing private ownership but preferably for consumption purposes and not as investments, however, this line was never properly drawn.

Owners of real estate other than owners of companies were never disowned so that private ownership of real estate continued to exist. Note however that condominiums didn't exist in Germany before WW2 and they were never introduced in the GDR. Furthermore ownership of apartment houses and rental apartments was discouraged and no new buildings were permitted. Construction of single family homes was from time to time even promoted, however, always with a particular goal in mind.

First of all building permits were given out more often on the countryside to stem migration to the metropolitan areas. Second with an eye on augmenting the failing construction industry with private initiative, building permits were given to citizens (or groups of citizens) who could perform at least 30 percent of the construction work by themselves. Finally, in a bid to mobilize private reserves of western currency, East Germans could order West German prefabricated houses from a catalogue if they could pay with West German money.

Legally, ownership meant little. Sales prices and rents were fixed by the government. Buying, selling and renting required government approval. Whether you rented or not you theoretically needed the same permits and paid very little for housing. For all practical matters the regulation resulted in a situation where the person living in a dwelling had control over it.

In case of owner occupied dwellings the state theoretically had the right to force people out of the house they owned but there is little evidence that this happened unless under very special circumstances. There is no evidence either that bequeathing houses was problematic. For households that rented their house or apartment the situation was almost the same as for owners. Once they were in, it was basically impossible for a landlord (be it a public company, a coop, or a private owner) to terminate the lease and there were regulations that made it easy to pass on a lease after one's death by simply registering the heirs in the

apartment, which allowed them to take over the lease.

Getting into a house or an apartment was an altogether different story. Whether you wanted to buy or rent you had to go through a government body. The market wasn't allowed to operate house prices and rents were low but there was no way to outbid other competitors by offering more. Rather the distribution was arranged by government bodies. Similarly it was more difficult to pass on the house, no matter whether you owned or rented it, during your lifetime.

Finally, costs of housing were extremely low no matter whether you bought or rented and although tenants theoretically had the right to have their dwellings maintained by the landlord, a focus on new construction left most tenants of existing buildings to their own devices very much the same as owners.

To sum up for all practical matters in the GDR there was little difference between owning or renting a house. As the reunification with all its implications for property rights was surely unforeseen, East Germans are unlikely to have cared whether they owned or rented. Moreover, given the notorious shortage of dwellings few if any East German will ever have 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. In that sense their choice was random. Of course, depending on where they were looking for a house or which kind of house they were looking for they were more likely to end up owning a house or not. In this sense the proposed instrument may not be completely random and I will have to take these biases into account in the regressions.

3 A Theoretical Framework

3.1 Setup

I consider two continuous populations of apartments each of measure 1. Population 1 is owner occupied and population 2 is rented, otherwise they are identical. In each apartment, indexed by i in both populations, an investment opportunity arises at date 1. There is a binary decision $a \in \{0, 1\}$ whether the investment is undertaken ($a = 1$) or not ($a = 0$). There is a cost K_i for each investment that differs among the different apartments that are otherwise identical. The cost $K_i \in [\underline{K}, \bar{K}]$ is distributed in the population according to the cdf $F(K)$ ($f(K) = F'(K)$).

Between date 1 and 2 a state of the world $S \in \{s, m\}$ is realized. The probability of $S = s$ is denoted by p . In state s the person living in the apartment at date 1 (that could be a tenant or the owner depending on the population) stays in the apartment while in state m he has to move out for exogenous reasons.

At date 2 a decision $q \in \{0, 1\}$ has to be taken whether the investment is left in the apartment $q = 1$ or taken out $q = 0$. Depending on a and q a benefit $B(a, q)$ is produced, either for the person living in this apartment ($q = 1$) or in another apartment reduced by the cost transfer ($q = 0$). There is no discounting. Regarding this function I make the following assumptions.

Assumption 1

$$B(0, \cdot) = 0, \quad 0 < \underline{K} < B(1, 1) < \bar{K}, \quad B(1, 1) > B(1, 0)$$

That is the benefit of no investment is normalized to zero and it is independent of q . There is a strictly positive benefit of investing if the investment is left in the apartment which is large enough to make the lowest investment cost worthwhile but for sure not large enough to do so for the highest cost. If the investment is taken out the benefit is reduced (presumably by the cost of moving). Note that

the benefit doesn't depend on the state, i.e. if the investment is not customized for a particular tenant ²

From these assumptions the first best actions follow immediately:

Definition 1 *The first best actions a^* and q^* are given by*

$$a^*(K_i) = \begin{cases} 1, & \text{if } K_i \leq B(1, 1) \\ 0, & \text{if } K_i > B(1, 1) \end{cases}$$

and

$$q^* = 1$$

In apartment i there should be investment if the costs are lower than the benefits. The investment should always be left in the apartment.³

3.2 Owner Occupied Apartments

In an owner occupied apartment there is only one (active player) the owner. He has to bear the cost K_i of the investment and can choose q at date 2. If he chooses to remove the investment $q = 0$, he gets the benefit $B(1, 0)$ directly. In state s he obtains the benefit of $B(1, 1)$. In state m we assume a competitive market for selling the apartment⁴ such that the owner can extract the whole benefit $B(1, 1)$ in state m as well.

From the fact that all costs and benefits of a and q accrue to the owner occupier the next result follows immediately:

Lemma 1 *The optimal decisions $a^O(K_i)$ and q^O for an owner occupier are the first best decisions, i.e.*

$$a^O(K_i) = a^*(K_i) = \begin{cases} 1, & \text{if } K_i \leq B(1, 1) \\ 0, & \text{if } K_i > B(1, 1) \end{cases}$$

²This is for simplicity only. I could easily extend the model to include investments specific to a particular owner or tenant without changing the qualitative results.

³Strictly speaking for $a = 0$ q doesn't matter and $q = 0$ would also be efficient.

⁴Introducing non competitive housing or rental markets introduces a number of additional problems that are, however, orthogonal to the problems considered here.

and

$$q^O = q^* = 1$$

This proposition concerning the share of apartments in which there is investment follows immediately from lemma 1:

Proposition 1 *In the population of owner occupied apartments*

1. *there is $a = 1$ in a share $\Sigma^O = F(B(1,1))$ and*
2. *in all apartments in which $a = 1$ $q = 1$.*

3.3 Rented Apartments - The Legal Default

In this section I will analyze the investment incentives of tenants and landlords in rented apartments if they use the default regulations provided by the German law. According to German law both the tenant or the landlord may invest but the tenant needs the permission of the landlord if he wants to do so. I model this as follows: There are two players ($P \in \{L, T\}$) and there are two actions to be taken simultaneously at date 1, $a_T \in \{0, 1\}$ by the tenant and $a_L \in \{0, 1\}$ by the landlord. I denote the investment outcome by $a = \max\{a_T, a_L\}$ The tenant has to ask the landlord for permission⁵, however, in my model the landlord has no incentive to refuse permission unless she wants to invest herself. Hence I model the process by assuming that if both want to invest the landlord prevails otherwise whoever wants to invest can do so.

Moreover at date 2 the decision regarding q has to be taken. According to German law the landlord may remove any installation she has made if she wishes to. Similarly, the tenant can do so. In addition the landlord can force the tenant to remove any installation upon moving out. Because the latter will never be

⁵Under special circumstances the permission of the tenant may be necessary. Given that the tenant has no incentive to block the landlords investment I don't explicitly include this feature of the law in my model.

in the interest of the landlord in my model I ignore this aspect of the law and assume that whoever has borne the investment cost, i.e. has chosen $a_P = 1$ can choose q .

Finally there are some regulations governing the distribution of costs and benefits of the investment. By law whoever makes the investment has to bear the full cost. Hence whoever chooses $a_P = 1$ at date 1 has to pay K_i . If the tenant has invested has no right to compensation neither if he stays nor if he moves out but he owns the investment and gets the removal value. If the landlord has made the investment under German law he may be able to raise the rent for the tenant without the consent of the tenant. If the tenant moves out the landlord can negotiate any rent with a new tenant. Of course the landlord can keep the proceeds from removing the investment.

I model these regulations by the two functions $U^P(a_L, a_T, q, s)$. For the landlord I get

$$U^L(1, a_T, q, s) = \begin{cases} B(1, 0), & \text{if } q = 0; \\ B(1, 1), & \text{if } q = 1 \text{ and } s = m; \quad \forall a_T \\ \gamma B(1, 1), & \text{if } q = 1 \text{ and } s = s. \end{cases}$$

If the tenant moves out the competitive rental market allows the landlord to extract the whole surplus. If the tenant stays the law allows the landlord only to extract a share γ , $0 \leq \gamma < 1$. Similarly I assume

$$U^L(0, 1, q, s) = \begin{cases} 0, & \text{if } q = 0; \\ B(1, 1), & \text{if } q = 1 \text{ and } s = m; \\ 0, & \text{if } q = 1 \text{ and } s = s. \end{cases}$$

The landlord only profits from the tenants investment if the tenant moves out without removing the investment. Finally $U^L(0, 0, q, s) = 0 \quad \forall q, s$.

For the tenant I assume

$$U^T(1, a_T, q, s) = \begin{cases} 0, & \text{if } q = 0; \\ 0, & \text{if } q = 1 \text{ and } s = m; \quad \forall a_T \\ (1 - \gamma)B(1, 1), & \text{if } q = 1 \text{ and } s = s. \end{cases}$$

i.e. the tenant only profits from the investment if he stays and if the landlord doesn't remove the investment. Because the landlord can increase the rent by the

share γ of the improvement the tenant only gets the share $1 - \gamma$. Furthermore I assume

$$U^T(0, 1, q, s) = \begin{cases} B(1, 0), & \text{if } q = 0; \\ 0, & \text{if } q = 1 \text{ and } s = m; \\ B(1, 1), & \text{if } q = 1 \text{ and } s = s. \end{cases}$$

i.e. the tenant gets the payoff of removing the investment and enjoys all the benefits if he stays. If he moves out and decides to leave the investment in the apartment he gets nothing. Finally for the tenant it also holds that $U^T(0, 0, q, s) = 0 \forall q, s$.

For simplicity I make the following assumption:

Assumption 2 $B(1, 0) < 0$

i.e. removing the investment is so costly that the value is negative. This assumption makes it never profitable to remove the investment at date 2 and the efficient choice of q is implemented and there is no scope for renegotiation.⁶ Given this we can start solving the game by backward induction and get the following result:

Proposition 2 *If only the legal default contract is used in the population of rented apartments*

1. *there is $a = 1$ in a share $\Sigma^R = F(\hat{K})$, where*

$$\hat{K} = \max \{pB(1, 1), (1 - (1 - \gamma)p)B(1, 1)\}$$

and

2. *in all apartments in which $a = 1$ $q = 1$.*

⁶Assumption is very plausible for bathroom renovations. Ripping out tiles and the bathtub is likely to be more expensive than their resale value. It is less convincing for investments such as a kitchen. If assumption 6 doesn't hold the investor can credibly threaten to remove the investment at date 2. This allows her or him to extract a payment in renegotiation from the other party even if the legal default doesn't entitle her or him to a compensation. As long as the investor doesn't have all the bargaining power, however, the investor still can't appropriate all the surplus and underinvestment at date 1 results.

Proof.

Result 2 follows immediately from assumption 6 that makes it never optimal to choose $q = 0$ if investment has taken place.

For result 1 note that I can ignore the zero probability events where $K = pB(1, 1)$ and/or $K = (1 - p(1 - \gamma))B(1, 1)$. I denote the probability that L chooses $a_L = 1$ by ω_L and the probability that T chooses $a_T = 1$ by ω_T . Then T chooses ω_T to

$$\max_{\omega_T} \omega_L [pB(1, 1)] + (1 - \omega_L) [pB(1, 1) - K] \omega_T \quad (1)$$

and L chooses ω_L to

$$\max_{\omega_L} \{ [1 - (1 - \gamma)p]B(1, 1) - K \} \omega_L + (1 - p)B(1, 1) \omega_T (1 - \omega_L) \quad (2)$$

I have to consider three cases:

1. $K > pB(1, 1)$ and $K > [1 - p(1 - \gamma)]B(1, 1)$: I can construct an equilibrium by iterated elimination of strictly dominated strategies. For $K > [1 - p(1 - \gamma)]B(1, 1)$ any $\omega_L > 0$ is strictly dominated by $\omega_L = 0$. For $\omega_L = 0$ $\omega_T = 0$ dominates any $\omega_T > 0$ so that the unique equilibrium in the stage game is $a_L = 0$ and $a_T = 0$.
2. $K < pB(1, 1)$ and $K > [1 - p(1 - \gamma)]B(1, 1)$: Again $\omega_L = 0$ strictly dominates all other strategies, but for $\omega_L = 0$ and $K < pB(1, 1)$ $\omega_T = 1$ strictly dominates any $\omega_T < 1$ so that the unique equilibrium in the stage game is $a_L = 1$ and $a_T = 0$.
3. $K > pB(1, 1)$ and $K < [1 - p(1 - \gamma)]B(1, 1)$: There is an equilibrium in which $a_T = 1$ and

$$\omega_L < \frac{[1 - (1 - \gamma)p]B(1, 1) - K}{(1 - p)B(1, 1)}.$$

I show that there can't be an equilibrium in which $\omega_L < 1$. Suppose there is an equilibrium in which $\omega_L < 1$. Then the optimal strategy of T is $\omega_T = 0$ but the best reply to $\omega_T = 0$ is $\omega_L = 1$ which is a contradiction.

Hence there is investment if and only if

$$K < \hat{K} = \max \{pB(1, 1), (1 - (1 - \gamma)p)B(1, 1)\}$$

and the share of apartments in which there is investment is $F(\hat{K})$. *Q.e.d*

The intuition is that as long as $K < \hat{K}$ at least one of the parties has an incentive to invest if the other party doesn't. If K is larger none of the parties has an incentive.

3.4 Rented Apartments - Comprehensive Contracts

In this section I analyze a situation in which the participants can pay a transaction cost $T \geq 0$ that makes any variable contractible. The timing now is that both parties pay T before date 1, i.e. at a newly introduced date 0. That allows them to fix a 's and the q 's conditional on the realization of S if desired. I assume that both parties know K_i at date 0. Furthermore they can transfer surplus by lump sum payments. From then on the contract is simply executed and payoffs are paid out. I don't explicitly consider renegotiation as the parties will always agree on the first best so that there is no scope for renegotiation.

I obtain the following result:

Proposition 3 *With the additional option to write a comprehensive contract at cost T*

1. (a) *there is $a = 1$ in a share $\Sigma^{\hat{T}} = F(\hat{K})$ if $T \geq \hat{T} = B(1, 1) - \hat{K}$,*
 (b) *there is $a = 1$ in a share $\Sigma^0 = F(B(1, 1))$ if $T = 0$*
 (c) *for any $T \in [0, \hat{T}]$ the share $\Sigma^T(T)$ is strictly decreasing in T .*
2. *in all apartments in which $a = 1$ $q = 1$.*

Proof.

Result 2 follows immediately from assumption 6 that makes it never optimal to choose $q = 0$ if investment has taken place.

Let $a^*(K)$ and $\hat{a}(K)$ denote the outcome for rented apartment with investment cost K in the first best and under the legal default respectively, then the willingness to pay for a contract is given by

$$P(K) = [B(1, 1) - K](a^*(K) - \hat{a}(K)).$$

Note that $\max_K P(K) = B(1, 1) - \hat{K}$ so that for no apartment a comprehensive contract will be written if $T \geq \hat{T}$. Result 1a is then implied by proposition 2.

$P(K) > 0$ if and only if $\hat{K} < K < K^*$. Hence for $T = 0$ for every apartment with $K < K^*$ a comprehensive contract is written if otherwise the first best can't be implemented. Result 1b is then implied by proposition 1.

Let $\hat{T} = B(1, 1) - \hat{K}$ and $\tilde{K}(T)$ be defined for any $T \in [0, \hat{T}]$ as $P(\tilde{K}) - T = 0$ to be the cost at which two parties with $K \in [\hat{K}, K^*]$ are indifferent between writing a contract or not. Note that $\frac{d\tilde{K}(T)}{dT} = -1 < 0$. The share of rented apartments in which investment takes place is given by

$$\Sigma^T(T) = F(\tilde{K}(T))$$

Taking the derivative yields

$$\frac{d\Sigma^T(T)}{dT} = f(\tilde{K}(T)) \frac{d\tilde{K}(T)}{dT} < 0 \quad \forall T \in [0, \hat{T}].$$

Q.e.d.

4 The Data

4.1 The German Socioeconomic Panel

The data come from the German Socioeconomic Panel (GSOEP). This panel survey started in 1984 in then Western Germany and was extended in 1990 (after the fall of the wall but before reunification) to the former GDR. Each year the survey records on household level whether there have been certain renovations,

e.g. bathroom or kitchen, and whether the household rents or lives in a owner occupied apartment. In addition there is information on a number of characteristics of the dwelling (e.g. type and building year) as well as on the household, such as income. A number of variables are collected on the person level, in this case I associate the household with the characteristics of the person filling in the household survey. I call this person the head of household.

For my main analysis I use the information on bathroom renovations. Alternatively, there is information on renovating kitchen, the heating system or windows. While I will use the kitchen data for a robustness check, investing in a kitchen compared to a bath room renovation is less clearly a relationship specific investment. There is kitchen equipment that quite well may be removed and even a built in kitchen often can be moved to another house at a reasonable cost. Hence the effects we observe should be expected to be smaller. Renovations of windows and heating systems are relationship specific but in houses with several apartments the decisions are collective and less likely to be influenced by the ownership structure of a single apartment. In particular there may be houses in which some of the units are owner occupied whereas others are rented out.

I use the years from 1997 until 2002 in my main analysis. After reunification there often were restitution claims by former house owners, who were forced to sell houses when they left the GDR. Hence for the years before 1997 I can't rule out that the ownership of a house was disputed. I use the years from 2002 to 2005 to check, whether the households still live in the same place after three years. Assuming rational expectations on behalf of the households I can use this information to directly control for expected length of stay in the apartment which will be desirable for a number of reasons.

4.2 Descriptive Statistics

In 1990 there were 2179 Households in the East German sample, which gives me a maximum 13074 observations over the six years from 1997-2002. Due to panel attrition and missing values I have 8351 observations for which I have information on ownership and bathroom renovations. In 39.8 percent of these observations households own the dwelling they live in. The per year renovation frequency is 6.1 percent.

In 1990 only 28.5 percent of households owned the place they lived in, a direct result of the fact that private ownership was mostly discouraged in the GDR. As should be expected households who own differ along a number of dimensions from the households who rent. First of all the fact that there were no condominiums and ownership of rental buildings was discouraged results in a large number of one or two family homes among the owned houses. Indeed in 1990 95 percent of owners lived in one or two family homes whereas only roughly 14 percent of renters did. Resulting from this bias and amplified by allowing ownership more often on the country side, renters and owners are distributed differently geographically. 64 percent of renters lived up to 25 kilometers from the next metropolitan area, whereas only 46 percent of owners did. A possible way to get your own house was to built it yourself, hence it is not surprising that 37 percent of homeowners report that they frequently make smaller repairs themselves in their homes whereas only 21 percent of renters do the same.

Which kind of housing option was available clearly depended on closeness to the communist regime. It is, however, not obvious whether this induced a bias for or against ownership. I have no direct data e.g. on party membership so I use two proxies. One is availability of a phone line, which shows little difference between owners (23 percent) and renters (22 percent) in 1990. As a second indicator I use the percentage of households answering that they are very unhappy with democracy as it was implemented in 1990 after the wall came down. Here we see

somewhat more renters (13 percent) than owners (10 percent) reporting such a sentiment. All in all there doesn't seem to be much of a political bias in home ownership and if there is one it is in the direction of politically well connected people renting, which accords well with the fact that newly built rental homes often were the most sought after homes, which to a large extent went to politically well connected people.

As argued above house ownership in 1990 provides me with an instrument for house ownership in later years. This restricts my analysis to households that were in the East German sample in 1990. Moreover in later years only the successor households to these households (i.e. households with the same identifier) are included. This rules out households that split from an existing household e.g. through a divorce or children that were moving out. Finally, the use of data up to 2005 requires me to drop all households that were lost during the years leading up to 2005.

5 Empirical Results

5.1 Main Result

I use a pooled estimation linear probability model to estimate the probability that a household i renovates its bathroom in a given year t :

$$renov_{it} = \beta_0 + \beta_1 own_{it} + \gamma' H_{it} + \delta' C_{it} + \chi_t year_t + \varepsilon_{it} \quad (3)$$

own_{it} indicates whether household i owns the apartment it is living in in period t . This variable may be instrumented by ownership in 1990. H_{it} is a vector of standard controls that are included in all specifications. The controls are a dummy that indicates whether the household has moved during the year, a variable indicating the condition of the house (ranging from one to four, four being the worse condition) in the year $t - 1$ and income and income squared. Furthermore, year dummies are always included.

	OLS	IV1	IV2	IV3
	(1)	(2)	(3)	(4)
own	0.062 (0.007)***	0.081 (0.011)***	0.073 (0.023)***	0.078 (0.027)***
cond	0.023 (0.005)***	0.025 (0.005)***	0.021 (0.005)***	0.022 (0.006)***
move	0.14 (0.017)***	0.142 (0.017)***	0.172 (0.023)***	0.173 (0.028)***
income	-.012 (0.005)**	-.013 (0.005)***	-.010 (0.005)*	-.013 (0.006)**
incomesq	0.001 (0.0005)**	0.001 (0.0005)**	0.001 (0.0005)**	0.001 (0.0003)***
aftere			-.038 (0.008)***	-.037 (0.009)***
diy			-.001 (0.002)	0.001 (0.002)
pds			0.008 (0.01)	0.0004 (0.012)
country			0.0007 (0.002)	-.003 (0.002)
single			-.005 (0.017)	-.008 (0.018)
wealth				-.001 (0.003)
wealthsq				0.0001 (0.0003)
stay				0.007 (0.011)
e(N)	8037	8037	7468	5060
e(r2)	0.051	0.049	0.052	0.055

Table 1: Probability of renovation; OLS and IV estimates

Table 1 reports the result of the baseline regression (specification IV) including the robust standard errors clustered to allow for correlation of the error terms by households. The main result is that a household has an 8 percent higher probability of renovation if it owns the apartment it lives in. Highly significant is also the condition of the house. A worse condition leads to more renovation. If the household has just moved, a renovation is more likely, too. Income has a U-shaped impact on renovations, for low incomes higher income reduces the probability of renovations, for high incomes it is increasing. Most likely this results from the interaction of two effects. On the one hand higher income makes it more expensive to renovate in terms of the opportunity cost of time, on the other hand people with higher income can afford more renovations.

In specification IV2 I include a number of controls that correct for the above suggested biases in the instrument. In particular I use a dummy for houses built after 1990. People who own an apartment in the years 1997-2005 only because they owned in 1990 are still in the house they owned then and are therefore less likely to move into a newly build house, which could result in more renovations. As described above, people who owned their houses in the GDR are more likely to live on the country side and to live in single family homes. Hence, I control for the distance to the next metropolitan area (on a scale from 1 to 6, 6 being the most distant) and include a dummy for single family homes. In addition I showed that GDR homeowners were more likely to be skilled craftsmen and maybe less likely to be closely affiliated with the leadership of the regime. To check whether this has an impact on the renovation probability, I control for the hours the head of household spent two years ago on working in home and garden and for an indicated PDS party preference.

The inclusion of these variables, as the third column of table 1 demonstrates, doesn't affect the ownership effect, which is still significant at the 99.9 percent level and only minimally reduced in its size. Furthermore the only control that is significant is whether the house was build after reunification. As expected a

newly build house reduces the renovation probability by almost 4 percent.

Finally I include controls for effects other than contractual problems that even randomly assigned ownership could have. I have argued that German laws protect tenants very well so that it is basically their decision whether they want to move out or not very much in the same way as it is the owners decision. Still, it could be the case that at least a few tenants suspect that they might have to move out before they want to. Similarly, one could argue that ownership makes it more costly to move so that households owning their house expect to stay longer. Both of these effects go in the same directions, namely that owners expect to stay longer in their house so that it makes more sense for them to renovate and customize the place.

Assuming rational expectations I can directly control for expected length of stay in the dwelling by using the realized length of stay that I can construct from the data up to 2005. Rational agents are on average right in their predictions. Suppose they have very good information on how long they will stay. In this case we can expect this knowledge to impact on their renovation decision but it also means that the actual length of stay is a very good proxy of the expectation. This is less the case if people get a very noisy signal. The latter, however, also means that expected length of stay is unlikely to influence the households renovation decision.

Owning a house has turned out ex-post, i.e. after reunification, to have been a better investment than other investment possibilities available to East Germans. Thus homeowners ended up being richer. We have already controlled for income, however, one could argue that there is a difference between having more wealth and having a higher income because the former may relax financing constraints. This would make it easier for borrowing constraint East German homeowners to finance renovations. I don't have yearly wealth data but data for 2002. However, what we are looking for is a persistent level effect in wealth. This effect should be and is visible in the 2002 data, which we use as a control (allowing for non-linear

	bath	kitchen	tv	car
	(1)	(2)	(3)	(4)
own	0.064 (0.016)***	0.045 (0.014)***	-.016 (0.018)	-.034 (0.018)*
cond	0.016 (0.007)**	0.003 (0.007)	0.01 (0.009)	0.005 (0.009)
move	0.135 (0.026)***	0.152 (0.028)***	-.044 (0.021)**	-.031 (0.022)
aftere	-.049 (0.009)***	-.038 (0.01)***	0.06 (0.019)***	0.025 (0.018)
stay	0.014 (0.011)	0.027 (0.011)**	-.013 (0.019)	-.016 (0.02)
pds	0.002 (0.013)	0.02 (0.015)	-.011 (0.019)	-.036 (0.017)**
e(N)	3519	3519	3418	3447
e(r2)	0.043	0.04	0.012	0.002

Table 2: Probability of renovation; IV estimates for different investments

effects by putting in squared wealth).

As one can see from column four of table 1, households who stay longer in their apartment are more likely to renovate but only minimally so and the coefficient is not significant. Neither is the coefficient on wealth or squared wealth. More importantly, including these controls doesn't change the coefficient on ownership. Actually it lies between the specifications IV1 and IV2.

Finally I have used biannual data on the purchase of kitchens, cars and tv-sets as a robustness check. If the hold-up problem is driving my results we would expect to find a similar, maybe somewhat smaller, effect on the probability of kitchen renovations because investment in kitchens is a relationship specific investment, too. But neither for cars nor for tv-sets we would expect a similar effect of home ownership. Table 2 confirms that this is exactly what I find.

6 Conclusion

Real world contracts are simple but are they incomplete in the sense that including observable information would make them more efficient? In this paper I investigate a real world hold up problem, tenants investing in their rented apartment by renovating kitchens and bathrooms. Using the house ownership allocation resulting from the communist regime in East Germany I compare the investment frequency in rented apartments with the one in owner occupied apartments. This natural experiment together with the large amount of information contained in the GSOEP dataset allows me to isolate the effect of contractual problems. It turns out to be large, a 8 percentage point drop in the renovation probability. I interpret this as indicating that there are large barriers to the introduction of more efficient contracts.

It remains to be shown in future research whether similar results may be found in other, similar situations and what are the main determinants that allow large inefficiencies to persist without triggering contractual innovations.

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