Finnish Economic Papers – Volume 3 – Number 1 – Spring 1990

HOUSING INVESTMENT IN FINLAND

KARI TAKALA and MATTI TUOMALA*

University of Helsinki, SF-00100 Helsinki

The high volatility of both housing investment and housing prices has raised questions about the determinants of housing investment in Finland. In this paper we estimate investment equations for the period 1972–1987. The exceptional durability of houses makes housing investment sensitive to interest rates as well as to changes in the liquidity constraints due to money market liberalization during the 1980's. Here, we confirm the applicability of Tobin's q theory of investment as an explanation for housing investment. Therefore housing investment can be successfully and sufficiently explained with the ratio of nominal housing prices to their construction costs. However, we observed structural changes in the model of housing investment and the q theory gives a better description for supply of houses in the latter half of the estimation period 1980–87.

1. Introduction

Housing is an important commodity both as a consumer good and as a capital asset. In 1981, 67% of the total wealth in Finland was housing wealth. About 80 percent of the total stock was held in the form of owner-occupied dwellings. This in itself, is very good reason to get to know how the housing market works. In this paper we are interested only in the supply side of the housing market. More specifically we estimate housing investment equation for the Finnish construction industry. There are some attractive features in the housing market for studying investment behaviour. **Firstly,** *housing construction is highly volatile.* As in many other countries, housing starts and construction exhibit great variance both in seasonal and business cycle components. The **second** reason for studying the housing market apart from its general importance is that *the prices of housing capital are directly observable.* As in other capital markets, housing investment decisions are supposed to be myopic.

In comparison to other capital commodities houses are exceptionally durable, and the product of investment is sold as itself in the market. In practice the construction firms do not keep any inventory stocks unless they are forced to do so. The durability of houses can be seen from the fact that the volume of housing investment has been about 1–2.5 percent of the total net housing stock. Housing investment forms about one third of the gross capital formation. For these reasons the housing prices are determined by the existing housing stock. Moves between existing dwellings are about three times more frequent than purchases of newly built houses. This also empha-

* *We are grateful to our energetic assistant Pertti Haaparanta and to Jarmo Kontulainen from the Bank of Finland for kindly providing most of our data and to Vesa Vihriälä plus an anonymous referee for useful comments.*

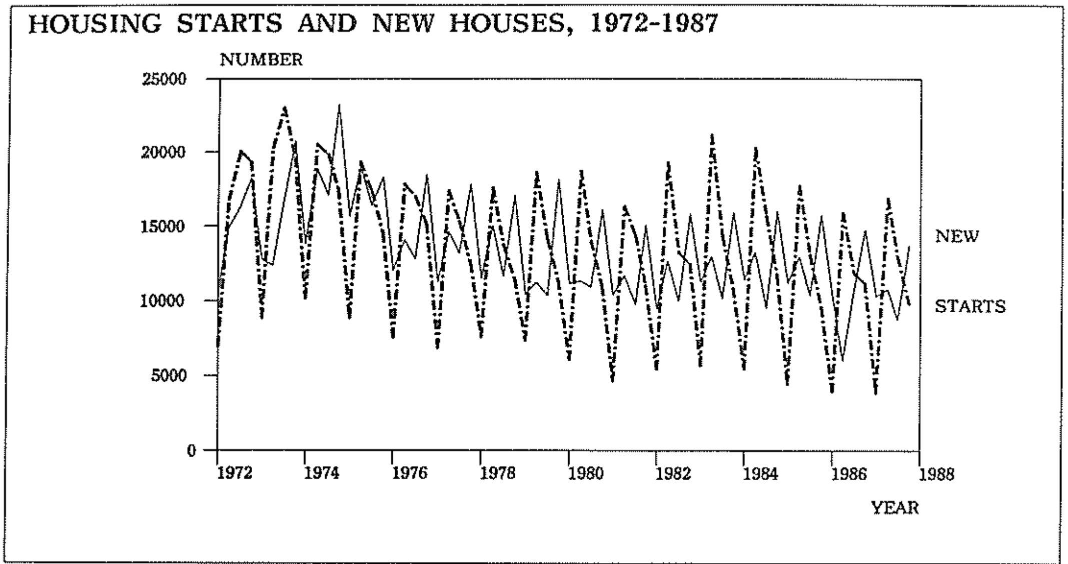

Figure 1.

sizes the role of supply-determined factors in housing investment. The importance of the existing housing stock should make the total supply of houses relatively inelastic with respect to house prices in the short run.

All assets produce returns in the form of money or consumption and perhaps in appreciation as well. Houses provide utility in consumption form as themselves, not in monetary payments or through production of capital.

We can think of the investment in houses as supply determined (see Poterba (1984) and Topel and Rosen (1988)). The view emphasizes the existing housing stock as a major determinant of the prices for new houses as well. Since new units are only a minor fraction of the total supply stock, the construction firms can expect to get the market price for their investment. In this sense current house prices are sufficient statistics for housing investment (Topel and Rosen 1988 p. 721). If there are delays in transferring factors of production between industries, price sufficiency does not hold. This may be puzzling because the sufficiency of current prices for investment rests on the assumption that the short and long run investment supply coincide. Thus the volume of new housing investment depends on the level of house market prices relative to marginal costs in construction.[1]

First we will make a short description of the housing market situation in Finland. Sections 3 and 4 present the theories and hypothesis to be tested. In section 5 we discuss estimation results in the context of time series modelling.

2. General description of housing market

We have tried to study the supply of new houses by explaining housing starts and volume of housing investment. Figure 1 shows that the seasonal variation is very large; this makes the investment in houses volatile too; as is shown in the housing starts and new houses graphs. From the housing starts series we took seasonal differences, before using them as dependent variables.

Most of the other series were obtained from the Bank of Finland databank, and therefore they were already seasonally adjusted. This may have some unpredictable implications on

[1] *One approach for investigating the supply of housing is to assume some housing production function, estimate its parameters, and use them to infer the shape of the supply function. In this paper we postulate a supply function that includes the price of housing input cost as an argument. Of course we know from the duality theory that we can work backward from the supply curve to the underlying production function.*

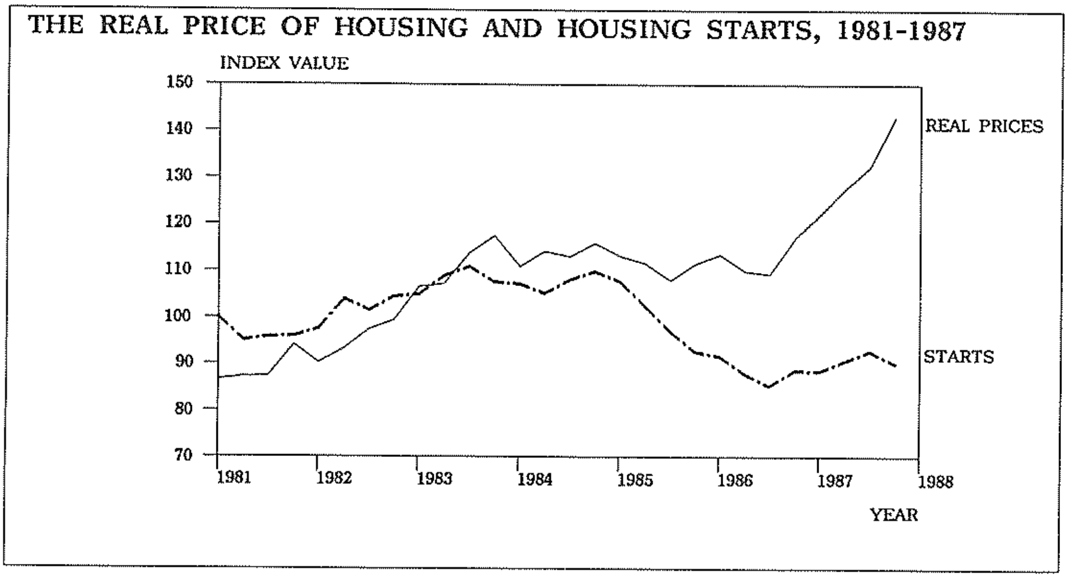

Figure 2.

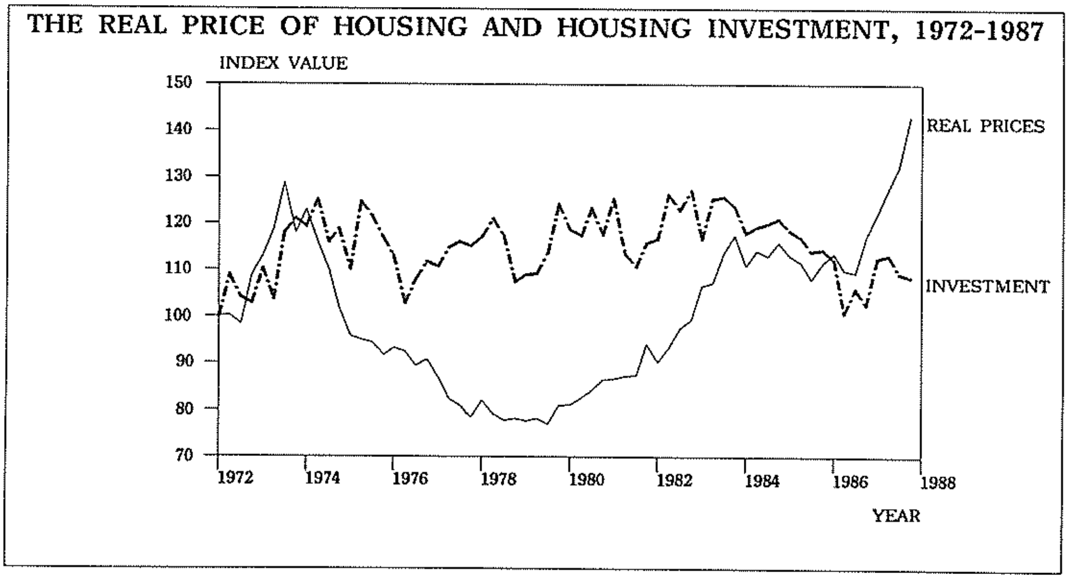

Figure 3.

the causal (predictive) relationships between variables. Since the construction industry is highly volatile, we should expect to find reasonable investment supply elasticity with respect to price changes.[2] Comparison of house prices and housing starts is shown in Figure 2, which exhibits significant positive correlation. The same pattern can be seen in a slightly deflated way in the graphs of housing investment and real house prices (Figure 3).

Quarterly starts and new houses data exhibit enormous seasonal variation. Unfortunately the quarterly data on housing starts was available only from 1981 onwards; therefore most

[2] *From the point of view of the labour market the construction industry is strained by high unemployment, high turnover and cyclicity, which makes it sensitive to cost shifts.*

CONSTRUCTION COSTS AND CONSUMER PRICES, 1972-1987

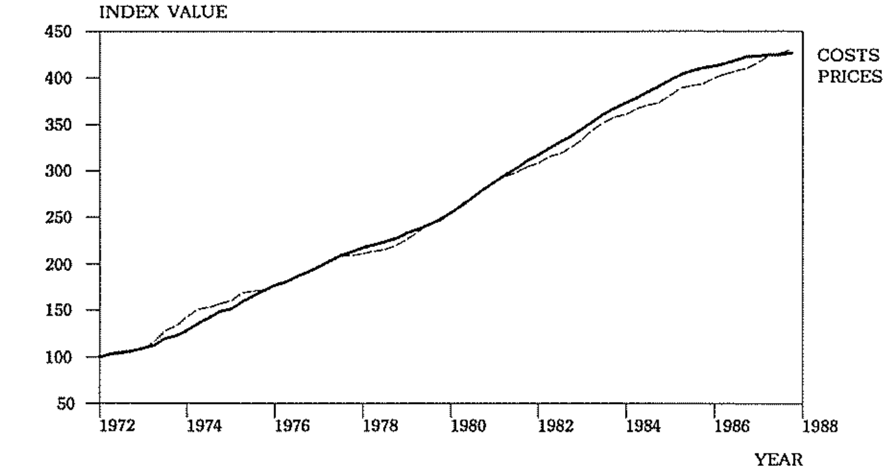

Figure 4.

REAL AND NOMINAL BANK LENDING, 1972-1987

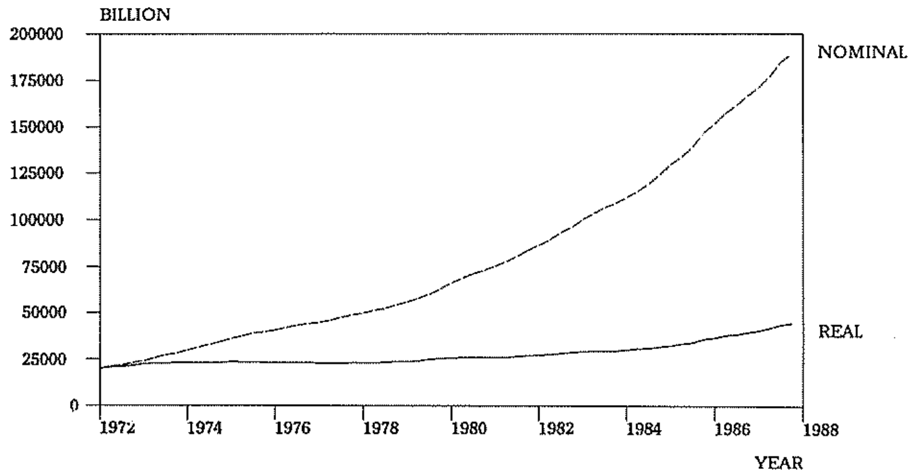

Figure 5.

of the regressions were run with the housing investment series. In summer construction activity is approximately twice as great as in winter.[3] The real price of houses is the nominal price deflated by the consumer price index. As shown in Figure 4 construction cost and the consumer prices index reveal similar co-movement.

[3] *We may expect several reasons for the volatility of housing production. To start from the financial side, it seems a priori plausible that the availability of housing loans is partly responsible for the variability in prices, at least on the private production. It has been argued that mortgage lenders are restricted more by other loan conditions than by the rate of interest itself. Unfortunately there is no clear indicator to measure these non-price determinants. To get a full picture, we used both cost and availability of credit variables as explanatory variables for housing investment.*

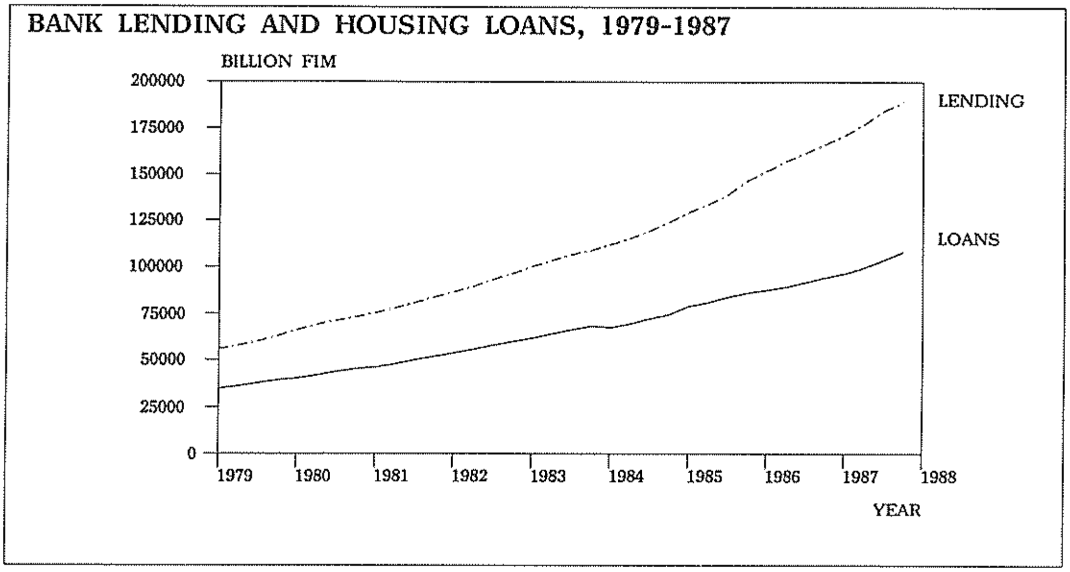

Figure 6.

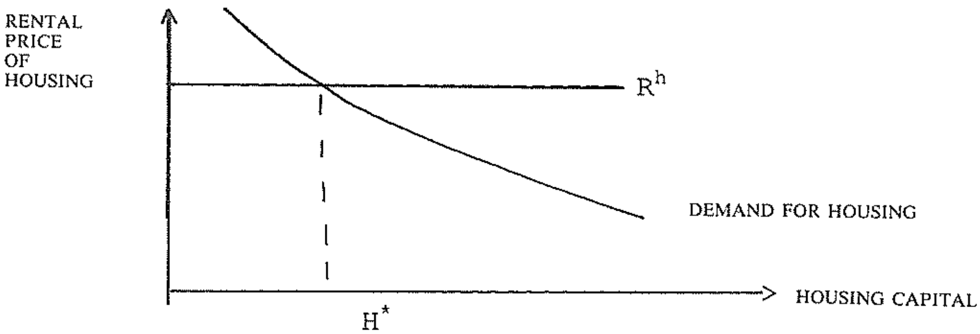

Figure 7. Determination of the housing stock.

The real price of houses took an upward course in 1972 – 1974 followed by a decline in the period 1975 – 1979. A more substantial upward course occurred during the 1980 – 83 and again from 1986 onwards. A visual comparison of real housing prices and investment suggests, especially from 1981 onwards that price movements and construction activity are positively correlated (Figure 3). The series of real bank loans was quite stable during our sample period, except for the last two years, when they took a clear jump upwards (Figure 5). Because of the time delays in statistics, our data does not contain house prices, housing starts and investment for the »crazy year» 1988. Our data on total bank lending and housing loans did not show a very large discrepancy in growth rates, not even annually (Figure 6).

3. *Theory of housing investment*

As in other investment decisions, households are expected to be forward-looking. Following the ordinary investment analysis, housing investment is assumed to exhibit a diminishing marginal product, which makes the marginal benefit curve negatively sloping (Figure 7). This is the demand side of the housing investment market.

The marginal cost of housing capital is determined by the rental price charged for the dwelling. As seen in Figure 7, the desired housing stock can be seen at the intersection of these curves at level H*.

The slow adjustment in housing investment to attain the desired housing stock implies that the marginal revenue on new investment will be lower than the interest rate if house prices increase because of excess demand for example. Only if the desired and actual housing stock coincide will marginal revenue on housing capital and the interest rate be equal. This is also the basic message of Tobin's q theory of investment. It says that lags in the investment process induce a positive correlation between investment and the ratio of marginal revenue on new capital to the rental price of this capital. To put it in another way, the market climate for investment (q) can be measured from the ratio of the market value of a investment to its replacement price (Hall and Taylor, 1986 p. 218–219).

There is an interesting implication about the price sensitivity of housing investment regarding the borrowing interest rate as well. If the rental price of housing R^h represents the potential rent on the house in the open market, we get the following relation between the rental price and the replacement price (P^h).

$$R^h = (R + d) P^h,$$

where R is interest rate and d is depreciation.

Now what seems to be important is the effect of depreciation on rental price. Since the depreciation in housing capital is expected to be very low, the interest rate itself has a much stronger effect on the rental price in comparison to other capital investment (Hall and Taylor, 1986 p. 223). Therefore, housing investment is much more sensitive to interest rate than is business investment.

We may also consider the length of lags in Finnish housing investment. It may be that planning, construction and other lags are quite long in housing compared to some small business investment, but there are also a few even longer average investment lags in Finnish industry. The main bulk of the paper industry plus other areas like shipbuilding and large chemical factories have much longer investment lags.

Among the many factors affecting housing investment is GNP, partly because of the investment acceleration process and economic

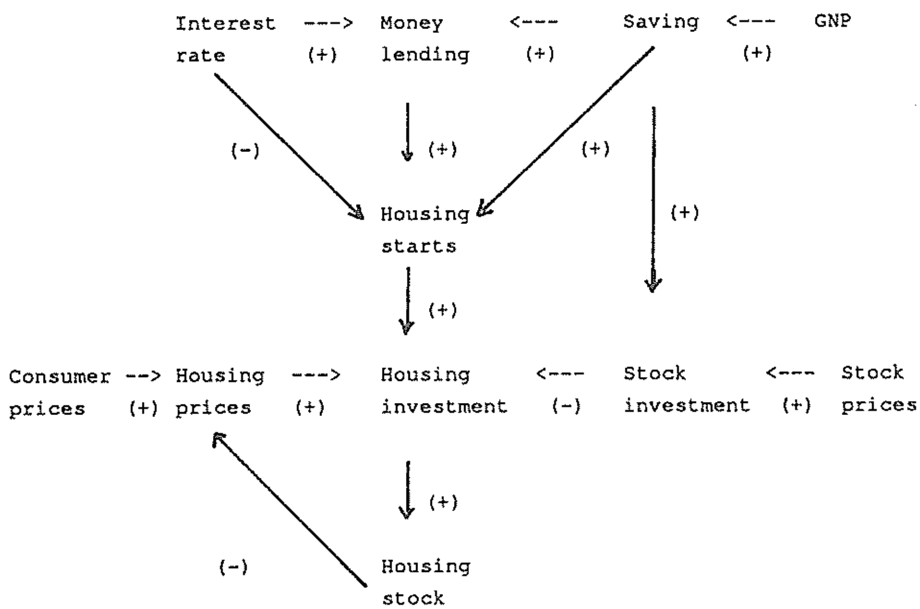

Figure 8. Determination of the housing equilibrium.

opportunities for better housing. Determination of the housing stock equilibrium can be seen in Figure 8.

Traditional investment theory has emphasized the present value of future returns in assessing the attractiveness of an investment project. Stock adjustment models equalize the marginal investment in houses to the marginal construction cost. Adjustment of the housing stock is continuously going on, since old houses have to be replaced or renewal investments have to be made. Investment is determined by the price of existing houses, the relevant rate of interest and expected profits from future appreciation of houses. The amount of new housing investment is also thought to depend on demographic factors, mobility of labour force etc.

According to Tobin's q theory, the rate of investment is a function of q, the ratio of the market value of new additional investment goods to their replacement cost. In making new investment on construction, firms optimize to make their ratio of marginal return from additional stock of housing equivalent to construction cost i.e., make q -ratio equal to one (Topel and Rosen 1988 p. 721). Compared to the traditional cost of capital approach in investment theory, *the q -theory* approach allows expectations to be taken into account in formation of housing prices. This theory rests upon a number of strong assumptions about the perfect capital markets, price-taking behaviour and identical tax rates across investors (Edwards and Keen 1985). So we must be careful not to make too strong implications about the relevance of these results.[4]

4. Hypothesis to be tested

Houses are sold on the market at a price that has not been determined so clearly by construction cost but by the prices of the existing stock of old houses. Generally construction costs make up a half of the total cost. Construction costs determine the market price of houses only under a competive production and stable demand situation.[5]

We have ignored the demand shift effects on the housing market, since we analyze the short term variations in housing stock. With these sorts of markets, too, we will move along the supply curve. Demand shifts work through house prices, which are an exogenous determinant for investment and therefore incorporated into the prices. Although prices of new houses are somewhat higher than those of existing houses, endogeneity of prices should not be a problem since new investment is a very small fraction of total supply. In addition, old houses are not perfect substitutes for new houses.

Since the role of existing housing stock is dominant, the equilibrium in the housing market can be characterized by a stock-flow adjustment. Existing stock presents the supply, and on the other side of the market, demand conditions will be reflected by a lag in price variations. Therefore housing investment responds to the current or lagged price level and can be seen as upward and downward movements along the supply curve. This sort of flow equilibrium is momentary, but housing producers are always on the supply curve.

Therefore our null hypothesis for Tobin's q is simply: Does the ratio of housing prices to construction costs appear as a significant explanatory variable in the investment equation? If the housing market is efficient enough, the market value of housing capital (housing prices) should be a sufficient statistic for housing investment. The alternative hypothesis for this is just the opposite.

5. Regression results from investment equations

There have been large structural changes in the price generating mechanism of housing prices since 1972 and therefore it seemed to

[4] One further difficulty is raised by the fact that incentive to invest is related to marginal q, but only average q is directly observed. From the market we observe only average q, which is the ratio of the existing value of houses to their construction cost. Average q and marginal q are the same only if construction firms are price-takers with constant returns to scale. Whether we think this is consistent with the housing market may have important implications for the reliance of our results.

[5] The price of land forms on average 20% of the total price. In the capital area and especially in Helsinki the land comprises up to 40 % of the price of newly built dwellings.

have spillover effects on the housing investment as well. Finland has been witnessing a gradual large-scale movement from relatively restricted financial markets to market-based determination of money lending and interest rates in the 1980's. This can be observed in the recursive OLS -estimations and parameter stability test. These estimations pointed out two special time points of change, namely shifts in parameters in period the 1979 – 80 and later a smaller change in 1986. So we split the estimation period into two intervals; but since we were also interested in the current situation, estimations were performed for the whole periods 1972 – 87 and 1980 – 87.

This sort of estimation may be subjected to spurious correlation problems, since economic time series have trends and probably common factors. This can be dealt with by differencing the data, when random walks and deterministic time trends will be removed from the integrated series. The crucial point here is whether at the same time we also remove the interesting long term economic relationships as a byproduct. Thus we chose to work with the levels, because there was no direct expectation that investment and housing prices would be cointegrated. Nevertheless we performed unit roots tests for the variables to be sure about the non-spurious regressions. By analysing only the differences of economic time series, all information about potential (long-run) relationships between the levels is lost. This seems to be too drastic a solution to spurious regression (Hendry 1986 b).

The consequence of unit roots would be that regression coefficients will not converge, the t-test would diverge, DW would converge to zero and R^2 should have a non-degenerate distribution (Hendry 1986 b). The results from unit root tests showed that there should not be any indication of unit root in investment series. The t-test for co-integration was not significant, according to the CRDW -test performed (see Engle and Granger 1987).[6]

With the OLS -estimation the data congruence principles include, in general, the following requirements (Hendry 1987a):

1. homoscedastic errors
2. weakly exogenous regressors
3. constant parameters
4. theory consistency
5. data admissibility
6. encompassing rival models.

The results from the estimations are shown in Tables 1 – 4. Although our first equation does not pass all the diagnostic tests performed, it shows the signs and possible significance of the explanatory variables with respect to change in housing stock. All the equations include a constant, trend and necessary dummies shown in Chow -parameter stability tests. These dummies have an explanation, since there were construction worker strikes, both in 1976/2 and 1986/2, that reduced significantly the amount of house production. In estimations we made trials with a few lagged values of independent variables, which was very easy to do with PC-GIVE. But we present here only the most consistent results.

The main series to be explained were housing starts and the volume of housing investment. With housing starts it was necessary to take seasonal differences (D4) or use quarterly dummies for the series. The residual autocorrelation in investment volume equations was not a problem, partly because the dependent variable was already seasonally adjusted and we did not need any seasonal dummies. All the variables were used in logarithmic form, to reduce the impact of different dimensionality and exponential growth effects and to get closer to relative measurement — log differences are symmetrical in the measurement of relative change. The explanatory variables had expected signs and significance in equation (1), namely the log of real house price seemed to be the important (leading) indicator for housing investment. Essentially our real house price index is the same as q proxy, because the construction cost and consumer price index almost coincide (Figure 4).

This was in accordance with our prior belief and the theory proposed by Poterba (1984) and Topel and Rosen (1988). The price of the alternative investment asset (stock prices) also had a negative and significant coefficient, as assumed.

[6] *Cointegration can be verified by making the so called cointegration regression, i.e., regressing housing investment on the house price index and testing the Durbin-Watson statistic for this regression, whether it exceeds some critical value (on 5 percent significance level 0.386). See more details in Engle and Granger (1987).*

Table 1. THE DETERMINANTS OF HOUSING INVESTMENT[1]
The Sample is 1972(2) to 1987(4)
Modelling LASINM by OLS

VARIABLE	COEFF.	STD ERROR	t-VALUE	PARTIAL R^2
CONSTANT	2.40162	1.75657	1.36722	.0323
TREND	−.01704	.00576	−2.95780	.1351
LASRH-1	.35422	.10194	3.47462	.1774
LUNI-1	−.14580	.03624	−4.02317	.2242
LANTO-1	.48799	.16815	2.90218	.1307
D76/2	−.13199	.04967	−2.65764	.1120
D86/2	−.15121	.04926	−3.06974	.1440

MODEL PERFORMANCE		CRITICAL VALUE	
R^2	0.40	0.21	
R^2 (diff. + seasonal)	0.23	0.21	
F(6,56)	6.30	2.27	
DIAGNOSTICS			**VIOLATIONS**
DW	1.24	1.56	
RES.AR(3); F(3,50)	3.82	2.79	*
ARCH; F(3,50)	0.23	2.78	
NORMALITY $X^2(2)$	1.19	3.00	
HETEROSCED. F(10,45)	0.76	2.05	
RESET F(1,55)	4.60	4.02	*

[1] Regressions were performed with PC-GIVE and the broad possibilities for diagnostics were used extensively. R^2 relative to difference and seasonal of the variable compares the error variance to a null model with the differenced and seasonally adjusted variance, i.e.

$$R^2 = (y_t^2 - e_t^2)/\Sigma(\Delta y_t - \bar{s})^2 ,$$

where $\bar{s}$ = relevant seasonal mean for quarterly data.
In diagnostic tests DW refers to Durbin-Watson statistics used to test the first order residual autocorrelation. Least squares assumption about constant residual variance is tested with the residual auto-regressive sum of squares (ARCH) form of F -test.
Residual squares are tested against heteroscedasticity with the F -test and to test for functional misspecification is similarly F -distributed.
Normality of residuals is tested as a chi-squared distributed goodness-of-fit test statistic.

Poterba (1984) argues that the supply of housing may be affected by conditions in the credit market and summarizes these by the flow of savings deposits received by savings and loan associations. Instead of deposits we used housing loans. Unfortunately, quarterly information on the housing loans is not available for the whole period. Therefore we used the total supply of bank loans as a proxy for the period 1972–1987, which seemed to work quite well. For the period 1980–1987 we could use actual housing loans.

In equation (1) we had trouble with residual autocorrelation, which can be removed either with an autoregressive residual (RALS-) estimation or as in equation (2) by adding the lagged endogenous variable to the right-hand side of the model.

Equation (2) passes all the diagnostic tests available in PC-GIVE (Hendry, 1987a). As a result of adding lagged investment to the equation, the real price of houses loses its significance for the whole estimation period 72–87. This happens to housing loans as well. Nevertheless we avoided using simultaneous values of the explanatory variables to get the genuine predictive power of our explanatory variables and reduce the possible endogeneity bias between variables included. We believe that the pure lag from price realisations to housing investment must take at least one quarter. In addition we performed a Granger-causality test between variables to get a closer look at the predictive power of the independent variables. Results from these tests are shown below in Table 2. However, these tests did not show the important relation between investment and house prices. To save our working hypothesis, this may be caused by seasonal adjustment.

For the second estimation period 1980 – 87 (Table 3), the real price of houses is significant. The results are a bit dubious, since replacing the bank loans with the housing loans in the equation seems for some reason to make all the regressors insignificant except the strike dummy D86/2. Equation (3) works very well with respect to model performance and residual diagnostics. In some experiments trouble was caused by the RESET -specification test in adding the square of the linear predictor to the equation. This is a slight indication of misspecification of the functional form. Otherwise results seem to pass the tests.

Table 2. THE DETERMINANTS OF HOUSING INVESTMENT
The Sample is 1972(2) to 1987(4)
Modelling LASINM by OLS

VARIABLE	COEFF.	STD ERROR	t-VALUE	PARTIAL R^2
CONSTANT	1.78088	1.57312	1.13207	.0228
TREND	–.00866	.00556	–1.55870	.0423
LASRH-1	.18494	.10048	1.84055	.0580
LUNI-1	–.07525	.03692	–2.03783	.0702
LANTO-1	.24523	.16200	1.51375	.0400
D76/2	–.11765	.04441	–2.64954	.1132
D86/2	–.13203	.04416	–2.98973	.1398
LASINM-1	.42728	.10843	3.94076	.2202

MODEL PERFORMANCE		CRITICAL VALUE
R^2	0.53	0.21
R^2 (diff. + seasonal)	0.40	0.21
F(6,56)	9.02	2.18
DIAGNOSTICS (no violations)		
DW	2.18	1.60
RES. AR(3); F(3,52)	0.55	2.78
ARCH; F(3,49)	0.98	2.79
NORMALITY $X^2(2)$	1.13	3.00
HETEROSCED. F(12,42)	0.55	1.99
RESET F(1,54)	0.45	4.02

GRANGER-CAUSALITY TESTS:

AUTOREGRESSIVE-DISTRIBUTED LAG MODEL of DEP.VAR. on EXPL.VAR.
AUTOREGRESSIVE part IN DEPENDENT VAR. has LAGS 1 to 5
DISTRIBUTED LAG part IN EXPLANATORY VAR. has LAGS 0 to 5

GRANGER-CAUSALITY TEST for adding LASRH to LASINM : F(6,47) = 0.59
GRANGER-CAUSALITY TEST for adding LASINM to LASRH : F(6,47) = 0.40
GRANGER-CAUSALITY TEST for adding LANTO to LASINM : F(6,47) = 0.77
GRANGER-CAUSALITY TEST for adding LASINM to LANTO : F(6,47) = 1.14
GRANGER-CAUSALITY TEST for adding LUNITAS to LASRH : F(6,47) = 2.75
GRANGER-CAUSALITY TEST for adding LASRH to LUNITAS : F(6,47) = 2.36

Critical value with 5 % significance level was F(6,47) = 2.30

Table 3. THE DETERMINANTS OF HOUSING INVESTMENT
The Sample is 1980(1) to 1987(4)
Modelling LASINM by OLS

VARIABLE	COEFF.	STD ERROR	t-VALUE	PARTIAL R^2
CONSTANT	1.83244	8.26832	.22162	.0020
TREND	−.01725	.02760	−.62510	.0154
LASRH-1	.44462	.18709	2.37652	.1843
LUNI-1	−.04109	.04379	−.93824	.0340
LANTO-1	.29649	.78347	.37843	.0057
D86/2	−.11261	.04001	−2.81421	.2406
LASINM-1	.18477	.19046	.97010	.0363

MODEL PERFORMANCE		CRITICAL VALUE
R^2	0.68	0.29
R^2 (diff. + seasonal)	0.52	0.29
F(6,25)	9.04	2.49
DIAGNOSTICS (no violations)		
DW	2.10	1.61
RES. AR(2); F(2,23)	0.16	3.42
ARCH; F(2,21)	0.45	3.47
NORMALITY $X^2(2)$	0.46	3.00
HETEROSCED. F(11,13)	0.70	2.63
RESET F(1,24)	1.04	4.26

PRICE ELASTICITY REGRESSION:

LDINVM = .1556 DLASRH
(.20153)

Solved STATIC LONG RUN Equation

LDINVM = .248 DLASRH
S.E. (.15841)
WALD Test $Chi^2(1)$ = 2.452
Critical value of $Chi^2_{0.05}(1)$ = 3.84

We have seen that in all estimated models errors were homoscedastic. The Granger-causality test did not indicate violations in exogeneity of real house prices to housing investment. Parameter constancy was tested with recursive OLS -estimation and Chow -tests. As said before, there were two breaks in the constancy of parameters, so dummies were necessary for the two exceptional periods. Theory consistency is fairly fully provided in Topel and Rosen (1988) and Poterba (1984).

We also performed an estimation in log-difference form to easily get the elasticities at the mean of the regressors. The effects of possible liquidity constraint on housing investment were supposed to be tested by adding a short term cost variable RB to the equation RB is the interest rate of the taxable government bonds. Nevertheless this variable did not seem to be important in any regression. So the interest rate sensitivity of housing investment proposed earlier was not found. However, this may be due to financial market development, inappropriate interest rate variable or the fact that housing loans were tied to the basic discount rate, not to the market interest rate.

In addition we formed autoregressive predictors for the interest rate and consumer prices to test whether expectations of these variables would affect investment. In these equations only housing prices were significant for the later 1980−87 period.

Table 3 presents these investment supply elasticities for real house prices. The price elasticity is positive within the current quarter, indicating that the short run supply curve is upward sloping. The short run price elasticity has a value of 0.16, which shows that supply is rather inelastic. Even the long run price elasticity 0.25 seems to be quite low. When logarithm differences are used in the model, the clear drop in explained variation and significance in price of houses is observed as expected, which is caused by the elimination of the long term relationship related to the trend. This was already expected from the Granger causality tests.

In Table 4 we used the Tobin q -proxy (ratio of nominal house price relative to construction cost) with one lag as an explanatory variable. This proved to be successful especially in the later estimation period. As seen in Figure 4, the construction costs and consumer prices seem to be cointegrated, there should not be a great difference between real house prices or Tobin's q variant as a regressor for investment. The only additional regressor needed in forecasting housing investment was the strike dummy D86/2. This confirms our estimations in favour of the q theory and house prices relative to construction cost as a sufficient statistic for housing investment.

6. *Conclusions*

In general our estimation results do not provide a very clear-cut answer to the determinants of housing investment. Housing markets seem to be quite volatile and subject to seasonal and cyclical variation. This has been partly obscured by the self evident structural change due to Finnish financial market liberation. Some changes in the financing system of the housing construction industry have taken place already in the late 70's and early 80's. This can be seen in recursive model estimations and performed parameter stability tests. We concluded that the same model applicable in 1972–80 cannot be successfully used in the second half of our estimation period, namely 1980–87. It turns out that the supply model is not very suitable for the period 1972–80. For the 1980's evidence provides

Table 4. THE DETERMINANTS OF HOUSING INVESTMENT
The Sample is 1980(1) to 1987(4)
Modelling LASINM by OLS

VARIABLE	COEFF.	STD ERROR	t-VALUE	PARTIAL R^2
CONSTANT	2.46144	9.11372	.27008	.0030
TREND	−.02729	.03063	−.89108	.0320
LASH/RK1	.47669	.18735	2.54440	.2124
LUNI-1	−.02320	.05127	−.45252	.0085
LANTO-1	.53651	.88002	.60966	.0153
RB-1	.00210	.01460	.14384	.0009
LASINM-1	.11434	.18910	.60467	.0150
D86/2	−.11267	.03950	−2.85207	.2531

MODEL PERFORMANCE		CRITICAL VALUE
R^2	0.71	0.29
R^2 (diff. + seasonal)	0.56	0.29
F(7,24)	8.53	2.42
DIAGNOSTICS (no violations)		
DW	2.09	1.61
RES.AR(2); F(2,22)	0.24	3.44
ARCH; F(2,20)	0.40	3.49
NORMALITY $X^2(2)$	0.64	3.00
RESET F(1,23)	0.43	4.28

support for the rising supply curve and the sensitivity of housing investment to real house prices has been increased.

However, there seems to be strong reliance on the Tobin q -theory in the housing market as well. So as a main implication we can predict the investment and supply of new houses by the real house price index or preferably by the ratio of nominal house prices to construction costs. According to theory, we do not need any other indicators. This is also intuitively plausible, since we may expect that the main indicator for a profitable investment is simply the change in the price index of existing housing stock. New houses are priced according to demand conditions in the existing market plus some function of construction cost. Therefore house prices serve as an indicator of the demand condition for the market.

DATA SERIES (quarterly observations):

LASHR	=	*logarithmic real price of houses (nominal house prices deflated with consumer price index)*
LASH/RK	=	*logarithmic house prices deflated with construction cost index (marginal cost of investment) = Tobin q*
LUNI	=	*logarithmic real price of stock index (UNITAS -index)*
LANTO	=	*logarithmic real bank lending*
LASINM	=	*logarithmic value of housing investment in constant (1985) prices, billion FIM*
LLUOT	=	*logarithmic real bank lending of housing loans*
EPCP	=	*expected consumer prices*
RB	=	*government short terms bonds interest rate*

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