A structural model for corporate profit in the U.S. industry

Gomez-Sorzano, Gustavo
leasingmetrix group inc

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A STRUCTURAL MODEL FOR CORPORATE PROFIT IN THE U.S. INDUSTRY

By Gustavo Alejandro Gómez-Sorzano*

Abstract: I estimate a theoretically and statistically satisfying model to account for corporate profit represented by Net Rental Income (NRI) for one of the largest Real Estate Investment Trust companies (REIT) in the U.S. I claim that I have found an accurate method to forecasts the direction and dollar amount of corporate profit in the apartment industry in The U.S. that can be extended to the remaining branches of the U.S. industry. The variables that together account for ninety seven percent of the variation in NRI for this apartment company are, one-period time lag of lease renewals, the Federal Funds interest rate end of month, total gross potential of the company, total concessions, two-period time lag of move-ins, the ratio between total non-farm employment and total construction permits authorized, the inventory of houses in the U.S, one-period time lag of move-outs and this REIT apartment units occupied.

Keywords: REIT, Net Rental Income (NRI), demand for lease renewals
JEL classification codes: C22, C51, C53, R21

Econometrician for LeasingMetrix Group Inc, Lakewood, Colorado,
alexgosorzano@hotmail.com. Fax 303-433-6122

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Introduction.

This paper provides a single structural equation model to understand the causal reasons for this REIT'S [1] corporate profit (or net rental income, NRI for brief) to move in the way it does and is constructed for forecasting purposes. A previous structural equation for quantities demanded of lease renewals was already constructed (Gómez-Sorzano, 2006). The simultaneous use of these two equations: equation for quantities demanded and the equation for profit allows the maximization of corporate profit in any industry bringing millions of dollars by represented by uncollected income.

The international literature on forecasting real estate variables has concentrated on forecasting housing starts, which as leader indicator plays an important role in predicting future economic activity (see, e.g., Coccari (1979), Evans (2003, pp.164-166), Ewing and Wang (2003)[2], Falk (1986), Fullerton, et al. (2000), Puri and Van Lierop (1988), and West (2000). The research reported here is a pure time-series study. I claim that I have found an accurate method to forecasts the dollar amount and direction for "net rental income" in the apartment industry in the U.S. that can be extended to the remaining branches of the leasing industry as trucks, cars, motorcycles, ships, aircraft, computer and software and, equipment for the heavy industry. The first section presents a discussion of the data and the theory supporting the model. This is followed by the interpretation of the estimated coefficients, a section on predicting the explanatory variables to feed up the structural model, and at the end a section on the conditional forecasts for corporate profit for this REIT.

Data and methods

Data for this Real Estate Investment Trust (REIT), macroeconomic variables and real estate indicators that might affect Net Rental Income were collected on a monthly basis from September 1998 to November 2003. The data corresponds to the portfolio of properties composed by conventional properties, all data is measured in thousands, when applicable monetary variables were adjusted for inflation using the consumer price index. The estimation method used was multiple regression analysis and the functional form was logarithmic.

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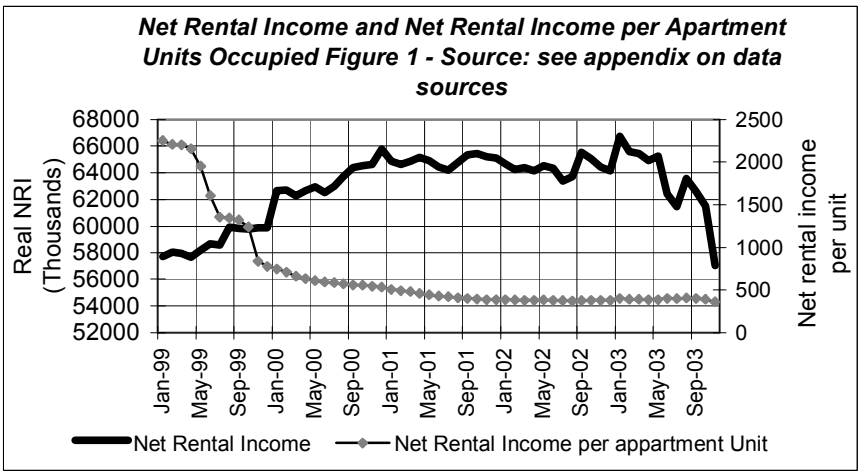
[1] This company is a Real Estate Investment Trust company or "REIT" whose common stock is traded on the NYSE, is one of the largest owner / operator of apartment properties in the United States, holds a diversified, portfolio of apartment communities that are owned or managed including: around 1,700 properties (58% U.S market) having more than 300,000 (34.63% U.S market) apartment homes located in 49 states. The company also owns A to C conventional properties, with a focus on B's affordable (primarily HUD subsidized) and student housing properties, invests solely in multifamily properties and is not a developer.

[2] See unpublished paper: Single housing starts and macroeconomic activity, Department of Economics, Texas Tech University, March 2003.

Explained variable

The explained variable is corporate profit measured by net rental income for this REIT: net rental income refers to the monthly collection of money for apartment leases. According to this company statistics, net rental income increased 0.2% and 0.16% in November 1999 and November 2000 respectively and decreased –0.3%, -0.9% and –7.3% respectively on November 2001, 2002 and 2003 (figure 1). When I adjusted for net rental income per apartment units occupied which is known in the apartment industry as the average rental, a clearly decreasing pattern emerges and stabilizes later on November 2003. Since NRI increases up to 2001, stabilizes up to 2003 and then decreases, the modeling effort is conducted using a combination of both trending and cyclical predictors.

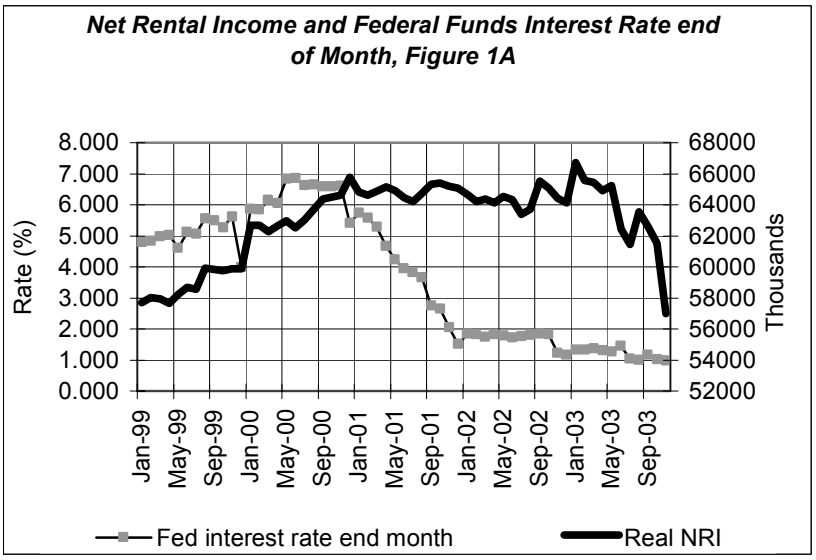


Initial model

A structural model explaining the causal reasons for the movement of NRI for this REIT should contain variables related with the economic environment and variables controlled by the firm. In regards to the macroeconomic conditions[3], the money market plays an important role. This is included in the simplest and most effective way in my model by using the standard price of money for the U.S economy represented by the Fed interest rates. I also must include short run macroeconomic demand factors, such as, employment indicators and internal factors such as move-ins and move-outs; and long demand factors, such as demographic trends, the vacancy rate, the inventory of houses in the U.S and personal consumption related with household operation such as consumption on electricity and gas and consumption required to maintain the household. My specification includes also four sub-types of this REIT controlled variables reflecting current market operating conditions, such as price concessions, total gross potential and lease renewals, and efficiency indicators, such as apartment units occupied.

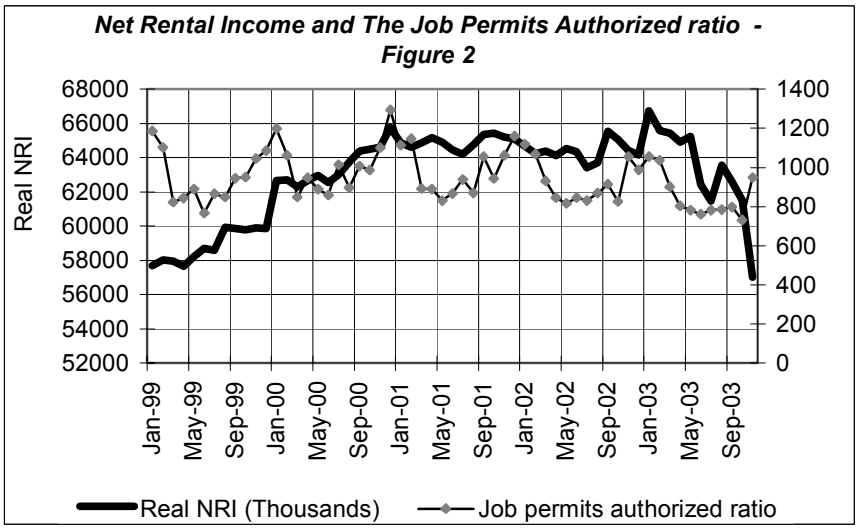
Macroeconomic variables: the interest rate.

Federal funds rate end of month. Figure 1A, shows the historical relationship between the Fed interest rate and this REIT's net rental income. The logic here is that the continued increase in the interest rate up to November 2001 was negatively impacting home sales giving fuel to the demand for lease renewals and so increasing NRI. My expected estimated coefficient between NRI and the interest rate should be positive.



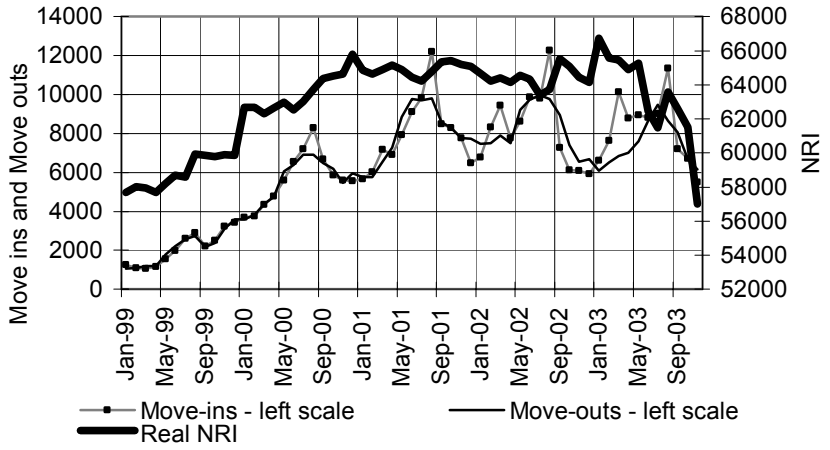
Short run demand factors.

Job creation: the job permits authorized ratio. Job creation has been widely accepted by real estate and REIT research institutions as an important predictor of occupancy and net rental income in the apartment industry. Since Figure 2 shows a direct relationship between both variables, I expect to find an estimated positive coefficient.



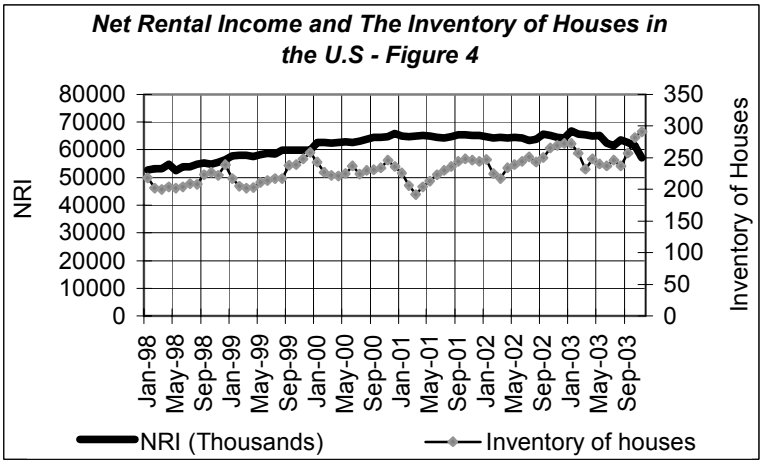
Move-ins and move-outs. Figure 3 shows the behavior of move ins and move outs, a move in usually comes a couple of days after signing a lease and so it impacts NRI with certain lagged structure e.g., a lease contract is signed several months in advance with a promise to move in the future, implying that according to the company's accounting system contemporaneous NRI is positively related with move-ins registered one or two months ago; my expected coefficient is positive; in the same way move outs registered yesterday impact negatively today's NRI and so my expected coefficient is negative.

Net Rental Income in relation to Move-ins and Move-outs - Figure 3

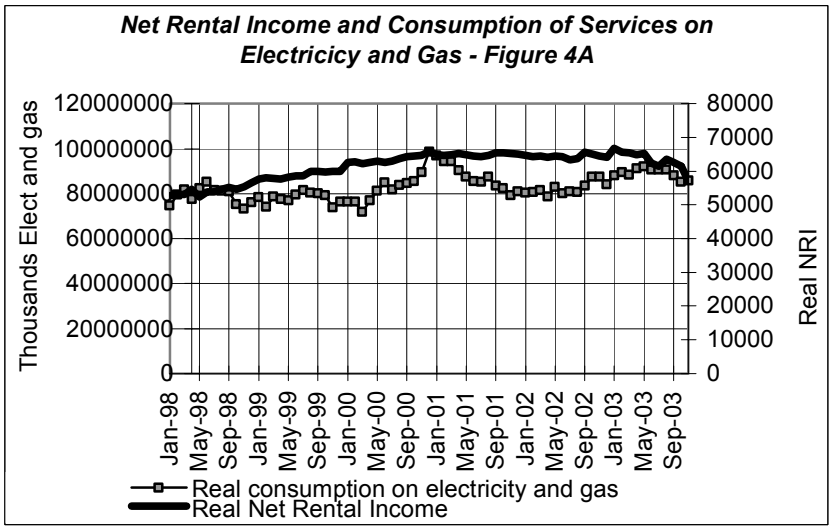


Long demand factors.

The inventory of available houses for sale in the U.S. The inventory of available houses for sale in the U.S is calculated as the difference between houses for sale and houses sold is considered a long demand factor which shows a increasing trend across time as is seen in figure 4, it has a negative relationship with NRI; this a consequence of the fact that additional houses are considered as a perfect substitute of apartments for rent, so when construction and the inventory of houses goes up on average people will tend to buy more houses and so the signing of leases will diminish impacting negatively net rental income. A priori my expected coefficient between NRI and the inventory of houses for sale is negative.



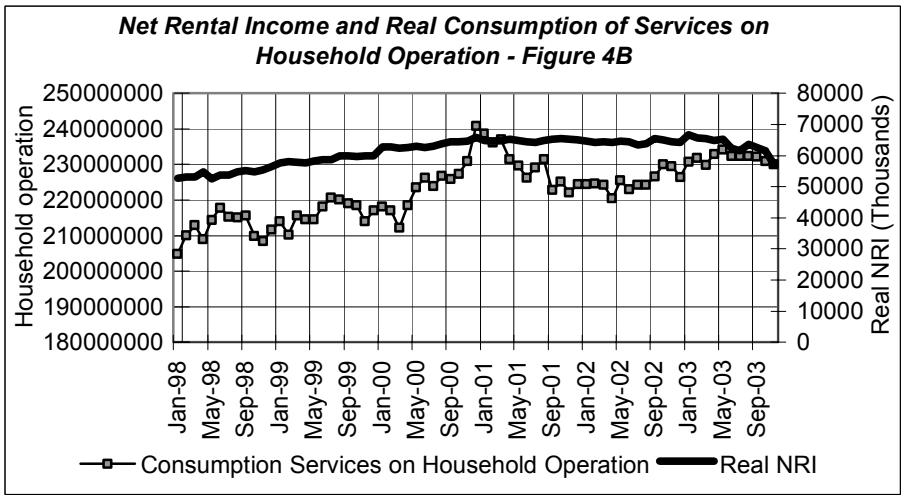
Services on electricity and gas. In average is expected that a minor component as consumption of electricity will not affect negatively net rental income, my expected coefficient is positive.



Services on household operation[4]**.** Services on household operation is the third long run demand factor related with the real estate market included in this model. This expenditure sub-account of the GDP is composed by: a. electricity and gas and, b. other household operation which includes water and other sanitary services, fuel oil and coal, telephone and telegraph, domestic service and others[5]. The historical co-movement between NRI and this big account for

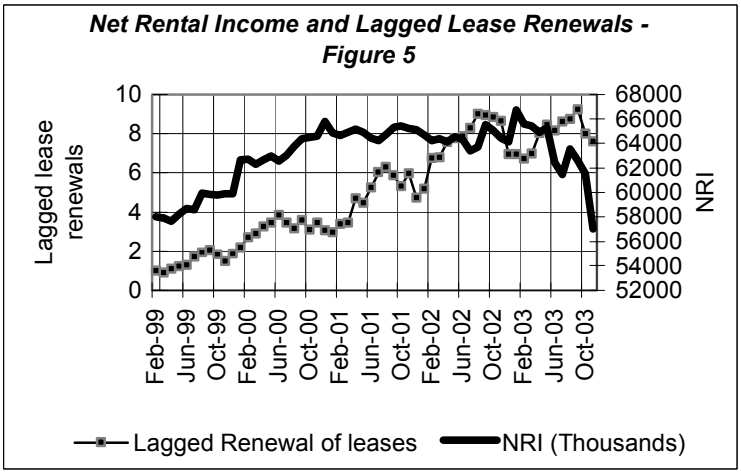
[4] This variable is taken from the NIPA (National Income and Product Accounts), from either table 2.6.U (personal consumption expenditures) or table 2.2 (personal consumption expenditures by major type of product).

services on household operations is negative. In average is expected that the increase in major sub categories of household operation will impact the leasing of apartments reducing net rental income and so, my expected coefficient is negative.



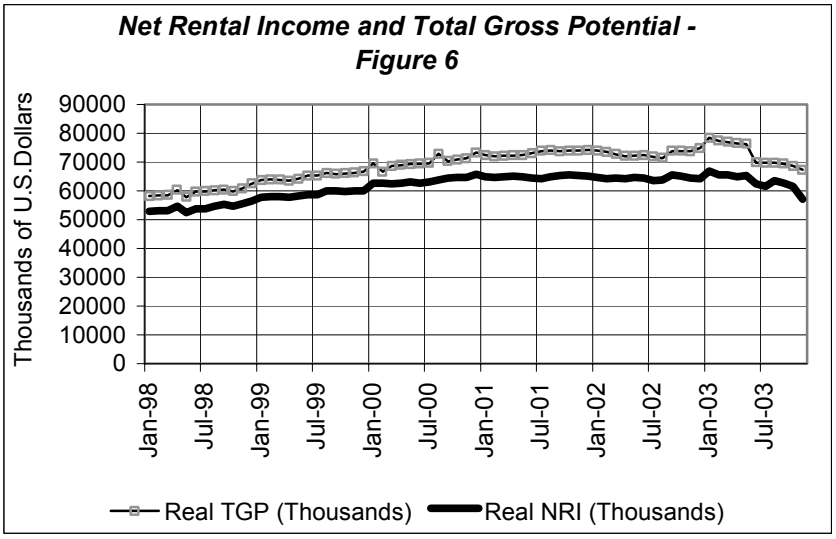
This REIT controlled variables reflecting current market operating conditions.

Lease renewals. Lease renewals must enter the equation for NRI with a lagged structure since leases signed today will affect future NRI, the logic here is that when the demand for leases (quantities of leases) moves to the right, under regular conditions NRI which is a proxy for price increases. Figure 5 shows a positive relation and so my expected coefficient is positive.



[5] Consists of maintenance services for appliances and house furnishings, moving and warehouse expenses, postage and express charges, premiums for fire and theft insurance on personal property less benefits and dividends, and miscellaneous household operation services.

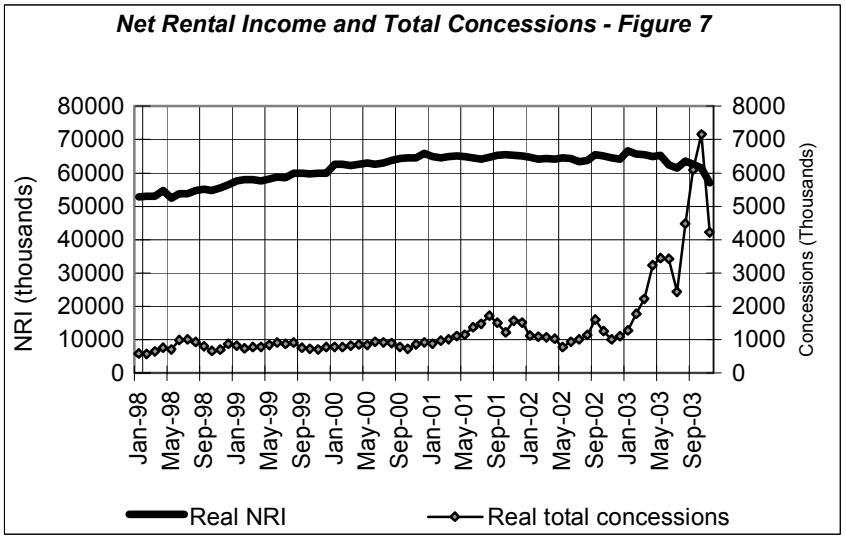
Total gross potential (TGP). The total gross potential[6] for the company refers to the maximum NRI that is reachable, the situation where all the apartments are rented and so the company has reached its maximum potential income from rented apartments; usually companies operate around a TGP of 80% and it varies inversely with the business cycle. Figure 6 shows the relation between TGP and NRI, my expected coefficient is positive.



[6] Total gross potential (TGP) is calculated as:

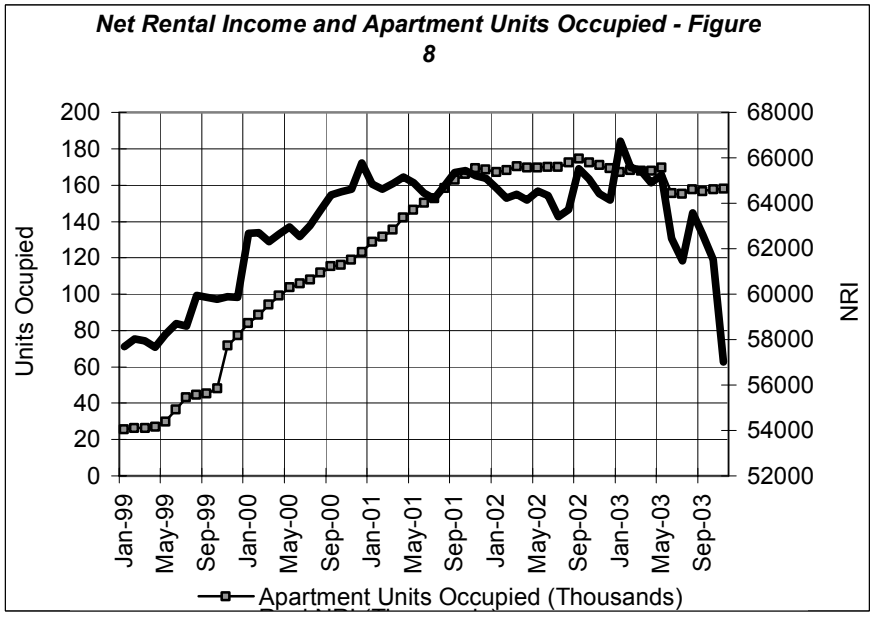
TGP= market rent – leases under schedule + leases over schedule + premium rent + upgrade rent + month to month fee + short term lease fee + bond adjustment + association dues + rent right price adjustment + renewal price adjustment + rent revenue + subsidy rent potential + commercial rent.

Total concessions. Under concessions this REIT groups a set of income accounts whose purpose is to reduce the net rental price artificially to make competitive the apartment unit[7], the company uses all these types of special concessions to grab market segments or to boost occupancy in depressed sub-markets, this reasoning implies a direct relationship between real concessions and the demand for lease renewals. Figure 7 suggests this direct relationship, for this reason my expected coefficient is positive.



Units occupied. Apartment units occupied (quantities of apartments rented) is, what brings the net rental income, figure 8 shows this direct relationship across the sample. My expected coefficient sign must be positive.

[7] This set of concessions are included on this REIT financials under numeric codes not presented here but including: Concessions reimbursement; Service maintenance guarantee; Concessions/special promotions; Renewal concessions; Discount residents monthly; Resident relation concessions; Resident referral concessions.



Results and interpretation

My two initial models[8] to be tested this is (with expected signs preceding the variables):

$$(1)\ LNRI_t = F\left(+L\,renew_{t-1},\ +Lffrem_t,\ +L\left(\frac{Tgp}{P}\right)_t, -L\left(\frac{Totacon}{P}\right)_{t-1} + Lmoin_{t-2}\right.$$

$$\left. + Ljobpau_t,\ -Linvh_t,\ -Lmout_{t-1},\ +Lunitso_t\right)$$

Where

LNri	this REIT's net rental income (corporate profit)
Lffrem	federal funds rate end of month
Ltgp	this REIT's total gross potential
Ltotacon	this REIT's total concessions
Lmoin	this REIT's move- ins
Ljobpau	job permits authorized ratio
Linvh	inventory of houses in the U.S.
Lmout	this REIT's move -outs
Lunitso	this REIT's apartment units occupied
P	consumer price index
L	stands for logarithm

[8] The difference between both models stems in the fact that model #1 includes lagged lease renewal and model #2 does not include lease renewals but includes services on household operation and services on electricity and gas.

$$(2)\ LNRI_t = F\left(+L\ jobpau_t,\ +Lffrem_t,\ +L\left(\frac{Tgp}{P}\right)_t,\ -L\left(\frac{Totacon}{P}\right)_{t-2},\ +Lmoin_{t-2}\right.$$

$$\left.-Lsho_t,\ +Lseg_t,\ -Linvh_t,\ +Lunitso_{t-1}\right)$$

Where

LNri	this REIT's net rental income (corporate profit)
Ljobpau	job permits authorized ratio
Lffrem	federal funds rate end of month
Ltgp	this REIT's total gross potential
Ltotacon	this REIT's total concessions
Lmoin	this REIT's move- ins
Lsho	services on household operation
Lseg	services on electricity and gas
Linvh	inventory of houses in the U.S
Lunitso	this REIT's apartment units occupied
P	consumer price index
L	stands for logarithm

Estimating model #1

The initial results are displayed in table 1.

Table 1 – Model-1A

```
Dependent Variable LNRIU2 - Estimation by Least Squares
Monthly Data From 1999:03 To 2003:04
Usable Observations     50      Degrees of Freedom    40
Centered R**2     0.978323      R Bar **2   0.973445
Uncentered R**2   1.000000      T x R**2      50.000
Mean of Dependent Variable      11.055395068
Std Error of Dependent Variable  0.038360951
Standard Error of Estimate       0.006251141
Sum of Squared Residuals        0.0015630705
Regression F(9,40)                 200.5838
Significance Level of F           0.00000000
Durbin-Watson Statistic             1.977709
Q(12-0)                            18.921328
Significance Level of Q            0.09044479
```

Variable	Coeff	Std Error	T-Stat	Signif
Constant	6.0566328	0.5350711	11.3193	0.0000
LRENEW{1}	0.0155746	0.0085693	1.8175	0.0766
LTOTACONU2{2}	-0.0119652	0.0060739	-1.9699	0.0558
LJOBPAU	0.0375692	0.0114838	3.2715	0.0022
LTGPU2	0.443574	0.0503473	8.8103	0.0000
LUNITSO{1}	0.0193715	0.010943	1.7702	0.0843
LMOIN{2}	0.0284673	0.0068286	4.1689	0.0002
LMOUT{1}	-0.0267714	0.0092398	-2.8974	0.0061
LFFREM	0.0139696	0.0041506	3.3657	0.0017
. LINVH	-0.0501587	0.0171945	-2.9171	0.0058

Table 2 – Model 1B takes away the lag in units occupied: includes units occupied in levels

```
Dependent Variable LNRIU2 - Estimation by Least Squares
Monthly Data From 1999:03 To 2003:04
Usable Observations     50      Degrees of Freedom    40
Centered R**2     0.978276      R Bar **2   0.973388
Uncentered R**2   1.000000      T x R**2      50.000
Mean of Dependent Variable      11.055395068
Std Error of Dependent Variable  0.038360951
Standard Error of Estimate       0.006257844
Sum of Squared Residuals        0.0015664245
Regression F(9,40)                  200.1448
Significance Level of F           0.00000000
Durbin-Watson Statistic             1.944739
Q(12-0)                            19.541991
Significance Level of Q           0.07626130
```

Variable	Coeff	Std Error	T-Stat	Signif
Constant	5.9849908	0.5181585	11.5505	0.0000
LRENEW{1}	0.0180002	0.0081075	2.2202	0.0321
LTOTACONU2{2}	-0.012607	0.0059831	-2.1071	0.0414
LJOBPAU	0.040144	0.0108251	3.7084	0.0006
LTGPU2	0.4518887	0.0483886	9.3387	0.0000
LUNITSO	0.0160841	0.0092228	1.7440	0.0889
LMOIN{2}	0.0310126	0.0064276	4.8249	0.0000
LMOUT{1}	-0.0281061	0.0095142	-2.9541	0.0052
LFFREM	0.0137294	0.0041381	3.3178	0.0019
LINVH	-0.0562138	0.0161587	-3.4789	0.0012

Table 3 – Model 1C takes away units occupied

```
Dependent Variable LNRIU2 - Estimation by Least Squares
Monthly Data From 1999:03 To 2003:04
Usable Observations     50      Degrees of Freedom    41
Centered R**2     0.976625      R Bar **2   0.972063
Uncentered R**2   1.000000      T x R**2      50.000
Mean of Dependent Variable      11.055395068
Std Error of Dependent Variable  0.038360951
Standard Error of Estimate       0.006411737
Sum of Squared Residuals        0.0016855254
Regression F(8,41)                  214.1219
Significance Level of F           0.00000000
Durbin-Watson Statistic             1.904688
Q(12-0)                            21.812486
Significance Level of Q           0.03967593
```

Variable	Coeff	Std Error	T-Stat	Signif
Constant	5.587628	0.4768167	11.7186	0.0000
LRENEW{1}	0.021943	0.0079774	2.7507	0.0088
LJOBPAU	0.0483167	0.0099981	4.8326	0.0000
LTGPU2	0.487236	0.0450197	10.8227	0.0000
LMOIN{2}	0.0330907	0.0064715	5.1133	0.0000
LFFREM	0.0128925	0.0042112	3.0615	0.0039
LINVH	-0.0623586	0.0161577	-3.8594	0.0004
LTOTACONU2{2}	-0.0153071	0.0059214	-2.5850	0.0134
LMOUT{1}	-0.0220157	0.0090677	-2.4279	0.0197

Estimating model #2

Table 4 – Model 2

```
Dependent Variable LNRIU2 - Estimation by Least Squares
Monthly Data From 1999:03 To 2003:04
Usable Observations     50      Degrees of Freedom    40
Centered R**2     0.976452      R Bar **2   0.971153
Uncentered R**2   1.000000      T x R**2      50.000
Mean of Dependent Variable      11.055395068
Std Error of Dependent Variable  0.038360951
Standard Error of Estimate       0.006515342
Sum of Squared Residuals        0.0016979871
Regression F(9,40)                  184.2929
Significance Level of F           0.00000000
Durbin-Watson Statistic             1.892674
Q(12-0)                            15.445412
Significance Level of Q           0.21797690
```

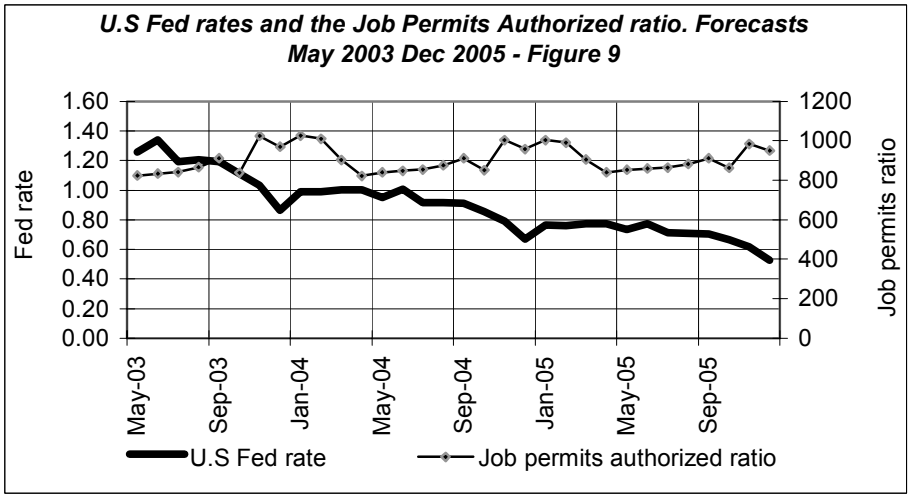
Variable	Coeff	Std Error	T-Stat	Signif
Constant	12.858102	3.2061614	4.0104	0.0003
LJOBPAU	0.0344747	0.0094879	3.6335	0.0008
LTGPU2	0.4293893	0.0680706	6.3080	0.0000
LUNITSO{1}	0.0229562	0.0095423	2.4057	0.0209
LMOIN{2}	0.0189942	0.0064375	2.9505	0.0053
LFFREM	0.007323	0.0032511	2.2525	0.0298
LINVH	-0.0466766	0.0183738	-2.5404	0.0151
LSHO2	-0.5479757	0.2554803	-2.1449	0.0381
LSEG2	0.20747	0.0933992	2.2213	0.0321
LTOTACONU2{2}	-0.0152072	0.006534	-2.3274	0.0251

Tables 1 to 3 show specification variations to equation or model #1 and table 4 show the estimates for equation or model #2. In the last section I produce forecasts and I refer to them as model-1A, model-1B, model-1C and, model 2. In general terms all coefficient estimates conform to my prior expectations. In regards to model 1, tables 1, 2 and 3 display minor variations in equation adjustment when I used in table 1 units occupied lagged one period, then in table 2 I used it again but in levels and in table 3 that variable was remove. The model shows a high R^2 of 0.97 in the three cases. In regards to model #2, table 4 also shows that all coefficients signs conform to what was theoretically expected and displays a high R^2 of 0.97, neither of the two models display autocorrelation neither misspecification problems their Durbin Watson indexes are pretty close to 2.

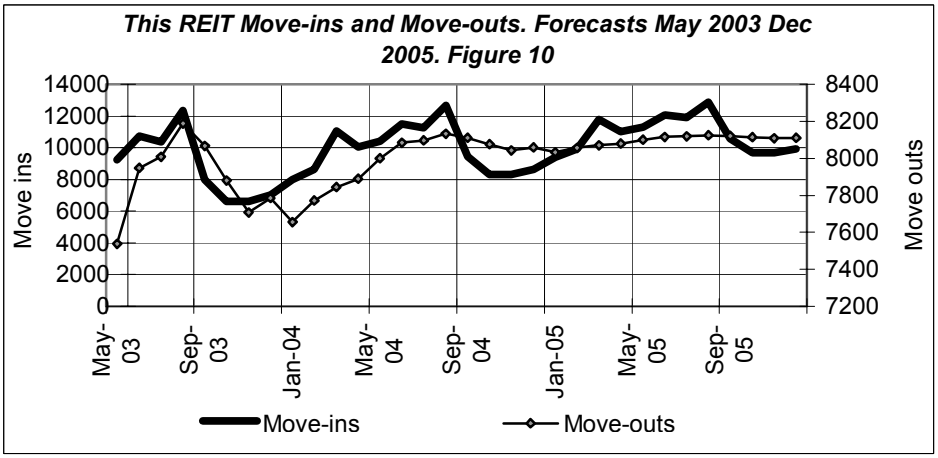
Predicting the explanatory variables using ARIMA model (the Box-Jenkins approach)

The list of explanatory variables was forecasted. I created a path for them on the purpose of plugging the coefficients for this REIT net rental income model to produce structural forecasts up to December 2005. The methodology used is The Box and Jenkins (1976) approach. The lease renewals variable feeding up models 1A, 1B and 1C was previously estimated using a Structural model for lease renewals and corresponds to the most probable leasing figures for this REIT (Gómez-Sorzano 2006. A *Structural Model for Lease Renewals in the U.S. Leasing Industry*, figure 19).

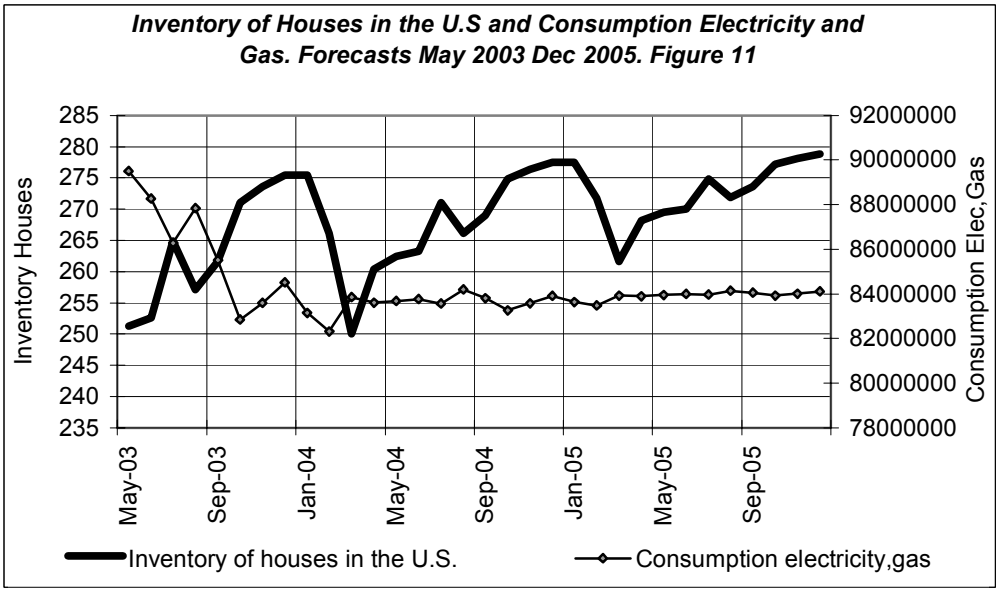
Forecasts for the U.S Federal Funds rate end of month and the job permits authorized ratio. Fed model is an ARIMA (3,1,0)(1,0,1) no constant included, with autoregressive structure of order 1 and 3. Job permits ratio uses ARIMA (2,0,0)(1,0,0) no constant term included.



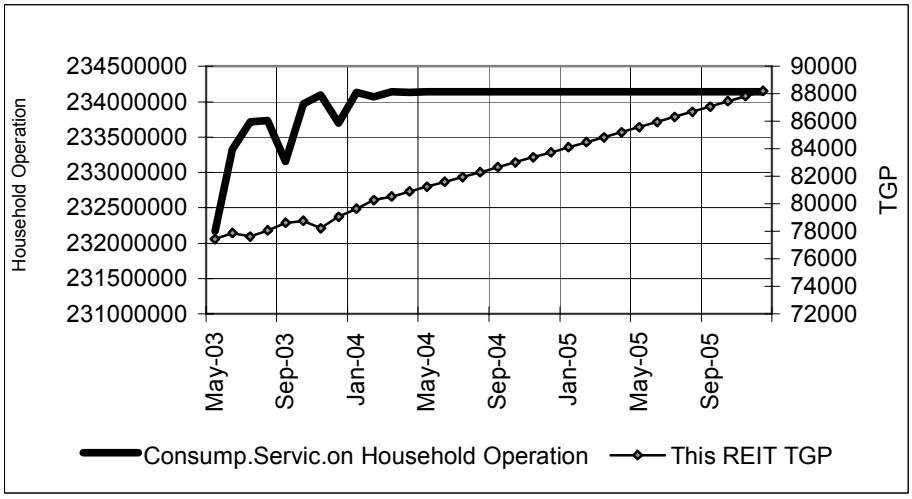
Forecasts for this company move-ins and move-outs. Move-ins uses ARIMA (0,1,12) with moving average parameters of order 1 and 12 and no constant term included. Move-outs uses ARIMA (2,1,4)(1,0,0) with moving average parameters of order 2 and 4 but no constant term included.



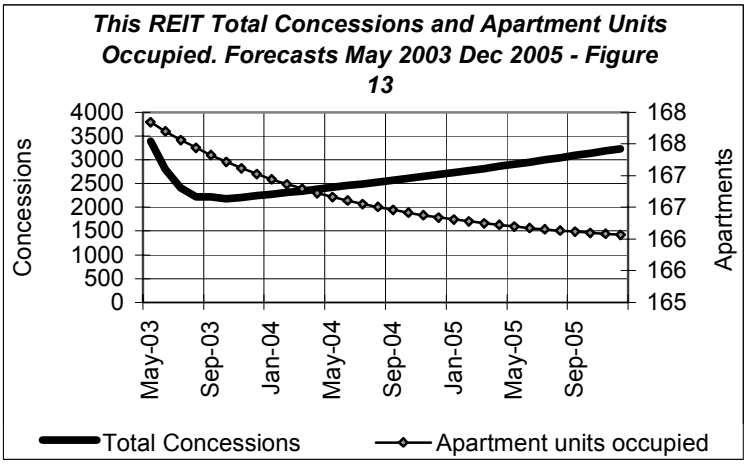
Forecasts for The Inventory of Houses and Consumption on Electricity and Gas. The inventory of houses in the U.S uses ARIMA(0,1,4)(1,0,0) no constant term included; consumption of electricity and gas is fitted according to ARIMA(1,0,12)(1,0,0) with moving average parameters of order 9 and 12, and no constant term included.



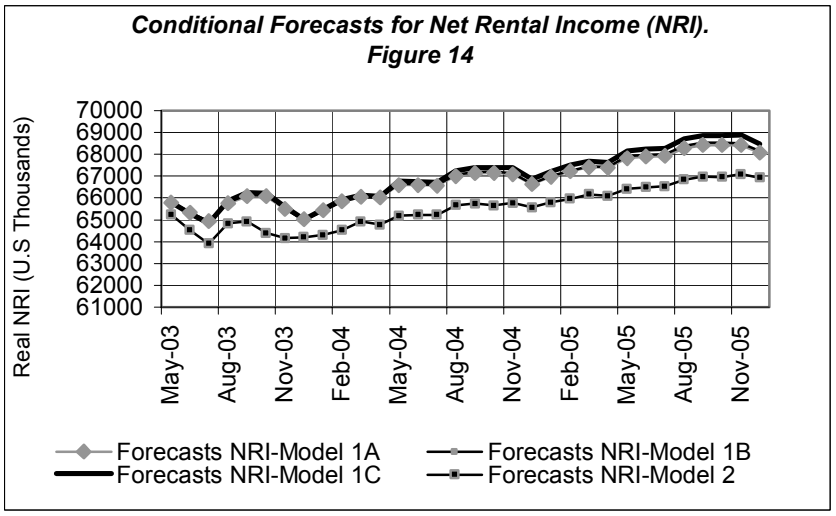
Forecasts for Consumption on Household Operations and for this company's Total Gross Potential. Consumption on Household operations uses ARIMA(2,1,9) no constant included and a moving average structure of order 2 and 9. TGP is adjusted using ARIMA(1,1,10) no constant included.



Forecasts for Apartment Units Occupied and Total Concessions. Units occupied use ARIMA(1,1,1) with no constant term included; total concessions is fitted with ARIMA(0,1,6) with no constant term included and moving average structure of order 4,5,6.



Conditional forecasts for corporate profit (NRI) for this REIT. I plugged the non-structural forecasts for the predictors into the estimated of the structural model for NRI getting the forecasts for them. Figure 14 displays four possible scenarios according to model 1A, model 1B, model 1C and model 2. The four models show a continued growth up to December 2005.



Conclusion

I built a structural model with monthly data from 1999 to April 2003 to explain the causal reasons for the variations in corporate progit for a REIT belonging to the apartment in industry in the U.S. The forecasts produced by this model must be used along with the forecasts produced by the equation for quantities demanded of lease renewals (Gómez-Sorzano, 2006) as a tool for setting up the direction and changes in rental prices for this REIT'S conventional portfolio of properties. The simultaneous application of a two-equation model of this sort brings millions of dollars in profit represented by uncollected rents and must be used on the purpose of maximizing

corporate income in any company belonging to a particular industry. This two-equation model basically composed by an equation for quantities demanded and an equation for corporate income gives the company possessing it a competitive advantage over its competitors in a given industry.

Appendix 1: data sources

All monetary variables were obtained in nominal terms on a monthly basis and converted with the consumer price index (August 1993=100) from the U.S Bureau of Labor Statistics. www.bls.gov.
Total non-farm employment taken from National Employment, Hours and Earnings, not-seasonally adjusted, Bureau of Labor Statistics (thousands of non-farm employees).
Total of housing unit permits authorized, corresponds to the total that, sums up permits authorized by 1, 2, 3, 3 to 4 and, more than 5 units, taken from the U.S Census Bureau (thousands). www.census.gov.
The Job permits authorized ratio was constructed as the quotient between total non-farm employment and total of housing unit permits authorized.
Services on household operation (SHO) and services in electricity and gas (SEG), were taken from the Survey of Current Business, National Income and Product Accounts, NIPA, Bureau of Economic Analysis, www.bea.gov.
Federal funds interest rate end of month, taken from the U.S Federal Reserve Board of Governors, www.federalreserve.gov.
The Inventory of available houses for sale is calculated by the difference between houses for sale (not seasonally adjusted) and houses sold (not seasonally adjusted); taken from the U.S Census Bureau, www.census.gov.

The information for Net rental income, total concessions, total gross potential, lease renewals, units occupied, move-ins and move-outs were taken from the company financials.

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