A Real Estate Risk Model
- applications for direct investments -

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RE - general asset features

Some features render the real estate asset class distinctive

▶ Each object belonging to this class has different characteristics
▶ These assets tend to have relatively stable cash flows over time
▶ Is a good asset for inflation hedging

**But:** Low transaction frequencies makes it difficult to get a good idea on the asset’s value dynamics. Aggregation across several housing units is needed for an analysis to produce significant results.

**Also:** Due to the high informational asymmetries and low liquidity the functions of RE markets are supplemented by the presence of professional appraisers.

**Thus:** RE data tends to be biased and smoothed over time ”hiding” its real risk profile.
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Introduction

Academic Research

Most of the issues of illiquidity and smoothing have been dealt with to some degree (Geltner '91 '93, Fisher '03). Also, some empirical facts are worth highlighting:

- As the CF are very stable over time, most of the volatility in the price will come from changes in the return rates (Campbell Mei 1993)
- Liu Mei ('93, '94) show that RE returns have some degree of predictability

This tells us then that a PV model with variable discount rates could be a good choice for pricing if we can pin down the dynamics of the two series of interest (CF and discount rates)
The Swiss rental housing market is highly regulated with different recommendations at each cantonal level. This induces fragmented risk/return characteristics for a portfolio of direct holdings spread across the country. The major factors impacting values are:

- changes in the mortgage rates of the cantonal banks
- changes in the CPI

Market rents can be reached only through renovations/restructurings! Macroeconomic factors impact the returns on dwellings in different ways according to the "riskiness" of the dwelling (low vs. high risk).
The building blocks

- Campbell Shiller (1988) log linear approximation of the PV model
- A bivariate VAR model is used for forecasting; (un-)conditional forecasts are fed into the PV model to obtain a change in the value over a one year period
- Data used in the VAR model is unsmoothed using various techniques (a liquidity adjustment to be prepared)
The Log Linear Approximation

Starting from the traditional PV formula, Campbell and Shiller derive a linear approximation which allows the discount rates to enter the formula in a linear way

\[
p_t = \frac{k}{1 - \rho} + (1 - \rho) \sum_{j=0}^{\infty} \rho^j E_t[d_{t+1+j}] - \sum_{j=0}^{\infty} \rho^j E_t[r_{t+1+j}] \quad (1)
\]

with

- \( p_t, d_t, r_t \) the log values of price, dividend and return
- \( k, \rho \) two constants depending on the average values of \( p_t \) and \( d_t \)
Regulation and its impact on value

The Swiss rental regulation can be thought as being relatively "tenant friendly". It is designed such that the tenant will support only part of the shocks that the landlord has to support when either maintenance or financing costs increase (these effects are spread over time for tenants).
The VAR model

The VAR model takes into account the legal framework through the selection of the variables and lags included in the regression

\[
\begin{align*}
    r^{rent}_{t+1} &= \beta_{11} r^{rent}_t + \beta_{12} r^{RE}_t + \beta_{13} \Delta r^{hypo}_t + \beta_{14} r^{CPI}_t + \beta_{15} r^{Hypo}_t + \epsilon^{rent}_{t+1} \\
    r^{RE}_{t+1} &= \beta_{21} r^{rent}_t + \beta_{22} r^{RE}_t + \beta_{23} \Delta r^{hypo}_t + \beta_{24} r^{CPI}_t + \beta_{25} r^{Hypo}_t + \epsilon^{hypo}_{t+1}
\end{align*}
\]
Unsmoothing and Liquidity adjustments

Various techniques are available according to the type of data used

- For appraisal based data: the Blundell-Ward filter
- For transaction based data: liquidity adjustment
Unsmoothing - the Blundell-Ward filter

The issue of appraisal smoothing has been thoroughly investigated in the academic and practitioners’ literature. The main reasons for this phenomenon are described briefly:

- for any evaluation, the lack of data on contemporaneous comparable sales pushes the appraiser to reach further back in time in order to find similar data to be used as comps for a given evaluation

- behavioral biases are present in the heuristic of appraisals leading to too much importance given to recent transactions (the recency bias coupled together with the anchoring and adjusting bias)

This leads to value estimates that lag actual market development and are less volatile than actual transaction prices.
Application of the Blundell-Ward filter

When appraisers form a value estimate at time $t$ ($a_t$) based on observed market transactions ($y^T_t$) and on past appraised values ($a_{t-1}$) then

$$a_t = Ky^T_t + (1 - K)a_{t-1}$$

$$r^T_t = \frac{r^a_t}{K} - \frac{(1 - K)r^a_{t-1}}{K}$$

- $K$ is the smoothing parameter obtained from an AR(1) regression of $r^a_t$ on $r^a_{t-1}$
- The question of the constant smoothing parameter was addressed in the literature: although appraisers do have an active learning process ($K$ is time varying and is directly linked to the market liquidity - lower liquidity leads to higher smoothing) a fixed $K$ will lead to almost the same results as a time varying one (Clayton et al. (2001)).
- The filter can be extended to accommodate higher order anchoring (the adjustment process can be done also for several periods of appraisal based returns).
Unsmoothing - filter output

NCREIF Index Values

- Original Series
- Unsmoothed BW

NCREIF Index Returns

- Original Series
- Unsmoothed BW
Available Data

- For rents, use an index provided by the SFSO
- For the developments of the price of rental housing, use an index provided by the SNB (computed by Wuest&Partner)
- For the mortgage rate, use an index for new mortgages of cantonal banks offered by the SNB
- the CPI index comes from the SNB as well
Available Data - Rents
Available Data - RE returns

Introduction
The Model
Data
Preliminary Results
Available Data - Mortgage rates
Available Data - CPI

Data

Preliminary Results
Some evidence in favor of the linear model?

The VAR needs to be enriched with general macro information and data on returns of alternative assets.