Real Estate & Financial Markets (REFM) Lab

Mission and Organization
REFM Lab Mission

• Provide modeling and analytic technology, data, hardware, software, and personnel needed to conduct economic analyses of real estate asset and capital markets. Develop scientific advances in valuation methods and systemic risk management practices needed for trading and monitoring activities in these markets.
REFM Lab – Goals

• Our Goals:
  – Contribute to the policy debate on the risk channels associated with real estate and mortgage markets in the U.S.
    • Macro and micro-economic foundations of real estate cycles,
    • Effects of monetary policy on mortgage capital market flows.
    • Supply and demand dynamics in housing and commercial real estate markets, including the effects of transportation infrastructure, job creation, and migration.
    • Develop and monitor house price indices.
  – Develop real estate and mortgage market risk management tools.
    • Interest rate, credit, and energy risk.
    • New metrics for systemic and regional components of these risks.
  – Establish risk analytics for the primary real estate energy sources – natural gas and electricity
    • Identify optimal capital market incentives for improving the energy efficiency of U.S. real estate markets.
REFM Lab – Where we want to be

• **Overarching Goals:**
  – Develop a large research data center focused on real estate asset and capital markets.
    • Center design includes IT infrastructure and security systems for large and often proprietary data sets.
  – Undertake high-quality academic research, to publish the findings of this research in academic journals and other practitioner outlets, and to promote data-based graduate student training that is focused on these markets.

• **Immediate Needs:**
  – Establish a high-performance and flexible hardware / software architecture that
    • Provides concurrent access to the REFM Lab datasets through a high-speed network
    • Benefits from the existing processing power
      – Users already holding powerful computers at their desktops can run processes locally
      – All users, including those without powerful local computational resources, have access to a shared processing facility composed of powerful compute servers
  – Implement a structured approach for granting user access to the lab datasets and running processes for analyzing data
  – Create a systematic approach for backing up lab datasets
REFM Lab Architecture – Next Steps

• Integrate REFM Lab with other scientific Labs such as Computer Science’s, Lawrence Berkeley, etc…

• Continue to expand the datasets
  – USGS National Elevation Dataset (Geospatial Data)
  – NRCS Gridded Soil Survey Geographical Database (Geospatial Data)
  – DataQuick – Nationwide residential house price and transaction data
  – Bridge into other external datasets such as Nielsen’s data
  – Etc…

• Establish a data model for REFM’s datasets
REFM Data Sets

**Mortgage markets**
- **FNMA/FHLMC:** mortgage origination and performance (32M)
- **Subprime:** mortgage origination and performance (22M)
- **GSE and Subprime pools:** origination and performance
- **Commercial mortgage:** origination and performance (~100K)
- **RMBS pricing** (daily): Bloomberg.
- **CMBS pricing** (index): NAICs mortgage insurer investments.

**Financial Services**
- **Call reports** (FFIEC0041): Depositories.
- **Bank Holding Company Reports** (BHC FR9C).
- **Survey of Deposits** (SOD): FDIC branching data.
- **HMDA:** bank/ geography loan-level origination.
- **HMDA crosswalk:** links between above.
- **Thrift call reports**
- **Nets Establishment data:** All Employment and Sales, (22M).

**Asset Markets**
- **House Prices (Dataquick):** Transactional data CA, option on all U.S. 1996-2012.
- **House Prices (CMDC):** Transactional data 1970-1996 (three counties).
- **Assessors data:** House-by-house characteristics.
- **Commercial RE Prices (US):** (1996-2009)
Mortgage Market Systems and Risk Characterizations?
Current Research focus: Lattice-based Measures of Mortgage-Linked Systemic Risk
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Dynamic House Price Indices: Designed for Fixed Income Valuation

• Price Indices Require: Controls for the evolution of “Prices” and for the evolution of the “Characteristics” (Quantity of Housing Services) for each house.
  – Current repeat sales indices do not do this!
• Our estimator includes two Poisson processes: 1) likelihood of re-modelling and 2) likelihood of sale.
  – Controls for the housing characteristics and the probability that these characteristics will change as a function of macro fundamentals.
  – Controls for the probability of sale as a function of macro fundamentals.
• Conditioned on these intensities: Use classical linear filtering techniques to estimate underlying “index”
  – Model includes reasonable assumptions for the long term average dynamics (mean reversion) of house prices and the dynamics of the volatility of house prices.
Differences in probabilities of sales by house structure
San Francisco County: Price Effects of New Supply

![Graph showing price effects of remodel and new construction over years.]
Augmented Commercial Mortgage Valuation Models

1. Simulate Rent
   - G.B.M.
   - CS Process
   - Hull White Process

2. Price Loans

Solve for the property specific drift, $\hat{\mu}_i$
Dynamics and Correlation of Energy Prices

- Use high-frequency price data to characterize the individual and joint behavior of energy spot, futures and forward prices

Joint distribution of electricity and natural gas forward prices for a given maturity
Seasonals in Futures Prices: Nymex Henry Hub Futures
Energy Asset Valuation and Risk Management

- Real-option approach for valuing energy assets – a foundation for asset securitization

At a certain time, price, and generation level, what is the best decision?
- Ramp-up?
- Ramp-down?
- Keep the same generation?

Which strategy gives more value?
Conclusions

- REFM is already up and running.
  - Successfully hired REFM Lab Director, Paulo Issler, Ph.D.
  - Completed short-term and long term planning objectives.
  - Completed proposal for lab cluster design.
- Data sets are in place as analytical tools: working to verify all contractual obligations for access.
- Research papers are in progress: