Discount Rates and Cash Flows:

A Local Projection Approach

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Abstract

We develop a **volatility decomposition** derived from flexible and robust **local projections** to quantify the relative contributions of expected discount rates and cash flows to the variation of dividend yields. Local projections enable the incorporation of **large information sets**, the use of **monthly data** along with annual data, and to consider **time variation** in the volatility decomposition. While the variation of expected discount rates remains the dominant contributor to market volatility, we find that the **contribution of expected cash flows is non-negligible** when moving beyond the standard model with the dividend yield as the single state variable.

Methodology

Campbell-Shiller (1988) **log-linear present value model:**

$$
\begin{aligned}
dp_t = E_t \sum_{j=1}^{k} \rho^{j-1} r_{t+j} &- E_t \sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j} + E_t \rho^k dp_{t+k} \\
\equiv \quad \delta_t^{(r,k)} \quad &- \quad \delta_t^{(d,k)} \quad + \quad \delta_t^{(dp,k)}
\end{aligned}
$$

Dividend yield dp_t has three components: *(i)* expected returns $\delta_t^{(r,k)}$, *(ii)* expected dividend growth $\delta_t^{(d,k)}$, *(iii)* expected dividend yield $\delta_t^{(dp,k)}$.

Objective: measure relative importance of expected discount rate and cash flow variation, at different horizons k:

$$
\sigma_{(d,r)}^{(k)} \equiv \frac{\mathrm{Std}(\delta_t{}^{(d,k)})}{\mathrm{Std}(\delta_t{}^{(r,k)})}
$$

Conventional VAR approach: estimate $\delta_t^{(r,k)}$ and $\delta_t^{(d,k)}$ by extrapolating expectations from VAR. E.g. Cochrane (2008): $\sigma_{(d,r)}^{(k)} \approx 0$, for long horizons k.

Is all volatility due to variation of discount rates or is VAR a poor model for dividend expectations?

This paper: Local projections (Jordà, 2005) – Horizon-specific regressions:

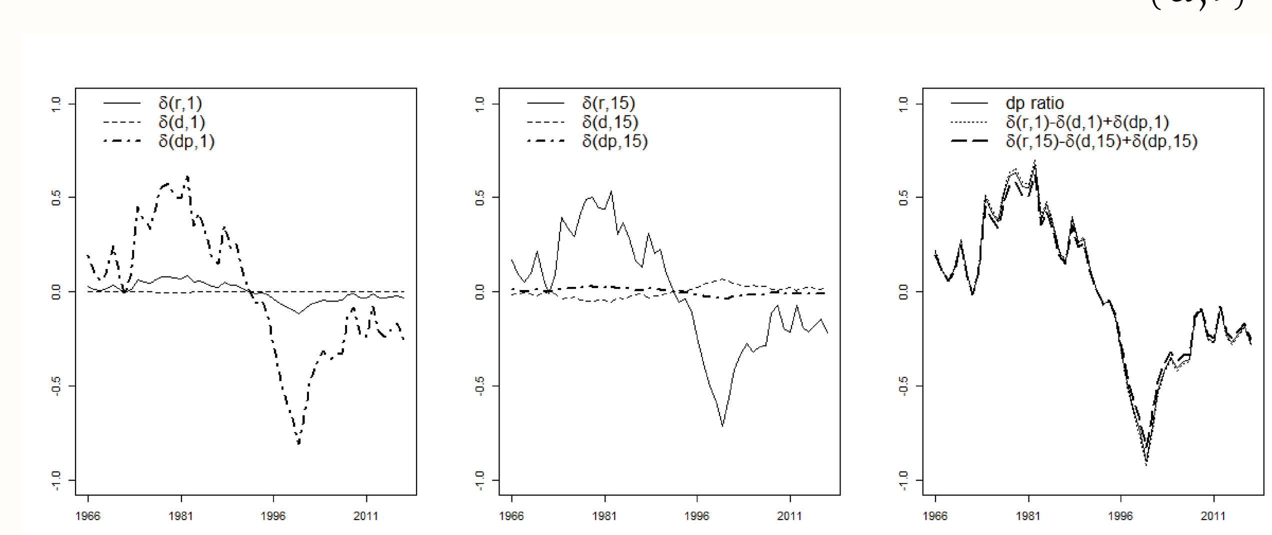
$$
\begin{aligned}
\sum_{j=1}^{k} \rho^{j-1} r_{t+j} &= \alpha^{(r,k)} + X_t^{(r,k)} \beta^{(r,k)} + \varepsilon_{t+k}^{(r,k)} \\
\sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j} &= \alpha^{(d,k)} + X_t^{(d,k)} \beta^{(d,k)} + \varepsilon_{t+k}^{(d,k)} \\
\rho^k dp_{t+k} &= \alpha^{(dp,k)} + X_t^{(dp,k)} \beta^{(dp,k)} + \varepsilon_{t+k}^{(dp,k)}
\end{aligned}
$$

Possible to select **state variables** X_t locally at horizon of interest. Allows for time-varying parameters.

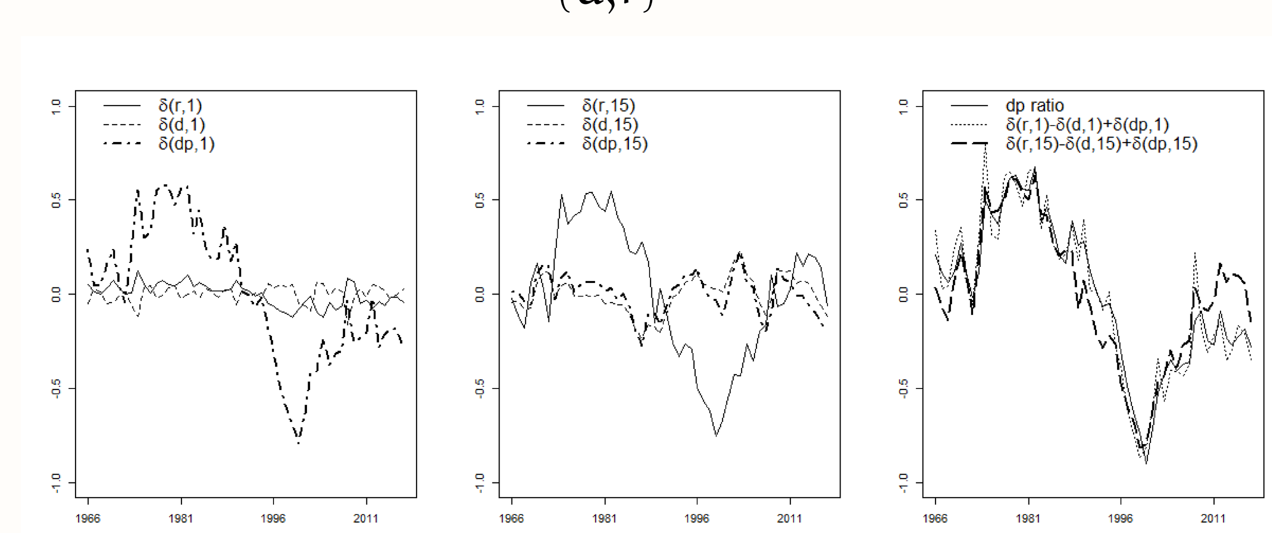
Estimate $\delta_t^{(r,k)}$,$\delta_t^{(d,k)}$ and $\delta_t^{(dp,k)}$ as the fitted values of local projections, for different state variables X_t.

Empirical results

Single state variable: $X_t = dp_t$. For $k = 15$ years, almost all variation is discount rate variation, $\sigma_{(d,r)}^{(k)} = 0.10$:

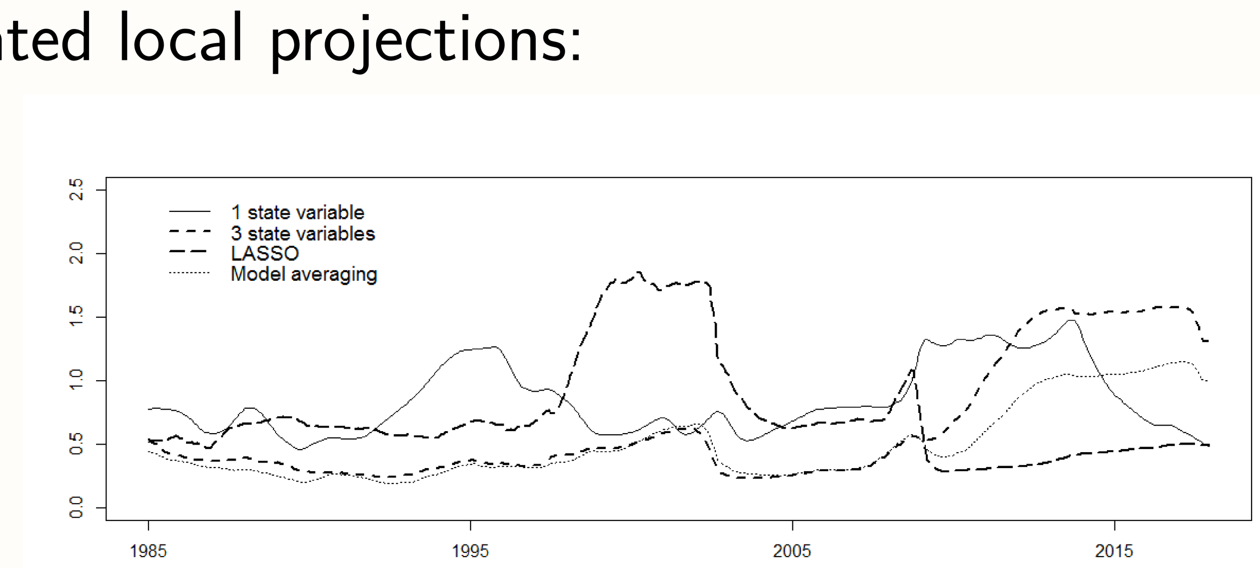


Three state variables: $X_t = (r_t, \Delta d_t, dp_t)$. Larger role for expected cash flows, $\sigma_{(d,r)}^{(15years)} = 0.27$:



LASSO: select X_t from large set of possible state variables, $\sigma_{(d,r)}^{(15years)} = 0.50$.

Time-varying volatility decomposition: Cash flows at times dominate discount rates. $\sigma_{t,(d,r)}^{(180months)}$ from recursively estimated local projections:



Conclusion

Static models with a single state variable suggest that discount rates are the only determinant of market volatility. After allowing for time-varying parameters and/or state variables beyond the lagged dividend yield, cash flow expectations emerge as a significant contributor to volatility.

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