Asset Insurance Premium in the Cross-Section of Asset Synchronicity

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Thought experiment

- Suppose there are $N + 1$ stocks
  - Pick out one stock i
  - What other N stocks are most "similar" to this stock i?
  - What can we say when stock i is very "dissimilar" to the other N assets? What happens when stock i is very "similar"?
- *Theoretically*, we *prove* that this is a meaningful economic question
- *Empirically*, this question is not so simple to answer

Punchline

Empirically, stocks that are most "dissimilar" to *all other stocks* have higher returns than stocks that are most "similar" to other stocks.

Literature review

"Big data" approaches to empirical asset pricing:

▶ Chinco, Clark-Joseph and Ye (JF forthcoming)

▶ Feng, Giglio and Xiu (WP 2017)

▶ Freyberger, Neuhierl and Weber (WP 2017)

▶ Gu, Kelly and Xiu (WP 2018)

▶ Kozak, Nagel and Santosh (JFE forthcoming)

Theoretical motivation

Asset insurance premium

Theorem

Suppose there are $N + 1$ risky assets, a single risk free asset, and all of these risky assets are governed by a linear factor structure with K factors. Then:

(a) *The excess returns R_i of any individual risky asset i can be expressed as:*

$$R_i = \boldsymbol{\beta}_i^\top \boldsymbol{F} + \varepsilon_i$$
$$= \mathbf{b}_i^\top \boldsymbol{R}_{-i} + \boldsymbol{\beta}_i^\top \boldsymbol{\Phi}_i - \mathbf{b}_i^\top \boldsymbol{\varepsilon}_{-i} + \varepsilon_i,$$

where there exists some $N \times 1$ vector $\mathbf{b}_i$ that depends on $\{\boldsymbol{\beta}_j\}_{j \neq i}$.

(b) *We call $K \times 1$ return vector $\boldsymbol{\Phi}_i$ as the returns of **insurance assets** of asset i, and it is constructed as,*

$$\Phi_{i,k} = F_k - \mathbf{c}_k^\top (\boldsymbol{R}_{-i} - \boldsymbol{\varepsilon}_{-i}),$$

where there exists some $N \times 1$ vector $\mathbf{c}_k$ that depends on $\{\boldsymbol{\beta}_j\}_{j \neq i}$.

(c) *If idiosyncratic risks are not priced, then the difference in expectations,*

$$\boxed{\mathbb{E}[R_i] - \mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}] = \boldsymbol{\beta}_i^\top \mathbb{E}[\boldsymbol{\Phi}_i]}$$

*is the **asset insurance premium** of asset i.*

Asset insurance premium

Three key empirical implications from *any* general factor model:

1. Microfoundations for linearly projecting returns R_i of one asset onto the vector of returns for all other assets $\boldsymbol{R}_{-i}$

$$R_i = \mathbf{b}_i^\top \boldsymbol{R}_{-i} + \mathbf{a}_i^\top \boldsymbol{\Phi}_i - \mathbf{b}_i^\top \boldsymbol{\varepsilon}_{-i} + \varepsilon_i$$

2. The difference in expectation

$$\mathbb{E}[R_i] - \mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}] = \mathbf{a}_i^\top \mathbb{E}[\boldsymbol{\Phi}_i]$$

captures an **asset insurance premium** of asset i. The LHS is a *pivotal quantity*.

3. Prediction:

High (low) regression R^2 for asset i

$\implies$ Small (big) difference between $\mathbb{E}[R_i]$ and $\mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}]$

$\implies$ Small (big) asset insurance premium $\mathbf{a}_i^\top \mathbb{E}[\boldsymbol{\Phi}_i]$ for asset i

Use *machine learning method* to econometrically execute point 1, then *portfolio sort* to evaluate point 2 the conditional expectation.

Asset insurance premium
Proof sketch

Fix any risky asset i. By the linear factor model structure,

$$R_i = \beta_i^\top \mathbf{F} + \varepsilon_i \qquad (1)$$

$$\mathbf{R}_{-i} = \mathbf{B}_{-i}\mathbf{F} + \varepsilon_i \qquad (2)$$

Key idea: Use (2) to "solve" for $\mathbf{F}$, and substitute the solved $\mathbf{F}$ into (1).

- _More equations than unknowns in_ (2) — # assets $\gg$ # factors — so $\mathbf{B}_{-i}$ is a $N \times K$ matrix, non-square and thus not invertible.
- Use _least squares approximation_ in (2). A solution $\mathbf{F}$ can be found using the _Moore-Penrose pseudoinverse_ $\mathbf{B}_i^+$.
- The $K \times 1$ return vector $\mathbf{\Phi}_i$ (i.e. the K insurance assets) is the approximation error from the above least squares approximation.

Empirical implementation

Projecting an asset onto the rest of the asset span

Motivated by the Theorem, we want to *empirically linearly project* an asset return R_i onto the span of all other assets $\boldsymbol{R}_{-i}$ to estimate $\mathbf{b}_i^\top \boldsymbol{R}_{-i}$.

We will use *daily* data, but:

▶ *OLS will* **not** *work*!

▶ Appeal to a *machine learning* method.

OLS vs. Elastic-Net
Issues with OLS

Suppose y is $T \times 1$ and X is $T \times N$. The *OLS estimator* (ignoring intercept):

$$\hat{\beta}_{\mathrm{OLS}} = \arg\min_{\beta \in \mathbb{R}^N} \frac{1}{2T} \|y - X\beta\|_2^2$$

▶ Need that $X^\top X$ is invertible (rank condition) — necessarily that $T > N$

When regressing on *all other* stocks (so N of them), we have far more stocks than time samples at *any* time frequency (i.e. daily, monthly, etc) — $N \gg T$

▶ Existence of OLS estimator fails outright
▶ The simple statistic idea — leaving aside economics — of "regressing on all stocks" *cannot* be addressed via OLS

OLS vs. Elastic-Net

Elastic-Net

The Elastic-Net is OLS plus L_1-norm and L_2-norm penalties:

$$\hat{\beta}_{\text{EN}} = \underset{\beta \in \mathbb{R}^N}{\arg\min} \left\{ ||y - X\beta||_2^2 + \lambda_1 ||\beta||_1 + \lambda_2 ||\beta||_2^2 \right\}, \quad \lambda_1, \lambda_2 \geq 0$$

- ▶ OLS rank condition not necessarily — can allow for $N \gg T$
- ▶ $\lambda_1 = 0, \lambda_2 = 0$: OLS (i.e. minimizes fitting error)
- ▶ $\lambda_1 = 0$: Ridge (i.e. encourages "grouping" in fitting)
- ▶ $\lambda_2 = 0$: LASSO (i.e. encourages "sparsity" in fitting)
- ▶ For any fixed $\lambda_1, \lambda_2 \geq 0$, the objective function is convex
- ▶ Sparse solutions — even when N is large, the number of non-zero $\hat{\beta}_{\text{EN}}$-coefficients will be small; particularly useful when we need to investigate portfolio replicability

Estimation procedure

Data:

1. CRSP data from December 1974 to December 2017
2. Fama-French data

Two steps:

1. Projection
2. Construct "ghost portfolio"

Projection

One month ahead

Month end $t-1=$ Mar 31 1996

Twelve months of daily observations $d_1, \ldots, D_{i,t-1}$

Mar 31 1995

i $\quad$ 1 $\quad$ $\cdots$ $\quad$ $i-1$ $\quad$ $i+1$ $\quad$ $\cdots$ $\quad$ N_t

$\hat{\beta}_{i,t-1}$ and $R^2_{i,t-1}$

Monthly return of *actual* stock i
$$R^{\text{Act}}_{i,t} \equiv R_{i,t} = \frac{P_{i,t}}{P_{i,t-1}} - 1$$

Monthly return of the *ghost portfolio* of stock i
$$R^{\text{Gho}}_{i,t} = (1 - \mathbf{1}^\top \hat{\beta}_{i,t-1}) r_{f,t} + \boldsymbol{R}^\top_{-i,t} \hat{\beta}_{i,t-1}$$

$t=$ Apr 30 1996
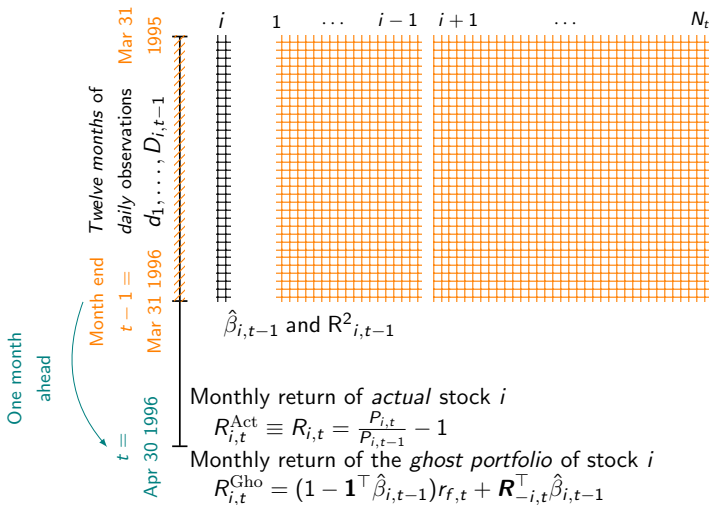
Number of regressors
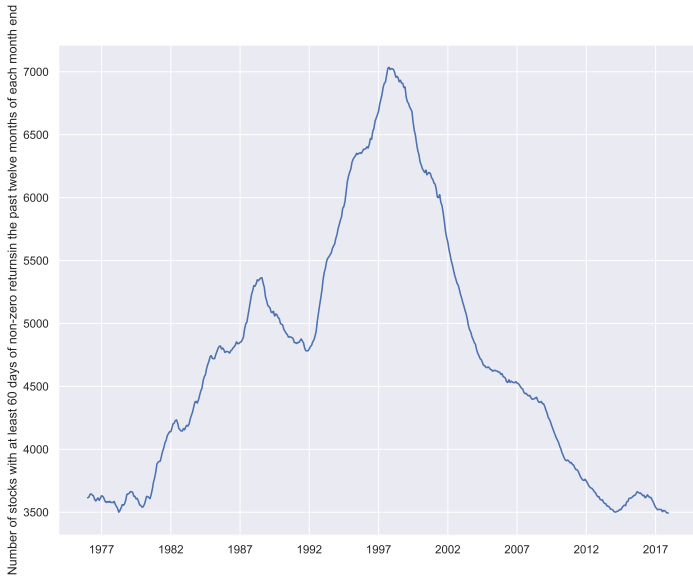
One month ahead returns

Three types

The i-th "actual stock" at month t

$$R_{i,t}^{\text{Act}} \equiv R_{i,t} = \frac{\text{Price}_{i,t}}{\text{Price}_{i,t-1}} - 1$$

This is R_i in the Theorem

The "ghost portfolio" of stock i at month t

$$R_{i,t}^{\text{Gho}} := (1 - \mathbf{1}^\top \hat{\beta}_{i,t-1}) r_{f,t} + \boldsymbol{R}_{-i,t}^\top \hat{\beta}_{i,t-1}$$

This proxies for $\mathbf{b}_i^\top \boldsymbol{R}_{-i}$ in the Theorem

Long actual & short ghost of stock i at month t

$$R_{i,t}^{\text{LS}} := R_{i,t}^{\text{Act}} - R_{i,t}^{\text{Gho}}$$

This proxies for $R_i - \mathbf{b}_i^\top \boldsymbol{R}_{-i}$ in the Theorem

One month ahead return

Three types

R_i^{Act}

$R_i^{Id} = R_i^{\mathrm{Act}} - R_i^{\mathrm{Gho}}$

R_i^{Gho}

$\mathbf{X}_i \mapsto \mathrm{span}\left\{R_1, \ldots, R_{i-1}, R_{i+1}, \ldots, R_{N_i}\right\}$
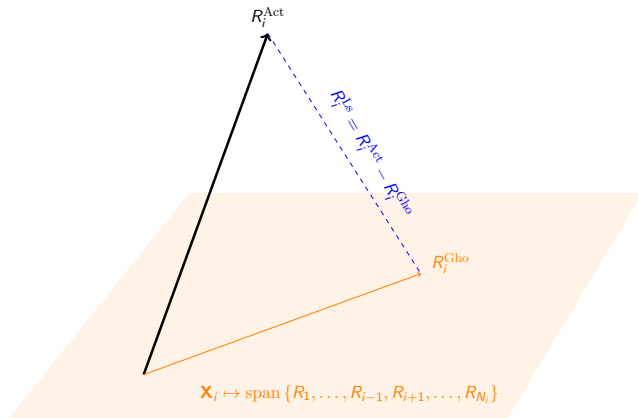
Portfolio formation

Sorting by $R^2_{i,t-1}$'s into *decile* bins B^k_{t-1}, for $k = 1('\text{Lo}'), 2\ldots, 10('\text{Hi}')$

Portfolio of one-month ahead excess returns of *actual stocks*

$$\bar{R}^k_{\text{ActEql,t}} := \frac{1}{|B^k_{t-1}|} \sum_{i \in B^k_{t-1}} (R^{\text{Act}}_{i,t} - r_{f,t}) \quad , \quad \bar{R}^k_{\text{ActVal,t}} := \sum_{i \in B^k_{t-1}} w^k_{i,t-1}(R^{\text{Act}}_{i,t} - r_{f,t})$$

This proxies for $\boxed{\mathbb{E}[R_i]}$ in the Theorem.

Portfolio of *ghost stocks*

$$\bar{R}^k_{\text{GhoEql,t}} := \frac{1}{|B^k_{t-1}|} \sum_{i \in B^k_{t-1}} (R^{\text{Gho}}_{i,t} - r_{f,t}) \quad , \quad \bar{R}^k_{\text{GhoVal,t}} := \sum_{i \in B^k_{t-1}} w^k_{i,t-1}(R^{\text{Gho}}_{i,t} - r_{f,t})$$

This proxies for $\boxed{\mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}]}$ in the Theorem

Portfolio of *actuals minus ghosts*

$$\bar{R}^k_{\text{LsEql,t}} := \frac{1}{|B^k_{t-1}|} \sum_{i \in B^k_{t-1}} (R^{\text{Act}}_{i,t} - R^{\text{Gho}}_{i,t}) \quad , \quad \bar{R}^k_{\text{LsVal,t}} := \sum_{i \in B^k_{t-1}} w^k_{i,t-1}(R^{\text{Act}}_{i,t} - R^{\text{Gho}}_{i,t})$$

This proxies for $\boxed{\mathbb{E}[R_i] - \mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}]} = \boxed{\mathbf{a}_i^\top \mathbb{E}[\boldsymbol{\Phi}_i]}$ in the Theorem

Why elastic-net and not other ML methods to improve R^2?

Parsimony: the explicit computation of $\hat{\beta}_{i,t-1}$'s is what allows the construction of the ghost portfolios. Recall,

$$R_{i,t}^{\text{Gho}} = (1 - \mathbf{1}^\top \hat{\beta}_{i,t-1}) r_{f,t} + \underbrace{\boldsymbol{R}_{-i,t}^\top \hat{\beta}_{i,t-1}}_{\substack{\text{linear} \\ \text{portfolio wgts}}}$$

A "fancy" ML method has the generic regression form,

$$\inf_{\boldsymbol{\theta}} \, ||y - \underbrace{g(X; \boldsymbol{\theta})}_{\text{non-linear}}||_2^2$$

In contrast, recall the elastic-net,

$$\hat{\beta}_{\text{EN}} = \arg\min_{\beta \in \mathbb{R}^N} \left\{ ||y - \underbrace{X\beta}_{\text{linear}}||_2^2 + \lambda_1 ||\beta||_1 + \lambda_2 ||\beta||_2^2 \right\}, \quad \lambda_1, \lambda_2 \geq 0$$

Summary statistics

Averaged count of non-zero elements in the estimated elastic-net coefficient vector $\hat{\beta}_{i,t-1}$

Recall,

$$R_{i,t}^{\mathrm{Gho}} = (1 - \mathbf{1}^{\top}\hat{\beta}_{i,t-1})r_{f,t} + \boldsymbol{R}_{-i,t}^{\top}\hat{\beta}_{i,t-1}$$

	mean	std	min	max	p5	p25	med	p75	p95
EN R^2									
Lo	0.505	0.594	0	10	0	0	0	1	1
2	0.639	0.970	0	22	0	0	1	1	2
3	2.004	4.512	0	58	0	0	1	1	11
4	5.448	10.087	0	91	0	0	1	5	29
5	10.184	15.104	0	116	0	1	2	16	43
6	16.059	19.701	0	132	0	1	6	28	56
7	23.024	24.396	0	152	1	2	14	39	70
8	31.407	29.591	1	167	1	4	26	51	87
9	43.724	35.402	1	205	3	9	40	67	109
Hi	79.032	52.403	1	448	10	41	71	108	177

Summary statistics

Averaged sum of all elements in the estimated elastic-net coefficient vector; $\mathbf{1}^\top \hat{\beta}_{i,t-1}$

EN R^2	mean	std	min	max	p5	p25	med	p75	p95
Lo	0.000	0.002	-0.147	0.538	-0.000	0.000	0.000	0.000	0.000
2	0.001	0.009	-0.132	0.427	-0.000	0.000	0.000	0.000	0.006
3	0.017	0.063	-0.265	1.078	-0.000	0.000	0.000	0.000	0.109
4	0.055	0.132	-0.485	1.658	-0.000	0.000	0.000	0.033	0.340
5	0.102	0.178	-0.342	1.771	-0.000	0.000	0.006	0.139	0.494
6	0.156	0.219	-0.472	2.117	-0.001	0.000	0.034	0.263	0.619
7	0.214	0.256	-0.216	2.245	-0.004	0.003	0.106	0.374	0.721
8	0.278	0.289	-0.399	2.580	-0.006	0.010	0.210	0.483	0.815
9	0.364	0.320	-0.293	3.289	-0.006	0.033	0.346	0.603	0.915
Hi	0.531	0.337	-0.391	4.674	0.008	0.261	0.567	0.773	1.043

Main results

Univariate **equal weight** excess returns (monthly % points)

EN R^2	Actual			Ghost			Act - Gho		
	mean	sd	t	mean	sd	t	mean	sd	t
Lo	1.440	4.964	(5.024)	-0.000	0.527	(-0.204)	1.440	4.966	(5.027)
2	1.158	4.877	(3.962)	0.005	0.661	(1.273)	1.153	4.872	(3.957)
3	0.958	4.980	(3.167)	0.043	1.662	(1.444)	0.916	4.890	(3.141)
4	0.889	4.972	(2.971)	0.104	2.606	(1.289)	0.788	4.717	(2.948)
5	0.875	5.014	(3.006)	0.136	3.082	(1.176)	0.740	4.571	(3.085)
6	0.849	5.109	(2.976)	0.153	3.425	(1.102)	0.698	4.483	(3.244)
7	0.860	5.179	(3.039)	0.223	3.786	(1.360)	0.639	4.308	(3.285)
8	0.890	5.333	(3.099)	0.254	4.219	(1.309)	0.640	4.152	(3.617)
9	0.824	5.464	(2.876)	0.280	4.669	(1.249)	0.546	3.972	(3.541)
Hi	0.786	5.360	(2.827)	0.416	4.898	(1.670)	0.371	3.384	(3.245)
Hi - Lo	-0.653	4.011	(-4.246)	0.417	4.899	(1.674)	-1.069	4.684	(-3.904)
Avg	0.953	5.023	(3.406)	0.161	3.170	(1.437)	0.793	4.256	(3.942)

▶ *Monotonic decrease* in long-short premia in Act − Gho

Main Results I: Unconditional average AIP and in the cross-section of asset synchronicity

Main results

Univariate **value weight** excess returns (monthly % points)

	Actual			**Ghost**			**Act - Gho**		
EN R^2	mean	sd	t	mean	sd	t	mean	sd	t
Lo	0.969	4.366	(5.034)	-0.001	0.529	(-0.418)	0.976	4.368	(5.081)
2	0.817	4.311	(4.341)	0.003	0.698	(0.819)	0.817	4.306	(4.364)
3	0.581	4.220	(3.117)	0.028	1.417	(1.358)	0.557	4.176	(3.057)
4	0.573	4.183	(3.176)	0.055	1.970	(1.235)	0.518	4.097	(3.089)
5	0.621	4.123	(3.672)	0.059	2.302	(0.969)	0.564	3.933	(3.792)
6	0.542	4.250	(2.981)	0.095	2.734	(1.088)	0.448	3.930	(2.950)
7	0.751	4.374	(3.863)	0.144	3.071	(1.295)	0.608	3.925	(4.156)
8	0.640	4.491	(3.155)	0.163	3.440	(1.192)	0.480	3.845	(3.460)
9	0.639	4.656	(2.842)	0.158	3.907	(0.899)	0.482	3.654	(3.825)
Hi	0.628	4.795	(2.677)	0.325	4.314	(1.617)	0.305	3.342	(2.700)
Hi - Lo	-0.341	3.954	(-2.174)	0.326	4.314	(1.623)	-0.671	4.138	(-3.536)
Avg	0.676	4.191	(3.757)	0.103	2.613	(1.307)	0.575	3.705	(4.333)

Note: The "value weight" of the ghost portfolio of stock i are identical to the value weight of the actual stock i.

Insurance property of the ghosts

Correlation between one month ahead $R_{i,t}^{\mathrm{Act}}$ and $R_{i,t}^{\mathrm{Gho}}$

EN R^2	Lo Ghost	2	3	4	5	6	7	8	9	Hi Ghost
Lo Actual	-0.096	0.099	0.319	0.418	0.494	0.563	0.614	0.638	0.663	0.775
2	-0.089	0.111	0.319	0.416	0.501	0.583	0.644	0.676	0.699	0.795
3	-0.091	0.142	0.374	0.466	0.547	0.627	0.686	0.711	0.724	0.812
4	-0.093	0.114	0.355	0.483	0.579	0.666	0.722	0.744	0.749	0.828
5	-0.088	0.118	0.355	0.493	0.598	0.691	0.750	0.772	0.777	0.853
6	-0.080	0.108	0.334	0.473	0.579	0.679	0.749	0.781	0.796	0.876
7	-0.060	0.118	0.329	0.463	0.568	0.673	0.755	0.803	0.829	0.903
8	-0.049	0.121	0.319	0.446	0.548	0.655	0.750	0.819	0.860	0.929
9	-0.053	0.101	0.288	0.406	0.505	0.614	0.715	0.795	0.858	0.938
Hi Actual	-0.043	0.105	0.285	0.402	0.497	0.596	0.680	0.743	0.802	0.921

Table: Equal-weighted portfolios

Insurance property of the ghosts

Correlation between one month ahead $R_{i,t}^{\text{Act}}$ and $R_{i,t}^{\text{Gho}}$

EN R^2	Lo Ghost	2	3	4	5	6	7	8	9	Hi Ghost
Lo Actual	-0.077	0.006	0.192	0.284	0.344	0.380	0.430	0.482	0.507	0.638
2	-0.056	0.109	0.246	0.353	0.420	0.480	0.523	0.560	0.575	0.661
3	-0.076	0.084	0.233	0.323	0.385	0.424	0.462	0.491	0.511	0.620
4	-0.082	0.010	0.162	0.291	0.364	0.417	0.460	0.486	0.503	0.612
5	-0.084	0.036	0.221	0.353	0.432	0.480	0.519	0.545	0.568	0.662
6	-0.049	0.084	0.246	0.385	0.468	0.533	0.560	0.589	0.609	0.708
7	-0.053	0.088	0.258	0.393	0.477	0.542	0.603	0.648	0.685	0.766
8	-0.043	0.115	0.306	0.441	0.518	0.580	0.626	0.688	0.730	0.811
9	-0.041	0.121	0.301	0.433	0.514	0.587	0.644	0.721	0.793	0.861
Hi Actual	-0.014	0.109	0.271	0.392	0.472	0.535	0.598	0.679	0.746	0.877

Table: Value-weighted portfolios

Main results

Asset synchronicity

We say a stock has high (low) *asset synchronicity* if it has a high (low) R^2 with all other stocks.

Asset insurance premium

We define *asset insurance premium* as the difference between a portfolio of actual stocks returns, less portfolio of its ghost counterpart returns.

Controlling for FF5 factor risks

		Actual			Ghost			Act - Gho		
		coef	sd	t	coef	sd	t	coef	sd	t
EN R^2										
Lo	const	1.314	0.251	(5.230)	-0.002	0.002	(-0.929)	1.317	0.251	(5.243)
2	const	0.961	0.243	(3.951)	0.002	0.004	(0.623)	0.958	0.242	(3.957)
3	const	0.757	0.256	(2.956)	0.032	0.028	(1.160)	0.725	0.245	(2.966)
4	const	0.714	0.262	(2.724)	0.074	0.076	(0.982)	0.644	0.228	(2.819)
5	const	0.740	0.263	(2.820)	0.089	0.111	(0.803)	0.652	0.206	(3.171)
6	const	0.752	0.263	(2.855)	0.095	0.137	(0.692)	0.658	0.186	(3.536)
7	const	0.850	0.272	(3.126)	0.167	0.161	(1.037)	0.684	0.177	(3.867)
8	const	0.925	0.277	(3.339)	0.216	0.188	(1.152)	0.711	0.167	(4.258)
9	const	0.901	0.287	(3.140)	0.289	0.217	(1.334)	0.616	0.157	(3.923)
Hi	const	0.875	0.287	(3.046)	0.428	0.244	(1.757)	0.447	0.122	(3.657)
	const	-0.440	0.157	(-2.802)	0.431	0.243	(1.770)	-0.869	0.232	(-3.751)
	Mkt-RF	-16.786	3.604	(-4.658)	13.836	7.134	(1.939)	-30.604	6.128	(-4.994)
_Hi - Lo_	HML	-8.512	7.894	(-1.078)	-0.850	14.450	(-0.059)	-7.643	12.105	(-0.631)
	SMB	-19.844	6.843	(-2.900)	-4.122	8.811	(-0.468)	-15.669	7.875	(-1.990)
	CMA	-1.747	13.970	(-0.125)	-8.862	23.430	(-0.378)	7.154	19.511	(0.367)
	RMW	-7.101	8.611	(-0.825)	-20.844	11.091	(-1.879)	13.552	10.679	(1.269)
	const	0.879	0.255	(3.442)	0.139	0.109	(1.276)	0.741	0.177	(4.184)
	Mkt-RF	21.693	6.878	(3.154)	7.893	3.429	(2.302)	13.817	4.458	(3.099)
Avg	HML	12.235	12.066	(1.014)	3.353	6.428	(0.522)	8.881	8.853	(1.003)
	SMB	10.672	9.055	(1.178)	-3.124	3.146	(-0.993)	13.789	6.977	(1.976)
	CMA	-32.935	23.274	(-1.415)	-2.652	8.968	(-0.296)	-30.292	17.087	(-1.773)
	RMW	-13.493	11.441	(-1.179)	-7.685	4.191	(-1.833)	-5.838	9.073	(-0.643)

Table: Equal-weighted portfolios

Controlling for FF5 factor risks

		Actual			Ghost			Act - Gho		
		coef	sd	t	coef	sd	t	coef	sd	t
EN R^2										
Lo	const	1.051	0.205	(5.120)	-0.003	0.002	(-1.104)	1.061	0.205	(5.180)
2	const	0.845	0.197	(4.289)	-0.000	0.004	(-0.109)	0.849	0.197	(4.320)
3	const	0.553	0.192	(2.880)	0.021	0.019	(1.103)	0.536	0.188	(2.848)
4	const	0.559	0.188	(2.971)	0.033	0.043	(0.777)	0.525	0.175	(2.996)
5	const	0.664	0.172	(3.858)	0.026	0.062	(0.426)	0.640	0.149	(4.300)
6	const	0.605	0.184	(3.289)	0.058	0.087	(0.673)	0.547	0.150	(3.651)
7	const	0.881	0.199	(4.428)	0.104	0.107	(0.975)	0.779	0.152	(5.130)
8	const	0.765	0.211	(3.618)	0.151	0.134	(1.133)	0.616	0.153	(4.029)
9	const	0.772	0.229	(3.369)	0.185	0.165	(1.123)	0.587	0.139	(4.212)
Hi	const	0.740	0.249	(2.967)	0.341	0.197	(1.733)	0.400	0.128	(3.121)
	const	-0.311	0.160	(-1.944)	0.344	0.196	(1.751)	-0.661	0.187	(-3.539)
	Mkt-RF	1.304	4.848	(0.269)	9.549	5.416	(1.763)	-8.166	4.578	(-1.784)
Hi - Lo	HML	-7.458	10.240	(-0.728)	1.235	10.800	(0.114)	-8.714	8.036	(-1.084)
	SMB	-9.962	5.427	(-1.836)	-1.693	6.858	(-0.247)	-8.303	5.636	(-1.473)
	CMA	14.999	14.358	(1.045)	-11.706	17.570	(-0.666)	26.868	14.266	(1.883)
	RMW	-9.531	8.262	(-1.154)	-15.026	8.903	(-1.688)	5.522	9.407	(0.587)
	const	0.744	0.187	(3.985)	0.092	0.077	(1.199)	0.654	0.142	(4.606)
	Mkt-RF	2.287	5.182	(0.441)	5.032	2.406	(2.092)	-2.726	3.577	(-0.762)
Avg	HML	7.701	7.589	(1.015)	2.949	4.472	(0.659)	4.772	5.920	(0.806)
	SMB	1.509	6.039	(0.250)	-1.689	2.268	(-0.745)	3.200	4.658	(0.687)
	CMA	-29.064	14.597	(-1.991)	-3.612	5.920	(-0.610)	-25.473	11.462	(-2.222)
	RMW	-9.773	7.111	(-1.374)	-5.292	2.840	(-1.864)	-4.489	5.643	(-0.795)

Table: Value-weighted portfolios

Main Results II: Asset synchronicity and macroeconomic countercyclicality

Macroeconomic relevance of asset synchronicity
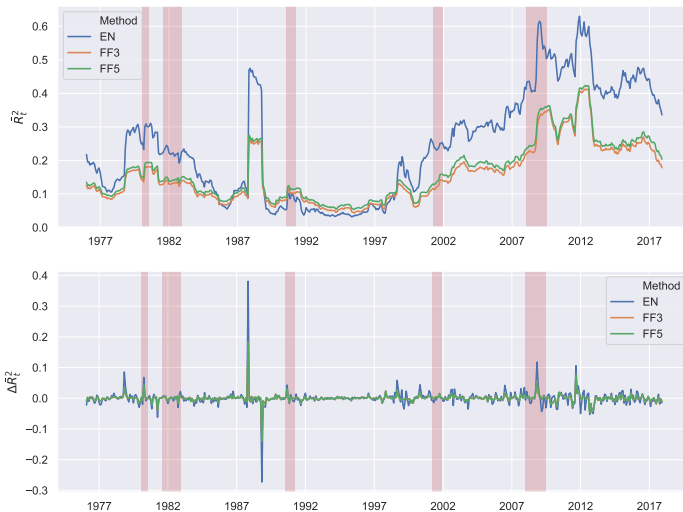
Countercyclical to consumption shocks

	Macro regressors			Financial regressors			All regressors		
	(1) EN $\Delta(\bar{R}^2)_t$	(2) FF3 $\Delta(\bar{R}^2)_t$	(3) FF5 $\Delta(\bar{R}^2)_t$	(4) EN $\Delta(\bar{R}^2)_t$	(5) FF3 $\Delta(\bar{R}^2)_t$	(6) FF5 $\Delta(\bar{R}^2)_t$	(7) EN $\Delta(\bar{R}^2)_t$	(8) FF3 $\Delta(\bar{R}^2)_t$	(9) FF5 $\Delta(\bar{R}^2)_t$
ΔINDPRO_t	0.411 (1.480)	0.184 (1.344)	0.168 (1.239)				0.295 (1.522)	0.114 (1.233)	0.099 (1.077)
ΔPCE_t	−0.665 (−1.957)	−0.414 (−2.576)	−0.408 (−2.568)				−0.473 (−2.052)	−0.307 (−2.842)	−0.300 (−2.808)
ΔUNRATE_t	0.067 (1.186)	0.031 (1.096)	0.032 (1.113)				0.074 (1.475)	0.034 (1.358)	0.035 (1.389)
ΔPAYEMS_t	1.268 (1.026)	0.541 (0.950)	0.560 (0.990)				1.343 (1.138)	0.589 (1.114)	0.607 (1.160)
$\Delta\text{INDPRO}_{t-1}$	−0.014 (−0.051)	−0.032 (−0.225)	−0.029 (−0.209)				0.103 (0.442)	0.034 (0.289)	0.038 (0.326)
ΔPCE_{t-1}	−0.459 (−1.244)	−0.259 (−1.542)	−0.259 (−1.557)				−0.286 (−0.995)	−0.161 (−1.237)	−0.161 (−1.241)
$\Delta\text{UNRATE}_{t-1}$	0.041 (0.977)	0.026 (1.204)	0.028 (1.310)				0.045 (1.053)	0.027 (1.262)	0.029 (1.370)
$\Delta\text{PAYEMS}_{t-1}$	−0.868 (−1.127)	−0.451 (−1.115)	−0.418 (−1.037)				−1.004 (−1.320)	−0.533 (−1.322)	−0.500 (−1.244)
MktRF_t				−0.178 (−2.046)	−0.103 (−2.595)	−0.104 (−2.630)	−0.170 (−2.141)	−0.098 (−2.705)	−0.099 (−2.747)
LIQ_t				−0.013 (−0.308)	−0.003 (−0.152)	−0.004 (−0.218)	−0.012 (−0.283)	−0.001 (−0.032)	−0.002 (−0.101)
Constant	0.001 (0.929)	0.001 (1.228)	0.001 (1.229)	0.001 (0.974)	0.001 (1.034)	0.001 (1.093)	0.002 (1.430)	0.001 (1.660)	0.001 (1.680)
Observations	503	503	503	503	503	503	503	503	503
R^2	0.030	0.038	0.037	0.086	0.109	0.111	0.105	0.132	0.134
Adjusted R^2	0.014	0.022	0.021	0.082	0.106	0.108	0.087	0.115	0.116

'Avg' AIP on financial & macro variables

Equal-weight

	EN Avg			FF3 Avg			FF5 Avg		
	(1) Act	(2) Gho	(3) Act - Gho	(4) Act	(5) Gho	(6) Act - Gho	(7) Act	(8) Gho	(9) Act - Gho
ΔINDPRO_t	0.107	0.401	−0.292	0.108	0.401	−0.290	0.108	0.401	−0.290
	(0.151)	(1.229)	(−0.556)	(0.153)	(1.229)	(−0.554)	(0.153)	(1.229)	(−0.553)
ΔPCE_t	2.432	0.324	2.104	2.434	0.324	2.105	2.434	0.324	2.105
	(1.935)	(0.827)	(2.160)	(1.936)	(0.827)	(2.160)	(1.936)	(0.827)	(2.160)
ΔUNRATE_t	−0.042	−0.016	−0.025	−0.041	−0.016	−0.025	−0.041	−0.016	−0.025
	(−0.262)	(−0.254)	(−0.235)	(−0.262)	(−0.254)	(−0.235)	(−0.262)	(−0.254)	(−0.236)
ΔPAYEMS_t	−5.240	−2.137	−3.120	−5.246	−2.137	−3.126	−5.246	−2.137	−3.126
	(−2.815)	(−2.140)	(−2.622)	(−2.818)	(−2.140)	(−2.626)	(−2.818)	(−2.140)	(−2.626)
$\Delta\text{INDPRO}_{t-1}$	0.779	−0.041	0.819	0.779	−0.041	0.818	0.779	−0.041	0.818
	(1.107)	(−0.139)	(1.592)	(1.107)	(−0.139)	(1.592)	(1.106)	(−0.139)	(1.591)
ΔPCE_{t-1}	−1.759	0.085	−1.841	−1.758	0.085	−1.839	−1.759	0.085	−1.839
	(−1.396)	(0.205)	(−1.887)	(−1.396)	(0.205)	(−1.883)	(−1.396)	(0.205)	(−1.884)
$\Delta\text{UNRATE}_{t-1}$	0.158	0.052	0.106	0.159	0.052	0.107	0.159	0.052	0.107
	(0.860)	(0.725)	(0.864)	(0.863)	(0.725)	(0.867)	(0.863)	(0.725)	(0.868)
$\Delta\text{PAYEMS}_{t-1}$	3.464	0.906	2.563	3.460	0.906	2.559	3.458	0.906	2.558
	(2.217)	(1.044)	(2.437)	(2.212)	(1.044)	(2.434)	(2.211)	(1.044)	(2.432)
MktRF_t	0.282	0.099	0.183	0.283	0.099	0.184	0.283	0.099	0.184
	(4.466)	(2.691)	(4.945)	(4.483)	(2.691)	(4.970)	(4.482)	(2.691)	(4.968)
LIQ_t	−0.099	−0.056	−0.043	−0.099	−0.056	−0.043	−0.099	−0.056	−0.043
	(−1.225)	(−1.417)	(−0.805)	(−1.231)	(−1.417)	(−0.811)	(−1.231)	(−1.417)	(−0.811)
Constant	0.007	0.001	0.006	0.007	0.001	0.006	0.007	0.001	0.006
	(1.748)	(0.585)	(2.421)	(1.747)	(0.585)	(2.419)	(1.748)	(0.585)	(2.419)
Observations	504	504	504	504	504	504	504	504	504
R^2	0.074	0.051	0.076	0.074	0.051	0.077	0.074	0.051	0.077
Adjusted R^2	0.055	0.031	0.057	0.056	0.031	0.058	0.056	0.031	0.058

'Avg' AIP on financial & macro variables

Value-weight

	EN Avg			FF3 Avg			FF5 Avg		
	(1) Act	(2) Gho	(3) Act - Gho	(4) Act	(5) Gho	(6) Act - Gho	(7) Act	(8) Gho	(9) Act - Gho
ΔINDPRO_t	0.175 (0.323)	0.230 (0.968)	−0.058 (−0.136)	0.124 (0.241)	0.292 (1.199)	−0.171 (−0.432)	0.042 (0.081)	0.256 (1.096)	−0.216 (−0.530)
ΔPCE_t	2.137 (2.277)	0.315 (1.238)	1.823 (2.350)	1.917 (1.955)	0.282 (1.181)	1.635 (2.029)	2.004 (2.066)	0.286 (1.293)	1.717 (2.111)
ΔUNRATE_t	0.054 (0.490)	−0.015 (−0.331)	0.070 (0.785)	0.033 (0.312)	−0.009 (−0.208)	0.042 (0.527)	0.017 (0.157)	−0.009 (−0.219)	0.026 (0.333)
ΔPAYEMS_t	−3.283 (−2.307)	−1.561 (−2.321)	−1.719 (−1.525)	−3.545 (−2.589)	−1.977 (−2.344)	−1.977 (−1.904)	−3.604 (−2.670)	−1.498 (−2.265)	−2.099 (−2.027)
$\Delta\text{INDPRO}_{t-1}$	0.590 (1.032)	0.024 (0.110)	0.566 (1.242)	0.625 (1.175)	−0.027 (−0.123)	0.650 (1.596)	0.726 (1.358)	−0.008 (−0.038)	0.733 (1.751)
ΔPCE_{t-1}	−1.779 (−1.933)	−0.035 (−0.130)	−1.744 (−2.335)	−1.504 (−1.570)	0.024 (0.095)	−1.525 (−1.937)	−1.660 (−1.750)	0.006 (0.026)	−1.664 (−2.085)
$\Delta\text{UNRATE}_{t-1}$	−0.051 (−0.403)	0.028 (0.561)	−0.079 (−0.824)	−0.004 (−0.033)	0.022 (0.472)	−0.026 (−0.303)	0.015 (0.130)	0.022 (0.490)	−0.007 (−0.082)
$\Delta\text{PAYEMS}_{t-1}$	1.907 (1.546)	0.717 (1.233)	1.194 (1.068)	2.089 (1.717)	0.601 (1.028)	1.495 (1.431)	1.926 (1.641)	0.548 (0.941)	1.384 (1.367)
MktRF_t	0.074 (1.604)	0.066 (2.479)	0.009 (0.285)	0.145 (3.062)	0.071 (2.477)	0.075 (2.612)	0.146 (3.090)	0.067 (2.425)	0.080 (2.677)
LIQ_t	−0.021 (−0.397)	−0.034 (−1.262)	0.013 (0.334)	−0.033 (−0.622)	−0.031 (−1.112)	−0.003 (−0.069)	−0.032 (−0.583)	−0.032 (−1.192)	0.0003 (0.008)
Constant	0.006 (2.025)	0.001 (0.521)	0.005 (2.711)	0.005 (1.837)	0.001 (0.609)	0.004 (2.380)	0.006 (2.029)	0.001 (0.658)	0.005 (2.550)
Observations	504	504	504	504	504	504	504	504	504
R^2	0.043	0.049	0.043	0.057	0.056	0.049	0.057	0.052	0.052
Adjusted R^2	0.024	0.030	0.023	0.038	0.036	0.030	0.038	0.033	0.033

Comparing against the Fama-French 3 and 5 ghost portfolios

Proportion into equity only

Plotting $\mathbf{1}^{\top}\hat{\beta}_{i,t-1}$ across time for the elastic-net, FF3 and FF5 methods
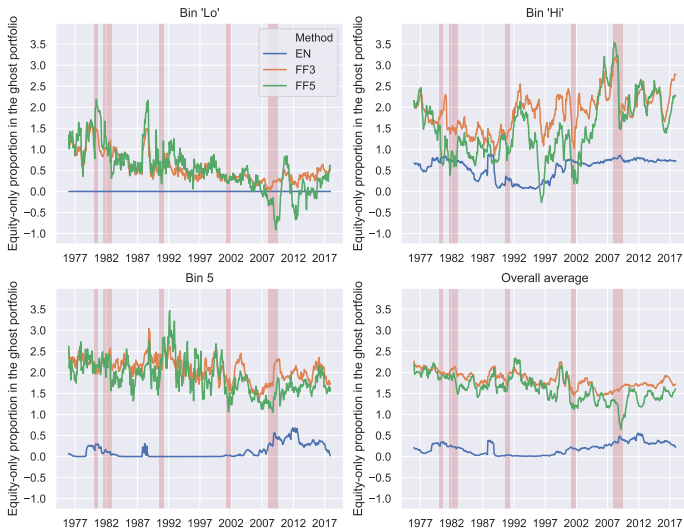
Compare to FF3-R^2 bin sorts

Univariate **value weight** excess returns (monthly % points)

FF3 R^2	Actual			Ghost			Act - Gho		
	mean	sd	*t*	mean	sd	*t*	mean	sd	*t*
Lo	0.610	4.149	(2.795)	0.030	1.415	(1.588)	0.588	4.075	(2.788)
2	0.632	4.500	(2.619)	0.023	1.811	(0.621)	0.611	4.357	(2.680)
3	0.769	4.397	(3.348)	0.016	2.093	(0.366)	0.760	4.136	(3.712)
4	0.651	4.338	(3.156)	0.085	2.325	(1.273)	0.573	4.064	(3.234)
5	0.718	4.357	(3.511)	0.142	2.665	(1.631)	0.579	3.993	(3.553)
6	0.617	4.343	(3.014)	0.148	2.772	(1.633)	0.473	3.948	(2.899)
7	0.701	4.327	(3.525)	0.119	2.897	(1.161)	0.586	3.859	(3.917)
8	0.668	4.346	(3.470)	0.159	3.100	(1.393)	0.511	3.813	(3.755)
9	0.703	4.514	(3.452)	0.206	3.478	(1.454)	0.501	3.790	(3.685)
Hi	0.594	4.688	(2.657)	0.206	4.039	(1.171)	0.389	3.494	(3.212)
Hi - Lo	-0.015	4.287	(-0.076)	0.176	3.989	(1.046)	-0.199	4.289	(-0.882)
Avg	0.666	4.192	(3.427)	0.113	2.603	(1.405)	0.557	3.660	(3.895)

▶ No result in 'Hi - Lo'

▶ Essentially same result in 'Avg' bin as EN R^2 sort

Compare to FF5-R^2 bin sorts

Univariate **value weight** returns (monthly % points)

	Actual			Ghost			Act - Gho		
	mean	sd	t	mean	sd	t	mean	sd	t
FF5 R^2									
Lo	0.546	4.093	(2.560)	0.022	1.089	(1.800)	0.532	4.040	(2.556)
2	0.605	4.424	(2.596)	0.023	1.727	(0.641)	0.589	4.291	(2.694)
3	0.894	4.491	(3.973)	0.030	2.037	(0.676)	0.869	4.257	(4.276)
4	0.709	4.324	(3.386)	0.098	2.293	(1.493)	0.619	4.081	(3.361)
5	0.838	4.372	(4.023)	0.133	2.624	(1.545)	0.709	4.012	(4.209)
6	0.650	4.370	(3.175)	0.128	2.767	(1.425)	0.523	3.972	(3.214)
7	0.739	4.346	(3.826)	0.168	2.944	(1.664)	0.574	3.865	(3.873)
8	0.692	4.337	(3.699)	0.167	3.056	(1.526)	0.527	3.829	(3.835)
9	0.676	4.466	(3.314)	0.196	3.388	(1.449)	0.484	3.799	(3.454)
Hi	0.595	4.646	(2.677)	0.203	4.009	(1.162)	0.392	3.474	(3.277)
Hi - Lo	0.049	4.161	(0.255)	0.181	3.943	(1.081)	-0.140	4.218	(-0.636)
Avg	0.694	4.206	(3.591)	0.117	2.583	(1.478)	0.582	3.687	(4.043)

▶ Again no result in 'Hi - Lo'
▶ Essentially same result in 'Avg' bin as EN R^2 sort

Controlling for FF5 factor risks

		Actual			**Ghost**			**Act - Gho**		
		coef	sd	t	coef	sd	t	coef	sd	t
FF5 R^2										
Lo	const	0.893	0.243	(3.671)	0.022	0.018	(1.202)	0.875	0.232	(3.778)
2	const	0.857	0.270	(3.169)	0.035	0.034	(1.032)	0.825	0.247	(3.335)
3	const	0.749	0.275	(2.721)	0.064	0.067	(0.963)	0.685	0.232	(2.953)
4	const	0.806	0.286	(2.818)	0.104	0.114	(0.909)	0.706	0.214	(3.307)
5	const	0.878	0.276	(3.175)	0.142	0.136	(1.046)	0.739	0.194	(3.810)
6	const	0.875	0.286	(3.059)	0.178	0.153	(1.167)	0.699	0.192	(3.631)
7	const	0.885	0.262	(3.383)	0.186	0.164	(1.136)	0.699	0.165	(4.227)
8	const	0.952	0.267	(3.563)	0.229	0.174	(1.318)	0.726	0.163	(4.443)
9	const	0.968	0.277	(3.496)	0.269	0.194	(1.388)	0.699	0.155	(4.522)
Hi	const	0.950	0.283	(3.360)	0.309	0.224	(1.381)	0.640	0.130	(4.908)
Hi - Lo	const	0.057	0.213	(0.266)	0.287	0.212	(1.353)	-0.235	0.238	(-0.986)
	Mkt-RF	-40.828	6.780	(-6.022)	9.751	6.301	(1.548)	-50.564	6.890	(-7.339)
	HML	-14.158	11.119	(-1.273)	0.808	12.199	(0.066)	-14.573	10.033	(-1.453)
	SMB	-38.397	8.640	(-4.444)	-7.903	7.699	(-1.026)	-30.351	8.159	(-3.720)
	CMA	-10.050	16.259	(-0.618)	-10.868	20.992	(-0.518)	0.136	15.730	(0.009)
	RMW	-17.375	12.399	(-1.401)	-18.039	9.883	(-1.825)	0.755	11.139	(0.068)
Avg	const	0.881	0.259	(3.401)	0.154	0.122	(1.257)	0.729	0.170	(4.293)
	Mkt-RF	20.783	7.034	(2.954)	9.005	3.835	(2.348)	11.785	4.236	(2.782)
	HML	11.433	12.362	(0.925)	3.021	7.076	(0.427)	8.418	8.605	(0.978)
	SMB	8.506	9.260	(0.918)	-3.546	3.643	(-0.973)	12.023	6.793	(1.770)
	CMA	-33.051	24.049	(-1.374)	-2.853	10.269	(-0.278)	-30.229	16.704	(-1.810)
	RMW	-14.686	11.493	(-1.278)	-9.148	4.767	(-1.919)	-5.585	8.564	(-0.652)

Table: Equal-weighted portfolios

Controlling for FF5 factor risks

		Actual			Ghost			Act - Gho		
		coef	sd	t	coef	sd	t	coef	sd	t
FF5 R^2										
Lo	const	0.446	0.197	(2.261)	0.007	0.023	(0.298)	0.448	0.187	(2.397)
2	const	0.627	0.221	(2.842)	0.055	0.050	(1.106)	0.573	0.200	(2.858)
3	const	0.680	0.224	(3.033)	0.038	0.052	(0.734)	0.645	0.197	(3.276)
4	const	0.644	0.210	(3.071)	0.083	0.073	(1.133)	0.568	0.169	(3.359)
5	const	0.718	0.203	(3.544)	0.084	0.090	(0.939)	0.636	0.161	(3.949)
6	const	0.739	0.209	(3.537)	0.096	0.100	(0.958)	0.645	0.159	(4.068)
7	const	0.688	0.202	(3.408)	0.125	0.105	(1.185)	0.564	0.157	(3.581)
8	const	0.785	0.205	(3.836)	0.142	0.116	(1.221)	0.647	0.152	(4.256)
9	const	0.754	0.217	(3.484)	0.172	0.137	(1.249)	0.586	0.148	(3.966)
Hi	const	0.728	0.238	(3.056)	0.225	0.176	(1.280)	0.503	0.133	(3.785)
	const	0.282	0.195	(1.446)	0.218	0.164	(1.329)	0.055	0.203	(0.271)
	Mkt-RF	-26.483	5.515	(-4.802)	7.736	4.825	(1.604)	-34.204	5.181	(-6.601)
Hi - Lo	HML	-23.999	8.913	(-2.693)	-0.431	9.027	(-0.048)	-23.558	7.402	(-3.183)
	SMB	-14.095	7.910	(-1.782)	-5.160	5.898	(-0.875)	-8.993	7.310	(-1.230)
	CMA	1.369	13.713	(0.100)	-7.475	15.235	(-0.491)	8.806	13.088	(0.673)
	RMW	-13.587	11.127	(-1.221)	-14.787	7.474	(-1.978)	1.332	11.028	(0.121)
	const	0.681	0.193	(3.520)	0.103	0.086	(1.195)	0.581	0.139	(4.181)
	Mkt-RF	9.771	5.116	(1.910)	6.273	2.718	(2.308)	3.549	3.291	(1.078)
Avg	HML	10.176	8.515	(1.195)	2.572	5.010	(0.513)	7.637	6.785	(1.126)
	SMB	4.195	6.898	(0.608)	-1.254	2.503	(-0.501)	5.440	5.353	(1.016)
	CMA	-26.252	16.702	(-1.572)	-1.395	6.497	(-0.215)	-24.876	12.979	(-1.917)
	RMW	-9.384	8.983	(-1.045)	-5.213	3.325	(-1.568)	-4.191	6.935	(-0.604)

Table: Value-weighted portfolios

Robustness Check I: Asset insurance premium is
not the equity risk premium

Each ghost must have at least one risky asset

Univariate **value weight** excess returns (monthly % points)

| | Actual | | | Ghost | | | Act - Gho | | |
| | mean | sd | t | mean | sd | t | mean | sd | t |
EN R^2									
Lo	0.899	4.344	(4.834)	-0.001	0.532	(-0.314)	0.906	4.346	(4.875)
2	0.646	4.288	(3.246)	0.017	1.227	(1.113)	0.634	4.252	(3.276)
3	0.534	4.266	(2.818)	0.025	1.776	(0.793)	0.508	4.177	(2.846)
4	0.696	4.164	(4.186)	0.049	2.150	(0.948)	0.649	4.008	(4.343)
5	0.686	4.219	(3.680)	0.082	2.580	(1.068)	0.605	3.944	(3.829)
6	0.739	4.365	(4.010)	0.135	2.920	(1.349)	0.605	3.957	(4.205)
7	0.675	4.465	(3.324)	0.125	3.276	(0.992)	0.551	3.935	(3.831)
8	0.567	4.550	(2.634)	0.165	3.622	(1.124)	0.404	3.760	(2.829)
9	0.633	4.740	(2.745)	0.195	4.005	(1.061)	0.440	3.679	(3.433)
Hi	0.669	4.818	(2.843)	0.336	4.364	(1.642)	0.335	3.341	(2.999)
Hi - Lo	-0.231	4.015	(-1.521)	0.337	4.363	(1.649)	-0.571	4.221	(-3.061)
Avg	0.674	4.236	(3.672)	0.113	2.782	(1.274)	0.564	3.679	(4.345)

▶ Compare to the unrestricted value-weighted case: the AIP is -0.671 (*t*-stat -3.536)

Each ghost must have at least one risky asset
Controlling for FF5 factor risks

		Actual			Ghost			Act - Gho		
EN R^2		coef	sd	t	coef	sd	t	coef	sd	t
Lo	const	1.022	0.198	(5.160)	-0.002	0.002	(-1.044)	1.030	0.198	(5.215)
2	const	0.618	0.201	(3.067)	0.011	0.014	(0.747)	0.613	0.197	(3.102)
3	const	0.585	0.206	(2.834)	0.012	0.032	(0.386)	0.570	0.195	(2.927)
4	const	0.717	0.170	(4.228)	0.017	0.053	(0.317)	0.702	0.150	(4.671)
5	const	0.757	0.192	(3.936)	0.045	0.078	(0.578)	0.713	0.162	(4.411)
6	const	0.861	0.189	(4.548)	0.100	0.097	(1.030)	0.762	0.149	(5.096)
7	const	0.791	0.202	(3.916)	0.099	0.120	(0.824)	0.693	0.148	(4.675)
8	const	0.683	0.226	(3.026)	0.156	0.143	(1.094)	0.528	0.156	(3.383)
9	const	0.768	0.244	(3.151)	0.225	0.174	(1.291)	0.545	0.147	(3.696)
Hi	const	0.780	0.249	(3.134)	0.353	0.200	(1.767)	0.428	0.125	(3.425)
Hi - Lo	const	-0.242	0.169	(-1.431)	0.356	0.199	(1.785)	-0.602	0.187	(-3.228)
	Mkt-RF	0.074	4.516	(0.016)	9.456	5.465	(1.730)	-9.301	4.763	(-1.953)
	HML	-2.120	9.189	(-0.231)	0.872	10.992	(0.079)	-3.038	8.688	(-0.350)
	SMB	-0.400	5.939	(-0.067)	-0.933	6.957	(-0.134)	0.490	6.356	(0.077)
	CMA	12.928	16.061	(0.805)	-12.106	17.960	(-0.674)	25.245	14.348	(1.760)
	RMW	-5.022	9.367	(-0.536)	-15.064	9.189	(-1.639)	10.099	8.283	(1.219)
Avg	const	0.758	0.190	(3.994)	0.102	0.086	(1.180)	0.658	0.140	(4.708)
	Mkt-RF	1.909	5.276	(0.362)	5.749	2.677	(2.148)	-3.817	3.518	(-1.085)
	HML	6.340	7.643	(0.829)	2.839	4.906	(0.579)	3.527	5.914	(0.596)
	SMB	0.537	6.312	(0.085)	-2.016	2.604	(-0.774)	2.559	4.724	(0.542)
	CMA	-29.460	14.828	(-1.987)	-3.922	6.733	(-0.583)	-25.565	11.177	(-2.287)
	RMW	-11.608	7.375	(-1.574)	-6.081	3.232	(-1.881)	-5.538	5.650	(-0.980)

Table: Value-weighted portfolios

Robustness Check II: Controlling for known risk factors

Dependent bivariate sort
Controlling for idiosyncratic volatility (value-weights)

		Lo EN R²	2	3	4	5	6	7	8	9	Hi EN R²	H-L	H-L FF3α
Actual	Lo IdioVol	0.833	0.681	0.732	0.804	0.667	0.689	0.725	0.696	0.675	0.690	-0.143	-0.168
		(5.192)	(4.179)	(4.428)	(4.767)	(3.784)	(4.012)	(3.844)	(3.530)	(3.731)	(3.327)	(-0.893)	(-0.994)
	2	1.026	0.853	0.756	0.751	0.744	0.683	0.822	0.844	0.499	0.910	-0.116	-0.035
		(4.427)	(3.648)	(3.571)	(3.397)	(3.195)	(2.930)	(3.261)	(3.165)	(1.736)	(3.179)	(-0.534)	(-0.157)
	3	1.165	0.813	0.812	0.752	0.602	0.722	0.607	0.652	0.871	0.677	-0.489	-0.396
		(4.416)	(2.884)	(2.885)	(2.769)	(1.985)	(2.469)	(1.873)	(1.991)	(2.456)	(1.704)	(-1.508)	(-1.099)
	4	1.328	0.751	0.579	0.400	0.046	0.253	0.436	0.768	0.540	0.051	-1.277	-1.173
		(3.786)	(2.235)	(1.690)	(1.179)	(0.133)	(0.657)	(1.077)	(1.825)	(1.286)	(0.108)	(-4.536)	(-4.097)
	Hi IdioVol	0.699	0.023	0.256	-0.300	0.199	-0.148	-0.291	0.253	-0.404	-0.000	-0.699	-0.599
		(1.509)	(0.057)	(0.505)	(-0.670)	(0.411)	(-0.272)	(-0.595)	(0.470)	(-0.806)	(-0.000)	(-1.595)	(-1.431)
	Avg	1.010	0.624	0.627	0.481	0.451	0.440	0.643	0.643	0.436	0.466	-0.545	-0.474
		(3.941)	(2.588)	(2.430)	(2.000)	(1.708)	(1.577)	(1.579)	(2.074)	(1.378)	(1.298)	(-2.460)	(-2.082)
Ghost	Lo IdioVol	0.032	0.045	0.060	0.099	0.101	0.158	0.190	0.202	0.285	0.366	0.333	0.281
		(2.002)	(1.054)	(1.029)	(1.272)	(1.177)	(1.497)	(1.510)	(1.489)	(1.917)	(2.097)	(1.977)	(1.723)
	2	0.013	0.060	0.081	0.095	0.121	0.249	0.210	0.235	0.222	0.453	0.440	0.335
		(0.992)	(1.232)	(0.986)	(0.998)	(1.162)	(1.715)	(1.297)	(1.358)	(1.058)	(1.803)	(1.780)	(1.340)
	3	0.000	0.025	0.093	0.104	0.139	0.161	0.234	0.167	0.304	0.425	0.424	0.333
		(0.127)	(1.445)	(1.636)	(1.165)	(1.126)	(1.032)	(1.271)	(0.803)	(1.168)	(1.340)	(1.341)	(1.070)
	4	-0.001	0.004	0.035	0.047	0.038	0.103	0.146	0.113	0.235	0.378	0.379	0.268
		(-0.469)	(1.299)	(1.781)	(1.179)	(0.424)	(0.713)	(0.736)	(0.474)	(0.797)	(0.917)	(0.920)	(0.696)
	Hi IdioVol	-0.000	0.001	-0.001	0.016	0.022	0.051	0.015	0.041	0.121	0.233	0.233	0.033
		(-0.221)	(0.419)	(-0.163)	(1.124)	(0.786)	(0.716)	(0.132)	(0.205)	(0.406)	(0.514)	(0.515)	(0.079)
	Avg	0.009	0.027	0.054	0.072	0.084	0.145	0.159	0.152	0.233	0.371	0.362	0.250
		(1.519)	(1.281)	(1.330)	(1.226)	(1.045)	(1.220)	(1.071)	(0.837)	(0.995)	(1.198)	(1.179)	(0.854)
Act - Gho	Lo IdioVol	0.806	0.638	0.672	0.706	0.566	0.531	0.536	0.494	0.392	0.326	-0.481	-0.452
		(5.072)	(4.079)	(4.388)	(4.548)	(3.802)	(3.580)	(3.576)	(3.603)	(3.230)	(2.609)	(-3.274)	(-3.262)
	2	1.023	0.793	0.676	0.657	0.623	0.434	0.617	0.613	0.279	0.461	-0.562	-0.376
		(4.416)	(3.527)	(3.623)	(3.325)	(3.481)	(2.400)	(3.483)	(3.240)	(1.611)	(3.736)	(-2.552)	(-1.913)
	3	1.180	0.797	0.723	0.650	0.463	0.565	0.374	0.484	0.560	0.260	-0.919	-0.739
		(4.480)	(2.863)	(2.768)	(2.720)	(1.850)	(2.422)	(1.660)	(2.345)	(2.717)	(1.546)	(-3.274)	(-2.706)
	4	1.345	0.757	0.549	0.356	0.012	0.157	0.298	0.665	0.307	-0.321	-1.666	-1.450
		(3.842)	(2.254)	(1.626)	(1.095)	(0.037)	(0.486)	(0.987)	(2.348)	(1.172)	(-1.618)	(-5.097)	(-4.974)
	Hi IdioVol	0.710	0.036	0.263	-0.304	0.182	-0.199	-0.304	0.210	-0.529	-0.241	-0.951	-0.654
		(1.533)	(0.088)	(0.520)	(-0.685)	(0.385)	(-0.391)	(-0.711)	(0.496)	(-1.593)	(-0.923)	(-2.303)	(-1.661)
	Avg	1.013	0.604	0.577	0.413	0.369	0.298	0.304	0.493	0.202	0.097	-0.916	-0.734
		(3.969)	(2.570)	(2.421)	(1.939)	(1.717)	(1.416)	(1.535)	(2.585)	(1.222)	(0.784)	(-4.138)	(-3.870)

Dependent bivariate sort
Controlling for FF5 R^2 (value-weights)

		Lo EN R^2	2	3	4	5	6	7	8	9	Hi EN R^2	H-L	H-L FF3 α
Actual	Lo FF5 R^2	0.961	0.774	0.636	0.540	0.619	0.255	0.635	0.698	0.588	0.254	-0.707	-0.822
		(3.997)	(3.229)	(2.653)	(1.973)	(2.559)	(0.942)	(2.574)	(2.674)	(2.251)	(0.927)	(-3.341)	(-3.724)
	2	1.255	0.888	0.713	0.744	0.621	0.300	0.694	0.806	0.740	0.552	-0.703	-0.777
		(5.568)	(3.393)	(3.105)	(2.801)	(2.468)	(1.211)	(2.777)	(2.998)	(2.662)	(2.235)	(-3.735)	(-4.302)
	3	1.024	0.699	0.615	0.802	0.659	0.715	0.768	0.757	0.580	0.845	-0.179	-0.264
		(5.074)	(3.210)	(2.538)	(3.445)	(2.842)	(3.224)	(3.173)	(3.115)	(2.383)	(3.473)	(-1.086)	(-1.421)
	4	0.820	0.780	0.828	0.789	0.566	0.673	0.700	0.765	0.474	0.683	-0.137	-0.145
		(4.381)	(3.856)	(3.979)	(3.879)	(2.463)	(2.926)	(3.283)	(3.213)	(1.883)	(2.983)	(-0.773)	(-0.778)
	Hi FF5 R^2	0.722	0.790	0.631	0.574	0.730	0.540	0.573	0.592	0.538	0.689	-0.033	-0.066
		(4.034)	(4.056)	(2.735)	(2.493)	(3.101)	(2.259)	(2.145)	(2.447)	(2.102)	(2.793)	(-0.199)	(-0.383)
	Avg	0.956	0.786	0.684	0.690	0.639	0.496	0.635	0.724	0.584	0.605	-0.352	-0.415
		(5.275)	(4.024)	(3.414)	(3.236)	(3.024)	(2.357)	(3.114)	(3.265)	(2.571)	(2.819)	(-3.359)	(-3.977)
Ghost	Lo FF5 R^2	-0.001	-0.001	-0.000	-0.001	-0.001	0.002	0.008	0.024	0.018	0.156	0.156	0.071
		(-0.241)	(-0.394)	(-0.091)	(-0.443)	(-0.290)	(0.637)	(1.225)	(1.781)	(0.669)	(1.328)	(1.335)	(0.673)
	2	-0.001	0.001	0.008	0.059	0.043	0.076	0.069	0.066	0.105	0.228	0.229	0.151
		(-0.324)	(0.163)	(0.733)	(1.695)	(1.308)	(1.579)	(0.889)	(0.843)	(1.173)	(1.519)	(1.527)	(1.122)
	3	0.038	0.061	0.086	0.119	0.074	0.107	0.101	0.215	0.174	0.351	0.313	0.238
		(1.367)	(1.156)	(1.164)	(1.365)	(0.784)	(0.981)	(0.897)	(1.643)	(1.088)	(2.293)	(2.251)	(1.857)
	4	0.046	0.106	0.139	0.135	0.160	0.136	0.168	0.201	0.236	0.373	0.327	0.267
		(1.095)	(1.319)	(1.266)	(1.193)	(1.261)	(0.997)	(1.170)	(1.263)	(1.336)	(2.006)	(2.036)	(1.742)
	Hi FF5 R^2	0.092	0.134	0.152	0.197	0.132	0.137	0.206	0.278	0.281	0.337	0.245	0.234
		(1.261)	(1.126)	(1.061)	(1.230)	(0.760)	(0.709)	(0.969)	(1.369)	(1.276)	(1.558)	(1.401)	(1.364)
	Avg	0.035	0.060	0.077	0.102	0.081	0.091	0.110	0.157	0.163	0.289	0.254	0.192
		(1.279)	(1.246)	(1.216)	(1.383)	(1.016)	(1.011)	(1.100)	(1.437)	(1.300)	(1.944)	(1.983)	(1.641)
Act - Gho	Lo FF5 R^2	0.981	0.788	0.643	0.545	0.623	0.258	0.632	0.679	0.573	0.100	-0.881	-0.908
		(4.089)	(3.291)	(2.685)	(1.993)	(2.579)	(0.954)	(2.580)	(2.654)	(2.315)	(0.458)	(-4.535)	(-4.427)
	2	1.268	0.895	0.713	0.695	0.582	0.223	0.623	0.744	0.637	0.325	-0.942	-0.939
		(5.631)	(3.428)	(3.147)	(2.759)	(2.393)	(0.950)	(2.680)	(3.107)	(2.768)	(1.759)	(-4.953)	(-5.050)
	3	0.992	0.643	0.531	0.686	0.589	0.607	0.665	0.542	0.409	0.496	-0.496	-0.503
		(5.033)	(3.128)	(2.425)	(3.272)	(2.933)	(3.289)	(3.475)	(2.918)	(2.459)	(3.128)	(-3.029)	(-3.020)
	4	0.778	0.677	0.690	0.655	0.406	0.540	0.534	0.566	0.240	0.317	-0.461	-0.410
		(4.271)	(3.735)	(3.989)	(4.119)	(2.267)	(3.315)	(3.561)	(3.420)	(1.397)	(2.578)	(-2.888)	(-2.624)
	Hi FF5 R^2	0.632	0.656	0.481	0.377	0.599	0.403	0.369	0.314	0.258	0.357	-0.275	-0.298
		(3.984)	(4.119)	(2.981)	(2.501)	(3.876)	(2.869)	(2.527)	(2.413)	(1.965)	(2.887)	(-1.840)	(-2.048)
	Avg	0.930	0.732	0.612	0.592	0.560	0.406	0.565	0.569	0.423	0.319	-0.611	-0.612
		(5.395)	(4.232)	(3.699)	(3.508)	(3.328)	(2.612)	(3.696)	(3.697)	(2.999)	(2.785)	(-5.749)	(-5.998)

Dependent bivariate sort

Controlling for market capitalization (value-weights)

		Lo EN R²	2	3	4	5	6	7	8	9	Hi EN R²	H-L	H-L FF3 α
Actual	Lo MktCap	1.543	1.026	0.774	0.873	0.522	0.624	0.735	0.968	1.004	1.033	-0.510	-0.439
		(4.255)	(2.853)	(2.159)	(2.324)	(1.601)	(1.762)	(2.008)	(2.379)	(2.695)	(2.315)	(-2.426)	(-2.034)
	2	1.355	0.736	0.859	0.706	0.442	0.490	0.749	0.780	0.758	0.746	-0.609	-0.585
		(4.459)	(2.560)	(2.999)	(2.435)	(1.404)	(1.521)	(2.260)	(2.156)	(2.023)	(1.929)	(-2.661)	(-2.611)
	3	1.215	1.089	0.782	0.675	0.683	0.786	0.797	0.784	0.762	0.836	-0.379	-0.353
		(4.669)	(4.131)	(2.772)	(2.369)	(2.336)	(2.670)	(2.614)	(2.579)	(2.343)	(2.554)	(-1.695)	(-1.511)
	4	1.050	1.014	0.949	0.703	0.861	0.799	0.939	0.883	0.794	0.791	-0.259	-0.210
		(4.197)	(4.225)	(3.946)	(2.984)	(3.616)	(3.100)	(3.160)	(3.160)	(2.724)	(2.665)	(-1.415)	(-1.101)
	Hi MktCap	0.761	0.697	0.679	0.736	0.545	0.593	0.616	0.569	0.612	0.719	-0.042	-0.084
		(4.572)	(4.225)	(3.863)	(3.959)	(2.760)	(2.704)	(2.824)	(2.258)	(2.618)	(3.085)	(-0.271)	(-0.511)
	Avg	1.185	0.912	0.809	0.738	0.611	0.659	0.767	0.797	0.786	0.825	-0.360	-0.334
		(4.794)	(3.790)	(3.242)	(2.910)	(2.376)	(2.438)	(2.768)	(2.663)	(2.631)	(2.647)	(-2.325)	(-2.088)
Ghost	Lo MktCap	-0.000	-0.000	-0.001	0.002	0.011	0.028	0.056	0.109	0.210	0.388	0.388	0.231
		(-0.075)	(-0.054)	(-0.433)	(0.809)	(1.626)	(1.680)	(1.660)	(1.726)	(1.716)	(1.543)	(1.545)	(1.021)
	2	-0.000	0.001	0.008	0.018	0.068	0.124	0.159	0.206	0.244	0.424	0.425	0.287
		(-0.211)	(0.255)	(0.890)	(0.732)	(1.322)	(1.454)	(1.225)	(1.226)	(1.190)	(1.475)	(1.478)	(1.102)
	3	0.017	0.074	0.105	0.130	0.130	0.175	0.203	0.230	0.269	0.418	0.401	0.302
		(0.879)	(1.013)	(0.968)	(1.003)	(0.926)	(1.107)	(1.164)	(1.156)	(1.158)	(1.501)	(1.470)	(1.197)
	4	0.035	0.087	0.118	0.139	0.198	0.232	0.259	0.264	0.305	0.421	0.386	0.336
		(0.790)	(0.962)	(1.072)	(1.080)	(1.329)	(1.341)	(1.385)	(1.240)	(1.262)	(1.550)	(1.523)	(1.413)
	Hi MktCap	0.037	0.076	0.144	0.150	0.144	0.141	0.151	0.250	0.277	0.367	0.330	0.293
		(1.179)	(1.212)	(1.507)	(1.325)	(1.099)	(0.939)	(0.850)	(1.319)	(1.381)	(1.777)	(1.716)	(1.567)
	Avg	0.018	0.047	0.075	0.088	0.110	0.140	0.165	0.212	0.261	0.404	0.386	0.290
		(0.974)	(1.080)	(1.221)	(1.169)	(1.223)	(1.277)	(1.256)	(1.357)	(1.384)	(1.634)	(1.630)	(1.340)
Act - Gho	Lo MktCap	1.548	1.031	0.780	0.874	0.515	0.601	0.684	0.863	0.801	0.683	-0.885	-0.662
		(4.272)	(2.869)	(2.175)	(2.330)	(1.587)	(1.720)	(1.945)	(2.307)	(2.662)	(2.530)	(-4.305)	(-3.727)
	2	1.361	0.739	0.854	0.690	0.377	0.371	0.592	0.576	0.517	0.323	-1.037	-0.877
		(4.479)	(2.573)	(2.999)	(2.449)	(1.275)	(1.301)	(2.182)	(2.115)	(2.105)	(1.698)	(-4.766)	(-4.401)
	3	1.205	1.019	0.680	0.547	0.554	0.611	0.597	0.556	0.490	0.419	-0.786	-0.661
		(4.671)	(4.181)	(2.824)	(2.340)	(2.398)	(2.831)	(2.824)	(2.817)	(2.695)	(2.874)	(-3.636)	(-3.284)
	4	1.021	0.930	0.834	0.565	0.666	0.569	0.681	0.622	0.492	0.376	-0.645	-0.546
		(4.271)	(4.392)	(4.325)	(3.057)	(3.922)	(3.347)	(4.022)	(3.726)	(3.215)	(2.875)	(-3.023)	(-2.851)
	Hi MktCap	0.729	0.622	0.536	0.588	0.402	0.453	0.466	0.321	0.336	0.356	-0.373	-0.379
		(4.546)	(4.114)	(3.607)	(3.957)	(2.847)	(3.087)	(3.555)	(2.295)	(2.711)	(3.082)	(-2.380)	(-2.425)
	Avg	1.173	0.868	0.737	0.653	0.503	0.521	0.604	0.588	0.527	0.427	-0.745	-0.625
		(4.853)	(3.895)	(3.403)	(3.101)	(2.477)	(2.592)	(3.169)	(3.080)	(3.304)	(3.563)	(-4.528)	(-4.429)

Dependent bivariate sort

Controlling for book-to-market (value-weights)

		Lo EN R^2	2	3	4	5	6	7	8	9	Hi EN R^2	H-L	H-L FF3 α
Actual	Lo B/M	1.005	0.588	0.452	0.310	0.092	0.301	0.582	0.339	0.625	0.484	-0.521	-0.470
		(4.008)	(2.595)	(1.936)	(1.324)	(0.393)	(1.208)	(2.281)	(1.185)	(2.316)	(1.591)	(-2.350)	(-2.138)
	2	0.945	0.638	0.696	0.625	0.886	0.804	0.692	0.653	0.646	0.660	-0.285	-0.289
		(4.375)	(2.954)	(3.226)	(3.051)	(3.878)	(3.591)	(3.148)	(2.983)	(2.692)	(2.946)	(-1.627)	(-1.446)
	3	0.749	1.095	0.770	0.834	0.662	0.787	0.863	1.017	0.777	0.616	-0.133	-0.145
		(3.594)	(5.061)	(3.306)	(3.749)	(3.173)	(3.791)	(3.906)	(4.582)	(3.360)	(2.682)	(-0.825)	(-0.867)
	4	0.886	0.870	0.799	0.816	0.772	0.834	1.012	0.608	0.707	0.811	-0.075	-0.076
		(4.096)	(4.005)	(3.765)	(3.225)	(3.476)	(3.796)	(4.693)	(2.498)	(2.817)	(3.300)	(-0.456)	(-0.443)
	Hi B/M	1.113	0.771	0.984	0.768	0.781	1.030	1.151	0.855	1.323	0.968	-0.145	-0.085
		(3.949)	(2.790)	(3.766)	(2.781)	(2.898)	(3.864)	(4.144)	(3.228)	(5.524)	(4.018)	(-0.718)	(-0.402)
	Avg	0.940	0.792	0.740	0.671	0.638	0.751	0.860	0.694	0.816	0.708	-0.232	-0.213
		(4.603)	(4.058)	(3.804)	(3.378)	(3.246)	(3.783)	(4.190)	(3.280)	(3.769)	(3.178)	(-1.980)	(-1.773)
Ghost	Lo B/M	-0.000	0.034	0.044	0.006	-0.011	0.099	0.103	0.073	0.204	0.143	0.143	0.103
		(-0.001)	(1.625)	(0.908)	(0.093)	(-0.130)	(0.881)	(0.691)	(0.417)	(1.010)	(0.601)	(0.602)	(0.456)
	2	-0.001	0.031	0.057	0.082	0.109	0.124	0.122	0.223	0.238	0.352	0.353	0.284
		(-0.591)	(1.326)	(1.265)	(1.141)	(1.167)	(1.170)	(0.956)	(1.474)	(1.390)	(1.823)	(1.833)	(1.542)
	3	-0.001	0.012	0.084	0.063	0.091	0.140	0.161	0.246	0.234	0.345	0.346	0.258
		(-0.409)	(0.933)	(1.791)	(0.956)	(1.028)	(1.301)	(1.269)	(1.502)	(1.349)	(1.840)	(1.848)	(1.424)
	4	-0.000	-0.001	0.026	0.075	0.080	0.102	0.149	0.181	0.209	0.363	0.364	0.242
		(-0.211)	(-0.424)	(1.328)	(1.457)	(0.964)	(0.932)	(1.140)	(1.225)	(1.195)	(1.724)	(1.729)	(1.168)
	Hi B/M	0.000	-0.002	0.006	0.021	0.055	0.124	0.100	0.161	0.346	0.642	0.642	0.517
		(0.022)	(-0.786)	(-1.594)	(1.685)	(1.290)	(1.404)	(0.851)	(1.113)	(2.056)	(3.170)	(3.172)	(2.811)
	Avg	-0.001	0.015	0.044	0.050	0.065	0.118	0.127	0.177	0.246	0.369	0.370	0.281
		(-0.246)	(1.374)	(1.427)	(1.017)	(0.878)	(1.194)	(1.039)	(1.198)	(1.441)	(1.873)	(1.878)	(1.506)
Act - Gho	Lo B/M	1.008	0.556	0.411	0.305	0.105	0.203	0.480	0.269	0.422	0.344	-0.664	-0.574
		(4.021)	(2.538)	(1.856)	(1.471)	(0.544)	(0.997)	(2.440)	(1.350)	(2.521)	(2.273)	(-2.724)	(-2.542)
	2	0.954	0.611	0.640	0.544	0.778	0.681	0.569	0.435	0.410	0.312	-0.642	-0.577
		(4.423)	(2.880)	(3.096)	(2.908)	(4.028)	(3.689)	(3.388)	(2.660)	(2.738)	(2.440)	(-2.819)	(-2.434)
	3	0.758	1.086	0.688	0.774	0.573	0.645	0.703	0.774	0.543	0.273	-0.485	-0.410
		(3.644)	(5.080)	(3.077)	(3.770)	(3.203)	(3.955)	(4.366)	(5.216)	(3.702)	(2.100)	(-2.439)	(-2.084)
	4	0.894	0.875	0.776	0.737	0.693	0.733	0.864	0.427	0.497	0.447	-0.447	-0.325
		(4.141)	(4.033)	(3.718)	(3.048)	(3.557)	(3.968)	(5.474)	(2.277)	(2.983)	(3.704)	(-2.157)	(-1.693)
	Hi B/M	1.119	0.777	0.980	0.748	0.727	1.049	1.049	0.695	0.974	0.328	-0.791	-0.606
		(3.972)	(2.810)	(3.762)	(2.751)	(2.821)	(3.793)	(4.653)	(3.278)	(5.898)	(2.196)	(-2.721)	(-2.224)
	Avg	0.947	0.781	0.699	0.622	0.575	0.635	0.733	0.520	0.569	0.341	-0.606	-0.498
		(4.643)	(4.067)	(3.766)	(3.475)	(3.516)	(4.118)	(5.088)	(3.689)	(4.584)	(3.201)	(-3.134)	(-2.823)

Dependent bivariate sort

Controlling for momentum (value-weights)

		Lo EN R²	2	3	4	5	6	7	8	9	Hi EN R²	H-L	H-L FF3 α
Actual	Lo Mom	-1.988	-2.541	-2.264	-2.690	-2.469	-2.338	-2.152	-2.343	-2.120	-2.285	-0.297	-0.223
		(-5.462)	(-7.260)	(-6.900)	(-7.694)	(-7.359)	(-7.290)	(-6.462)	(-7.131)	(-6.259)	(-6.256)	(-0.957)	(-0.722)
	2	-0.113	-0.077	-0.086	-0.299	-0.216	-0.139	-0.046	-0.268	-0.219	-0.363	-0.249	-0.178
		(-0.495)	(-0.326)	(-0.334)	(-1.439)	(-0.972)	(-0.584)	(-0.203)	(-1.096)	(-0.941)	(-1.444)	(-1.306)	(-0.943)
	3	0.839	0.568	0.605	0.427	0.590	0.689	0.711	0.621	0.577	0.626	-0.212	-0.249
		(4.295)	(2.793)	(2.679)	(2.276)	(2.957)	(3.383)	(3.470)	(2.959)	(2.651)	(2.888)	(-1.240)	(-1.241)
	4	1.503	1.485	1.427	1.482	1.370	1.282	1.426	1.341	1.322	1.318	-0.184	-0.168
		(6.699)	(6.622)	(7.341)	(7.300)	(7.114)	(5.893)	(6.810)	(6.154)	(5.851)	(5.632)	(-1.138)	(-1.032)
	Hi Mom	3.619	3.323	3.194	2.917	2.823	2.985	3.022	3.085	2.904	2.611	-1.008	-0.932
		(11.011)	(9.856)	(10.401)	(9.813)	(9.461)	(10.155)	(9.941)	(10.697)	(9.620)	(8.182)	(-3.849)	(-3.549)
	Avg	0.772	0.552	0.575	0.367	0.419	0.496	0.592	0.487	0.493	0.382	-0.390	-0.350
		(3.463)	(2.398)	(2.544)	(1.745)	(1.917)	(2.251)	(2.621)	(2.137)	(2.052)	(1.519)	(-2.755)	(-2.340)
Ghost	Lo Mom	-0.001	0.000	0.016	0.014	-0.009	0.025	0.080	-0.030	-0.074	-0.124	-0.123	-0.197
		(-0.312)	(0.150)	(1.011)	(0.404)	(-0.126)	(0.239)	(0.546)	(-0.160)	(-0.322)	(-0.458)	(-0.456)	(-0.765)
	2	-0.001	0.014	0.025	0.063	0.052	0.106	0.083	0.084	0.138	0.119	0.120	0.082
		(-0.309)	(1.307)	(0.888)	(1.366)	(0.661)	(1.014)	(0.638)	(0.590)	(0.780)	(0.596)	(0.601)	(0.415)
	3	-0.001	0.018	0.042	0.051	0.097	0.146	0.147	0.165	0.223	0.339	0.340	0.244
		(-0.469)	(1.248)	(1.078)	(1.026)	(1.316)	(1.393)	(1.376)	(1.123)	(1.274)	(1.778)	(1.784)	(1.325)
	4	-0.001	0.026	0.076	0.109	0.096	0.138	0.206	0.286	0.278	0.451	0.452	0.370
		(-0.410)	(1.425)	(1.625)	(1.555)	(1.167)	(1.361)	(1.770)	(1.890)	(1.567)	(2.211)	(2.218)	(1.889)
	Hi Mom	-0.000	0.017	0.036	0.072	0.130	0.149	0.232	0.226	0.430	0.683	0.683	0.577
		(-0.058)	(1.282)	(1.149)	(1.173)	(1.352)	(1.150)	(1.437)	(1.280)	(2.076)	(2.499)	(2.503)	(2.191)
	Avg	-0.001	0.015	0.039	0.062	0.073	0.113	0.150	0.146	0.199	0.294	0.294	0.215
		(-0.318)	(1.505)	(1.355)	(1.236)	(0.950)	(1.076)	(1.176)	(0.947)	(1.063)	(1.344)	(1.349)	(1.027)
Act - Gho	Lo Mom	-1.987	-2.541	-2.279	-2.704	-2.460	-2.362	-2.237	-2.314	-2.046	-2.161	-0.174	-0.026
		(-5.461)	(-7.267)	(-7.022)	(-8.072)	(-7.961)	(-8.675)	(-8.379)	(-9.625)	(-9.879)	(-11.094)	(-0.509)	(-0.077)
	2	-0.113	-0.091	-0.111	-0.362	-0.268	-0.245	-0.129	-0.351	-0.358	-0.482	-0.370	-0.259
		(-0.491)	(-0.387)	(-0.450)	(-1.864)	(-1.414)	(-1.213)	(-0.768)	(-1.966)	(-2.476)	(-4.184)	(-1.733)	(-1.290)
	3	0.840	0.550	0.563	0.376	0.493	0.542	0.564	0.457	0.354	0.287	-0.553	-0.493
		(4.301)	(2.720)	(2.604)	(2.132)	(2.789)	(3.304)	(3.520)	(3.181)	(2.604)	(2.277)	(-2.768)	(-2.298)
	4	1.504	1.459	1.351	1.373	1.274	1.144	1.220	1.055	1.045	0.866	-0.637	-0.539
		(6.701)	(6.658)	(7.223)	(7.632)	(7.702)	(6.483)	(7.243)	(6.300)	(7.546)	(6.732)	(-2.836)	(-2.516)
	Hi Mom	3.620	3.306	3.158	2.845	2.693	2.836	2.789	2.859	2.473	1.928	-1.692	-1.509
		(11.014)	(9.920)	(10.745)	(10.131)	(10.152)	(12.342)	(12.285)	(14.291)	(12.638)	(11.284)	(-4.775)	(-5.154)
	Avg	0.773	0.537	0.536	0.306	0.346	0.383	0.442	0.341	0.294	0.088	-0.685	-0.565
		(3.468)	(2.362)	(2.490)	(1.599)	(1.858)	(2.284)	(2.754)	(2.333)	(2.314)	(0.803)	(-3.251)	(-2.951)

Dependent bivariate sort
Controlling for Amihud's illiquidity (value-weights)

		Lo EN R²	2	3	4	5	6	7	8	9	Hi EN R²	H-L	H-L FF3 α
Actual	Lo AmihudIlliq	0.793	0.661	0.680	0.606	0.586	0.605	0.620	0.507	0.585	0.719	-0.074	-0.132
		(4.834)	(4.093)	(3.958)	(3.029)	(2.996)	(2.771)	(2.808)	(1.953)	(2.442)	(3.079)	(-0.459)	(-0.781)
	2	0.887	0.947	0.789	0.747	0.711	0.807	0.764	0.768	0.739	0.832	-0.055	-0.005
		(3.902)	(4.213)	(3.495)	(3.310)	(3.020)	(3.292)	(2.953)	(2.850)	(2.581)	(2.966)	(-0.330)	(-0.031)
	3	1.221	1.126	0.853	0.801	0.620	0.685	0.780	0.806	0.795	0.807	-0.414	-0.444
		(4.675)	(4.325)	(3.099)	(2.781)	(2.423)	(2.572)	(2.887)	(2.888)	(2.819)	(2.914)	(-2.074)	(-2.101)
	4	1.387	1.025	0.922	0.816	0.785	0.628	1.002	0.918	1.145	0.958	-0.429	-0.383
		(4.790)	(3.780)	(3.550)	(3.039)	(2.687)	(2.226)	(3.413)	(3.682)	(3.200)	(3.200)	(-2.040)	(-1.726)
	Hi AmihudIlliq	1.087	0.990	0.840	0.915	0.643	0.635	0.873	0.759	0.782	1.018	-0.069	-0.001
		(3.065)	(3.117)	(3.072)	(2.999)	(2.105)	(2.023)	(2.812)	(2.309)	(2.563)	(3.228)	(-0.320)	(-0.004)
	Avg	1.075	0.950	0.817	0.777	0.669	0.672	0.808	0.752	0.809	0.867	-0.208	-0.193
		(4.578)	(4.205)	(3.689)	(3.280)	(2.804)	(2.774)	(3.245)	(2.848)	(3.093)	(3.341)	(-1.596)	(-1.427)
Ghost	Lo AmihudIlliq	0.036	0.074	0.155	0.131	0.152	0.113	0.171	0.249	0.260	0.361	0.325	0.287
		(1.154)	(1.133)	(1.641)	(1.112)	(1.168)	(0.711)	(0.967)	(1.263)	(1.280)	(1.742)	(1.684)	(1.523)
	2	0.043	0.084	0.117	0.167	0.191	0.223	0.261	0.240	0.257	0.421	0.378	0.331
		(0.885)	(0.990)	(1.078)	(1.305)	(1.276)	(1.281)	(1.383)	(1.144)	(1.100)	(1.644)	(1.601)	(1.514)
	3	0.027	0.108	0.113	0.110	0.142	0.162	0.228	0.231	0.223	0.357	0.330	0.264
		(0.944)	(1.147)	(0.990)	(0.859)	(0.951)	(0.989)	(1.281)	(1.215)	(1.041)	(1.430)	(1.380)	(1.197)
	4	-0.001	0.004	0.011	0.029	0.068	0.113	0.138	0.193	0.226	0.334	0.335	0.209
		(-0.291)	(0.736)	(0.791)	(1.010)	(1.266)	(1.446)	(1.212)	(1.308)	(1.211)	(1.399)	(1.404)	(0.977)
	Hi AmihudIlliq	-0.000	-0.001	-0.001	-0.002	0.006	0.015	0.037	0.040	0.109	0.397	0.397	0.320
		(-0.004)	(-0.497)	(-0.374)	(-0.966)	(1.112)	(1.328)	(1.462)	(0.993)	(1.410)	(2.319)	(2.321)	(2.032)
	Avg	0.021	0.054	0.079	0.087	0.112	0.125	0.167	0.191	0.215	0.374	0.353	0.282
		(0.990)	(1.138)	(1.275)	(1.143)	(1.218)	(1.132)	(1.292)	(1.285)	(1.250)	(1.742)	(1.736)	(1.526)
Act - Gho	Lo AmihudIlliq	0.761	0.589	0.526	0.478	0.434	0.492	0.448	0.259	0.326	0.362	-0.398	-0.420
		(4.824)	(4.007)	(3.600)	(3.146)	(3.096)	(3.525)	(3.324)	(1.818)	(2.630)	(3.148)	(-2.617)	(-2.699)
	2	0.850	0.866	0.674	0.579	0.523	0.587	0.505	0.531	0.489	0.414	-0.435	-0.338
		(3.970)	(4.342)	(3.832)	(3.391)	(3.388)	(3.671)	(3.139)	(3.469)	(3.273)	(3.160)	(-2.165)	(-1.889)
	3	1.200	1.022	0.741	0.693	0.480	0.524	0.555	0.576	0.571	0.454	-0.746	-0.710
		(4.687)	(4.410)	(3.127)	(2.993)	(2.428)	(2.636)	(3.031)	(3.140)	(3.373)	(2.884)	(-3.068)	(-2.918)
	4	1.394	1.026	0.914	0.790	0.719	0.516	0.868	0.726	0.921	0.635	-0.759	-0.586
		(4.818)	(3.797)	(3.560)	(3.040)	(2.653)	(2.086)	(3.585)	(3.181)	(4.270)	(3.509)	(-3.065)	(-2.541)
	Hi AmihudIlliq	1.093	0.996	0.844	0.920	0.640	0.623	0.842	0.723	0.676	0.636	-0.457	-0.314
		(3.083)	(3.138)	(3.090)	(3.015)	(2.099)	(2.001)	(2.797)	(2.330)	(2.523)	(2.899)	(-1.842)	(-1.284)
	Avg	1.059	0.900	0.740	0.692	0.559	0.548	0.644	0.563	0.597	0.500	-0.559	-0.473
		(4.613)	(4.339)	(3.886)	(3.591)	(3.076)	(3.123)	(3.846)	(3.402)	(4.203)	(4.174)	(-3.134)	(-2.905)

Conclusion

Conclusion

1. General theoretical result on factor models that predicts the existence of an **asset insurance premium** associated with **asset synchronicity**

$$\mathbb{E}[R_i] - \mathbf{b}_i^\top \mathbb{E}[\boldsymbol{R}_{-i}] = \mathbf{a}_i^\top \mathbb{E}[\boldsymbol{\Phi}_i]$$

2. We are **not** proposing another factor!
3. Use of elastic-net to overcome a critical rank condition weakness of the OLS
4. Stocks *less (more)* synchronized with other assets have a *higher (lower)* asset insurance premium
5. Asset synchronicity is countercyclical (i.e. especially to consumption shocks)
6. Asset insurance premium exists after controlling for known factors:
   - Idiosyncratic volatility, FF5 R^2, size, book-to-market, momentum, illiquidity; (not shown in slides: also robust to idiosyncratic skewness, dollar trading volume, short-term reversal)

Why FFz methods cannot find results?

Recall construction method of the ghosts of stock i:

$$R_{i,t}^{\text{FF5,Gho}} := (1 - \mathbf{1}^\top \hat{\beta}_{i,t-1}^{\text{FF5}}) r_{f,t} + \boldsymbol{R}_{\text{FF5},t}^\top \hat{\beta}_{i,t-1}^{\text{FF5}}$$

The sum of the coefficients $\mathbf{1}^\top \hat{\beta}_{i,t-1}^{\text{FF5}}$ is precisely the proportion of wealth invested into the equity only component of the ghost portfolio. Consider the summary statistics (across time) of the sequence $t \mapsto \frac{1}{B_{t-1}^k} \sum_{i \in B_{t-1}^k} \mathbf{1}^\top \hat{\beta}_{i,t-1}^{\text{FF5}}$.

	mean	std	min	max	p5	p25	med	p75	p95
FF5 R^2									
Lo	0.531	2.722	-34.460	48.679	-3.336	-0.643	0.402	1.616	4.744
2	0.912	3.339	-59.982	62.835	-3.909	-0.574	0.809	2.343	6.006
3	1.260	3.415	-61.032	57.593	-3.680	-0.273	1.181	2.750	6.409
4	1.624	3.320	-66.341	72.018	-3.059	0.165	1.528	3.029	6.514
5	1.882	3.091	-59.558	83.209	-2.399	0.497	1.759	3.205	6.408
6	2.030	2.880	-44.017	86.901	-2.012	0.695	1.925	3.306	6.305
7	2.115	2.611	-46.645	57.034	-1.696	0.830	2.048	3.364	6.068
8	2.173	2.402	-22.130	65.972	-1.534	0.929	2.128	3.417	5.971
9	2.048	2.301	-16.594	78.785	-1.685	0.849	2.052	3.318	5.661
Hi	1.456	2.452	-17.009	15.767	-2.837	0.326	1.654	2.853	5.033

Why FFz methods cannot find results?

Recall construction method of the ghosts of stock i:

$$R_{i,t}^{\text{EN,Gho}} := (1 - \mathbf{1}^\top \hat{\beta}_{i,t-1}^{\text{EN}}) r_{f,t} + \mathbf{R}_{-i,t}^\top \hat{\beta}_{i,t-1}^{\text{EN}}$$

EN R^2	mean	std	min	max	p5	p25	med	p75	p95
Lo	0.000	0.002	-0.147	0.538	-0.000	0.000	0.000	0.000	0.000
2	0.001	0.009	-0.132	0.427	-0.000	0.000	0.000	0.000	0.006
3	0.017	0.063	-0.265	1.078	-0.000	0.000	0.000	0.000	0.109
4	0.055	0.132	-0.485	1.658	-0.000	0.000	0.000	0.033	0.340
5	0.102	0.178	-0.342	1.771	-0.000	0.000	0.006	0.139	0.494
6	0.156	0.219	-0.472	2.117	-0.001	0.000	0.034	0.263	0.619
7	0.214	0.256	-0.216	2.245	-0.004	0.003	0.106	0.374	0.721
8	0.278	0.289	-0.399	2.580	-0.006	0.010	0.210	0.483	0.815
9	0.364	0.320	-0.293	3.289	-0.006	0.033	0.346	0.603	0.915
Hi	0.531	0.337	-0.391	4.674	0.008	0.261	0.567	0.773	1.043

▶ Ghost portfolio constructed out of FFz method necessarily requires substantial turnover

▶ Ghost portfolio constructed out of EN method appears to be much more stable