COMPUTATIONAL FINANCE & RISK MANAGEMENT
UNIVERSITY of WASHINGTON
Department of Applied Mathematics

IR Maximizing Factor Models

R. Douglas Martin*

Computational Finance Program Director
Departments of Applied Mathematics and Statistics
University of Washington
doug@amath.washington.edu

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* Joint with Zhuanxin Ding, PhD, Research Analyst, Analytic Investors, Los Angeles

Fundamental Law of Active Management

Grinold (1989, 2000)

predictor

$$IR = \sqrt{BR} \cdot IC \quad \text{where} \quad IC = corr(r_t, x_{t-1})$$

"information coefficient"

$$BR = N$$

often assumed but very wrong!

Ding and Martin (2015)*

Random IC with mean μ_{IC} and variance σ^2_{IC}

$$\mathrm{IR} = \frac{\mu_{\mathrm{IC}}}{\sqrt{(1-\mu^2_{\mathrm{IC}} - \sigma^2_{\mathrm{IC}}) / N + \sigma^2_{\mathrm{IC}}}} \rightarrow \frac{\mu_{\mathrm{IC}}}{\sigma_{\mathrm{IC}}}$$

(large N)

* ssrn.com/abstract=2730434

Optimal Active Portfolio Information Ratio

Quadratic utility analytic solution with active weights constraint, using residual returns as input. Resulting information ratio

$$IR_t = \frac{\alpha_{A,t}}{\sigma_{A,t}} = \sqrt{(\boldsymbol{\alpha}_t' \boldsymbol{\Omega}_t^{-1} \boldsymbol{\alpha}_t) - \mu_{GMV} \cdot (\mathbf{1}' \boldsymbol{\Omega}_t^{-1} \boldsymbol{\alpha}_t)}$$

conditional mean forecast — conditional forecast covariance

Average over time t-1 conditional forecast variables:

$$IR = E\left(IR_t\right) = E\left(\sqrt{(\boldsymbol{\alpha}_t' \boldsymbol{\Omega}_t^{-1} \boldsymbol{\alpha}_t) - \mu_{GMV} \cdot (\mathbf{1}' \boldsymbol{\Omega}_t^{-1} \boldsymbol{\alpha}_t)}\right)$$

Depends on returns and forecast model. Ding and Martin (2015) use the following new version of cross-section regression model.

The New Cross-Section Factor Model

Returns Standardization $\tilde{r}_{i,t} = r_{i,t} / \sigma_{r_{i,t-1}}$

Cross-Section Model

$$\tilde{r}_{it} = f_t z_{i,t-1} + \varepsilon_{it}, \quad i = 1, \cdots, N, \quad t = 1, \cdots, T$$

↑

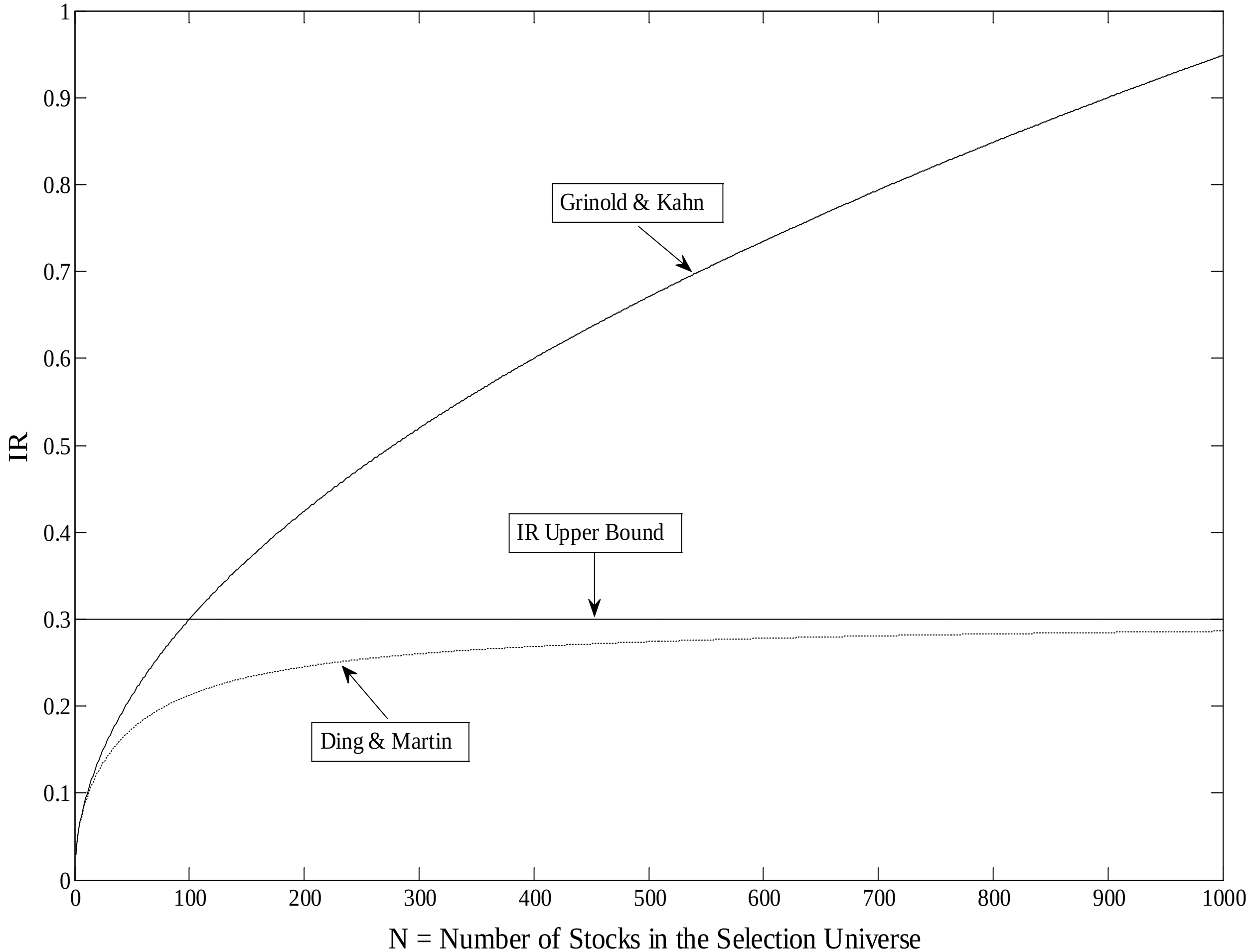
Standardized version of raw exposures $x_{i,t-1}$ on an asset-by-asset basis!

Information Coefficient

$$f_t \triangleq \frac{\mathrm{cov}(\tilde{r}_{it}, z_{i,t-1})}{\mathrm{var}(z_{i,t-1})} = \mathrm{corr}(\tilde{r}_{it}, z_{i,t-1}) = \mathrm{IC}_t$$

Comparison of Our Fundamental Law with G&K Version

IC=0.03 and $\sigma_{\text{IC}} = 0.1$



Empirical Study of New FLAM for 8 SFM's

GOAL: Show that our FLAM asymptotic and finite sample formulas give a much more accurate estimate of the portfolio IR than the G&K formula.

Exposures

Factor	**Definition**	**Sample Period Studied**
B/P	Book to price ratio	1979-01 to 2010-06
C/P	Cash flow to price ratio	1990-02 to 2010-06
D/P	Dividend yield	1979-01 to 2010-06
E/P	Earnings-to-price ratio	1979-01 to 2010-06
FE/P	Forward earnings-to-price ratio	1979-01 to 2010-06
S/P	Sales-to-price ratio	1979-01 to 2010-06
MOM	Cumulative 11-month return from *t*-12 to *t*-2	1979-01 to 2010-06
SHORT	Short as a percent of total shares floating	1988-01 to 2010-06

Investment universe is the Russell 3000 over the time intervals shown.
Average number of stocks used is approximately 2000.

IC and IR Values for Eight Fundamental Factors and Two Models

Factor	Model	N	$\widehat{\text{IC}}$	$\hat{\sigma}_{\text{IC}}$	$\widehat{\text{IR}}_{\text{GK}}$	$\widehat{\text{IR}}_{\infty}$	$\widehat{\text{IR}}_{N}$	$\widehat{\text{IR}}_{\text{sim}}$
B/P	NEW	2088	0.029	0.074	1.337	0.394	0.378	0.395
B/P	ISM	2089	0.017	0.089	0.783	0.193	0.188	0.162
C/P	NEW	2006	0.032	0.049	1.432	0.650	0.592	0.523
C/P	ISM	2007	0.039	0.081	1.727	0.478	0.461	0.255
D/P	NEW	1244	0.029	0.080	1.014	0.359	0.338	0.318
D/P	ISM	1244	0.014	0.086	0.502	0.165	0.157	0.157
E/P	NEW	2095	0.031	0.061	1.411	0.504	0.475	0.421
E/P	ISM	2096	0.035	0.102	1.608	0.344	0.336	0.175
FE/P	NEW	1986	0.034	0.068	1.494	0.496	0.471	0.430
FE/P	ISM	1987	0.030	0.096	1.352	0.316	0.308	0.188
S/P	NEW	2078	0.020	0.068	0.927	0.301	0.286	0.287
S/P	ISM	2080	0.014	0.089	0.627	0.154	0.150	0.137
MOM	NEW	2151	0.025	0.095	1.162	0.263	0.257	0.217
MOM	ISM	2153	0.035	0.126	1.603	0.275	0.271	0.149
SHORT	NEW	2150	0.036	0.066	1.688	0.555	0.528	0.410
SHORT	ISM	2152	0.038	0.079	1.751	0.480	0.463	0.326