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湖南大學
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硕士学位论文

高维因子模型的极大似然分析的理论与方法

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培 养 单 位 金融与统计学院
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摘　　要

在过去的20年里，经济学见证了经济统计工作的飞跃发展。

关键词：高维分位数因子模型

Abstract

In order to investigate the dynamic connectedness among the four variables...

Key Words: High-dimension factor model

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附录A　抽样算法

A.1 算法细节

引理 A.1 令$N_{t+1} = \mathrm{Var}(y_{t+1}|y^{0,t}, x_t, \mathbb{K}^{1,t+1})$。于是，

$$N_{t+1} = h'_{t+1}\tilde{\Gamma}_{t+1}\tilde{\Gamma}'_{t+1}h_{t+1} + G_{t+1}G'_{t+1} \tag{A.1}$$

$$\mathbb{E}(y_{t+1}|y^{0,t}, x_t, \mathbb{K}^{1,t+1}) = g_{t+1} + h'_{t+1}(f_{t+1} + F_{t+1}x_t) \tag{A.2}$$

$(x_{t+1}|y^{0,t+1}, x_t, \mathbb{K})$的均值和方差为：

$$\mathbb{E}(x_{t+1}|y^{0,t+1}, x_t, \mathbb{K}) = a_{t+1} + A_{t+1}x_t + B_{t+1}y_{t+1} \tag{A.3}$$

$$\mathrm{Var}(x_{t+1}|y^{0,t+1}, x_t, \mathbb{K}) = C_{t+1}C'_{t+1} \tag{A.4}$$

其中，

$$a_{t+1} = (I - B_{t+1}h'_{t+1})f_{t+1} - B_{t+1}g_{t+1} \tag{A.5}$$

$$A_{t+1} = (I - B_{t+1}h'_{t+1})F_{t+1} \tag{A.6}$$

$$B_{t+1} = \tilde{\Gamma}_{t+1}\tilde{\Gamma}'_{t+1}h_{t+1}N^{-1}_{t+1} \tag{A.7}$$

$$C_{t+1}C'_{t+1} = \tilde{\Gamma}_{t+1}\tilde{\Gamma}'_{t+1} - B_{t+1}N_{t+1}B'_{t+1} \tag{A.8}$$

假设，

$$x_{t+1} = a_{t+1} + A_{t+1}x_t + B_{t+1}y_{t+1} + C_{t+1}z_{t+1} \tag{A.9}$$

其中，$z_{t+1}|\mathbb{K} \sim \mathcal{N}(0, I)$独立于$x_t$和$y_{t+1}$。 □

证明：

$$\begin{aligned}\mathrm{Cov}(x_{t+1}, y_{t+1}) &= \mathbb{E}\left[(x_{t+1} - \mathbb{E}(x_{t+1}|\mathbb{K}))(y_{t+1} - \mathbb{E}(y_{t+1}|\mathbb{K}))'\right] \\ &= \mathbb{E}\left\{[B_{t+1}(y_{t+1} - \mu_{y_{t+1}}) + C_{t+1}z_{t+1}](y_{t+1} - \mu_{y_{t+1}})'\right\} \\ &= B_{t+1}N_{t+1}\end{aligned}$$

$$\begin{aligned}\mathrm{Cov}(x_{t+1}, y_{t+1}) &= \mathrm{Cov}(x_{t+1},\ g_{t+1} + h'_{t+1}x_{t+1} + G_{t+1}u_{t+1}) \\ &= \mathbb{E}\left[(x_{t+1} - \mu_{x_{t+1}})((x_{t+1} - \mu_{x_{t+1}})'h_{t+1} + u'_{t+1}G'_{t+1})\right] \\ &= \tilde{\Gamma}_{t+1}\tilde{\Gamma}'_{t+1}h_{t+1}\end{aligned}$$

$$B_{t+1} = \tilde{\Gamma}_{t+1}\tilde{\Gamma}'_{t+1}h_{t+1}N^{-1}_{t+1} \tag{A.10}$$

显然，

$$\begin{aligned} C_{t+1}C_{t+1}' &= \mathrm{Var}_{t+1}(x|y) = \tilde{\Gamma}_{t+1}\tilde{\Gamma}_{t+1}' - B_{t+1}N_{t+1}N_{t+1}^{-1}N_{t+1}B_{t+1}' \\ &= \tilde{\Gamma}_{t+1}\tilde{\Gamma}_{t+1}' - B_{t+1}N_{t+1}B_{t+1}' \end{aligned} \tag{A.11}$$

$$\begin{aligned} x_{t+1} &= a_{t+1} + A_{t+1}x_t + B_{t+1}(g_{t+1} + h_{t+1}'x_{t+1} + G_{t+1}\mu_{t+1}) \\ &= a_{t+1} + A_{t+1}x_t + B_{t+1}g_{t+1} + B_{t+1}h_{t+1}'f_{t+1} + B_{t+1}h_{t+1}'x_t + B_{t+1}h_{t+1}'\tilde{\Gamma}_{t+1}v_{t+1} + B_{t+1}G_{t+1}\mu_{t+1} \\ &= f_{t+1} + F_{t+1}x_t + \tilde{\Gamma}_{t+1}v_{t+1} \end{aligned}$$

因此，

$$A_{t+1} + B_{t+1}h_{t+1}'F_{t+1} = F_{t+1}$$

$$a_{t+1} + B_{t+1}g_{t+1} + B_{t+1}h_{t+1}'f_{t+1} = f_{t+1}$$

□

表 A.1 混合分布中对应的七个正态分布的参数

ω	$q_j = \Pr\{\omega = j\}$	m_j	v_j^2
1	0.00730	−10.12999	5.79596
2	0.10556	−3.97281	2.61369
3	0.00002	−8.56686	5.17950
4	0.04395	2.77786	0.16735
5	0.34001	0.61942	0.64009
6	0.24566	1.79518	0.34023
7	0.25750	−1.08819	1.26261

* 来源: Kim 等（1998）

附录A.2 后验分布

本节将介绍部分参数的后验分布。

附录B　发表论文和参加科研情况说明

（一）发表的学术论文

[1]

（二）申请及已获得的专利（无专利时此项不必列出）

[1]　XXX，XXX. XXXXXXXXX：中国，1234567.8[P]. 2012-04-25.

（三）参与的科研项目

[1]　XXX，XXX. XX 信息管理与信息系统，国家自然科学基金项目.课题编号：XXXX.

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