

# 加中金融

## CCFA JOURNAL OF FINANCE

### 俄烏熱戰到金融戰



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## 编辑寄语 Editor's Message

多伦多的五月，收拾好雪地靴就可以开冷空调了。这个五月，我们可能会错过樱花季节，却不会错过加油站油价飙升的触目惊心。我们也许错过庆祝疫情后重启，但不会错过俄罗斯乌克兰的战争带给全世界的惊恐；如果今年你开始投资，你不会错过一个接一个的不确定：就像五月初美联储的议息会议后的市场反应。对此 IB Steve 称为科比的假动作。

但美联储的加息也不一定对抑制通胀真正起到作用，俄罗斯乌克兰的战争不断升级增加了市场的不确定性，王勇陈秋雨梳理了地域战争到金融战争的演变风险。新一轮的地缘政治风险正在冲击全球经济。而 Bluebay 从另一个角度关注分析了大家关心的在美联储启动加息周期之际，新兴市场债务投资者怎样驾驭逆风环境。

而作为新兴市场的经济动能的中国此刻遭遇自 2020 年疫情爆发以来的最大不确定性。“三重压力”之下的中国经济何去何从，伍戈博士带来他的分析。

无论市场怎样动荡，总有安安静静做学问的。Tomiko 的清算模式推演和 CCFA 的风险小组会员专业分享活动都是十足的干货分享。世界很多不确定，我们坚信并祈告和平。

It is finally May Toronto, so pack up your snow-boots and turn on your air-conditioner. We will likely miss the cherry blossoms this month, but we won't miss the higher gasoline prices. We may have not celebrated the reopening of restaurants and general facilities, but we couldn't avoid the panic brought on by the war in Ukraine. If you started investing this year, you likely didn't miss at all the constant economic surprises like the market reaction after the Fed's FOMC meeting in early May. Interactive Broker's Steve Sosnick called that a fake pump by Kobe (RIP).

However, the Fed's interest rate hike may not have sufficiently put a leash on inflation. The escalating war between Russia and Ukraine has increased the uncertainty of the supply in energy and resources, Wang Yong and Chen Qiuyu from China has summarized the risks of geopolitical war as disruption on a wide range of industries, including financials, supply chain etc.

A new round of geopolitical risks are hitting the global economy. Bluebay Asset Management's Polina discusses how emerging market debt investors can navigate headwinds as the Federal Reserve begins its interest rate hike cycle.

China, the economic driver of emerging markets, is now facing the biggest challenge of uncertainties in growth since the outbreak of pandemic in 2020. Dr. Wu Ge brought his insights on Economic trends under the "threefold" pressure.

No matter how turbulent the market, there are always quiet scholars hard at work. Tomiko's demonstration of clearing models and CCFA's recent panel on risk management highlighted the continuous learning and professional development of the next generation of finance leaders.

The world is full of uncertainty. Stand firm with faith, we pray for peace.

*Emily Gu*



# Goldilocks or Kobe Bryant?

## 金发美女还是科比？



Steve Sosnick 是 Interactive Brokers (IBKR)的总战略师

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授权转载 Interactive Brokers **Traders' Insight**

I'm sure that many of you are wondering why a late basketball superstar is mentioned in the title of today's piece. Kobe Bryant was regarded as having one of the best pump fake moves in basketball history. The market's immediate reaction to Chairman Powell's press conference was exuberant, with 3% jumps in major US indices in the final 90 minutes of the day. As I write this, about 90 minutes into the following session, we have given back all those gains and then some. Can you blame me for thinking about classic pump fakes at a time like this?

Note the significant round trip in just 3 hours of normal market hours (and notice that we're still up for the week):

我相信你们中的许多人都想知道为什么今天的文章标题中提到了一位已故的篮球巨星。科比·布莱恩特被认为是篮球历史上投篮假动作最好的运动员之一。前一天美联储会议后，市场对鲍威尔主席新闻发布会立即产生了火爆的反应，美国主要指数在当天的最后 90 分钟内上涨了 3%。在我写这篇文章时的在接下来的 90 分钟里，我们就已经损失了所有指数上涨带来的收益，甚至更多。这时你还会怪我提及经典的假动作吗？

请注意在正向市场时间 3 小时内的重要双向交易：注意！我们还在本周内保持向上的趋势之中



4 天图表 纳斯达克 100 指数 (NDX, 红/绿 1 分钟线) , 标准普尔 500 指数 (SPX, 蓝线)

4 Day Chart NASDAQ 100 Index (NDX, red/green 1 minute bars), S&P 500 Index (SPX, blue line)

Source: Interactive Brokers

It appeared for a while that Mr. Powell was inhabiting his classic role as “Goldilocks in a Suit,” assuaging the worst fears that investors held after weeks of jawboning by various Fed Governors. The FOMC raised its target rate by 50 basis points, as expected, and outlined its plans for reducing the size of its balance sheet beginning in June. The Fed’s plans for balance sheet reduction were somewhat vague before yesterday, and bond investors seemed pleased with the news that the Fed will allow a maximum of \$47.5 billion in maturing bonds to run off its balance sheet for three months starting in June and doubling that amount to \$95 billion per month from September on. At that pace, the balance sheet would shrink by about \$1 trillion per year. Considering that the balance sheet more than doubled from about \$4.5 trillion before March 2020 to just under \$9 trillion now, that would still leave a significant amount of financial accommodation in place for several years. Bond traders, who are usually more clear-eyed than their equity counterparts, relished that news. Two-year note yields fell by 14 basis points from a multi-year high of 2.784%, and 10-year yields fell by about 4 basis points. It turns out that bond traders bit on the pump fake too. Today the 2-year yield has recouped about half yesterday’s drop, while the 10-year yield is currently 15 basis points higher at a multi-year high of 3.08%)

As is often the case, traders fixated on one line in the commentary – Mr. Powell’s comment that a 75-basis point hike was not “actively considered”. We noted yesterday that Fed Funds futures were implying just under a 50% chance of a 75-basis point rise at the next FOMC meeting. After an evening to consider that comment, many investors realized that a 12.5 basis point reduction in the implied Fed Funds rate for the coming six weeks[i] was hardly worth the enthusiastic response. For starters, Mr. Powell kept the possibility of bigger hikes on the table, they’re simply not under active consideration. Alternatively, many investors took the relatively dovish tone of the press conference as a sign that the Fed’s inflation-fighting resolve may not be sufficient. The rising yields at the long end of the curve send that message, which equities are now hearing.

**Ahead of yesterday’s meeting, we asserted** that there was a reasonable likelihood for a relief rally in the three-day period ending. That seemed prescient yesterday, less so now. Much will depend upon the market’s reaction to tomorrow morning’s Nonfarm Payrolls and Unemployment reports. As of now, our January call to “Sell the Rips” remains firmly in place. Yesterday’s move seemed overdone and due for a fade, but today’s moves are more than routine profit taking – this is a potentially vicious selloff.

Earlier in January, after Congressional testimony that soothed some frayed nerves that investors were displaying while indices pulled back from a year-end rally, I questioned whether Chairman Powell was “Goldilocks in a Suit or Sully Sullenberger”. Even at the time we questioned whether the Fed Chair was as skilled a pilot as the market believed him to be, writing:

“Here’s the problem with that analogy: we have no idea if Mr. Powell will be able to land the market without incident this time around.”

Today, after a Kobe-worthy pump fake and ongoing volatility, we’ll extend the pilot analogy one step further – please make sure your belts are securely fastened, because the fasten seat belt sign remains lit.

Remark. A 50% chance of an incremental 0.25% hike is an expected value of 12.5 basis points. ( $0.5 * 0.25\% = 0.125\%$ ; a basis point is 1/100 of a percent)

一段时间以来，鲍威尔似乎一直在扮演他的经典角色——“穿西装的金发女郎”，以缓解投资者数周来被不同美联储官员呼吁后的深深担忧。正如预期的那样，联邦公开市场委员会（FOMC）将目标利率上调了 50 个基点，并概述了从 6 月开始缩减资产负债表规模的计划。美联储缩表的计划在昨天之前还有些模糊，债券投资者似乎对美联储将从 6 月开始的三个月内允许最多 475 亿美元的到期债券从资产负债表中缩减并将该数额每月翻倍直至 950 亿美元的消息感到高兴。按照这个进度，资产负债表每年将缩减约 1 万亿美元。考虑到资产负债表从 2020 年 3 月之前的约 4.5 万亿美元翻了一番还多，到现在的略低于 9 万亿美元这一点，说明在后几年内流动性仍然留有不少空间。债券交易员通常比股票交易员头脑更清醒，他们会喜欢这个消息。两年期国债收益率从多年来的高点 2.784% 下跌 14 个基点，10 年期国债收益率下降约 4 个基点。事实证明，债券交易员也学会放烟雾弹了。今天 2 年期国债收益率已经上升了约昨天一半的跌幅，而 10 年期国债收益率目前上涨 15 个基点，达到多年的高位 3.08%。

和往常一样，交易员关注到了评论中的一句话——鲍威尔先生表示：75 个基点的加息没有被“积极考虑”。我们昨天注意到，联邦基金期货暗示在下一次联邦公开市场委员会会议上加息 75 个基点的可能性略低于 50%。经过一晚的思考，许多投资者意识到：未来六周内隐含联邦基金利率下降 12.5 个基点不值得热情的回应。一方面，鲍威尔先生一直在考虑更大幅度加息的可能性，只是没有积极考虑。另一方面，许多投资者认为：新闻发布会相对平和的基调表明美联储抗击通胀的决心可能还不够。曲线长端收益率的上升传递了这一信息，同时也正在被股市接收到。

在昨天的会议之前，我们断言：当三天的期限结束时，有合理的可能性出现压抑后的反弹。这似乎在昨天有先见之明，但在现在就没有了。它很大程度上取决于市场对明天上午的非农就业人数和失业报告的反应。到目前为止，我们 1 月份“趁着超卖后的短暂反弹做空正在下跌的资产”的号召仍然坚定不移。昨天的走势似乎有些过了，应该会消退，但今天的走势不仅仅是常规的获利了结——可能是一次潜在的恶性抛售。

在 1 月上旬，指数从年底的涨势中回落之际，国会证词安抚了投资者的紧张情绪。在此之后，我质疑鲍威尔主席是“穿西装的金发姑娘还是萨利·萨伦伯格”。甚至在质疑美联储主席是否像市场所认为的那样是一名熟练的飞行员时，我们写道：

“这个类比的问题是：我们不知道鲍威尔先生这次是否能够在不出意外的情况下进行市场着陆。”

今天，在假动作和持续波动之后，我们将进一步扩大飞行员的类比——请确保你的安全带系好，因为安全带的指示灯仍然亮着。

注解：加息 0.25% 的概率为 50%，预期值为 12.5 个基点。( $0.5 * 0.25\% = 0.125\%$ ;) 一个基点是百分之一的百分之一)

# Risk Management Implicated from the Russia-Ukraine War

## 俄乌冲突的风险启示

Qiuyu Chen 陈秋雨 Founder of the R & S Technology 雨禾科技创始人

Yong Wang 王勇 Chairman of TF International Securities 天风国际证券董事长

### 1. 前言. 从俄乌冲突到金融战

2022年2月21日，俄罗斯总统普京宣布承认乌克兰东部的“顿涅茨克人民共和国”和“卢甘斯克人民共和国”为独立国家，三天后，普京宣布在顿巴斯地区进行特别军事行动，俄乌冲突随之打响。

俄乌经过多次谈判均失败，而战争已持续了近三个月时间，随着芬兰表态申请加入北约，使得局势变得更加扑朔迷离。且不论双方孰是孰非，俄乌战争这一客观事实导致了全球各个方面的连锁反应，一时间风起云涌。

尽管美国领导下的北约不敢贸然直接跟俄罗斯开战，但是却对俄罗斯进行了全方位制裁和围堵。俄罗斯也不甘示弱进行了抵抗和反制裁，进而引发了金融战如火如荼。欧美对俄罗斯的制裁手段层出不穷，令人眼花缭乱。俄罗斯的反击手段更是逐步升级，魔高一丈。两者的金融战涉及的领域囊括了能源、股票、黄金、利率、汇率、期货、国际支付、外汇、国债，加密货币等市场，并对世界金融格局造成了很大的冲击。

### 2. 世界金融格局新动态

#### 2.1. 世界结算体系的角逐

2月26日，美欧联合声明禁止俄罗斯使用SWIFT体系，这意味着俄罗斯无法进行美元结算，也无法进行美元体系下的国际贸易。短期内对俄罗斯的国际贸易和金融的冲击是非常剧烈和直接的，直接导致了俄罗斯卢布大幅贬值。到3月7号达到贬值顶峰1美元兑换154.25卢布（图1）。针对SWIFT的制裁，俄罗斯表示可能否定美元的合法货币地位，这意味着美元不仅在俄罗斯国内无法使用，其他国家在于俄罗斯贸易中也不能使用。随后，普京宣布只能用卢布和黄金购买天然气，俄罗斯卢布得以迅速升值。随着近期美联储加息，世界各主要国家的货币均对美元快速贬值（图2-图4）。而俄罗斯将每克黄金与5000卢布绑定，以此固定汇率来稳定卢布汇率和金融体系，从而撕开了欧美金融制裁的口子，脱离了美元加息的漩涡，走出了独立的行情。目前卢布汇率已经回升，甚至超过战前水平。

#### 1. Introduction From the Russia-Ukraine War to the Financial War

On February 21, 2022, Russian President Vladimir Putin announced the recognition of the "Donetsk People's Republic" and the "Luhansk People's Republic" in eastern Ukraine as independent states. 3 days later, he announced "a special military operations" in the Donbas region, and the Russian-Ukrainian conflict began.

After multiple negotiations between Russia and Ukraine, no armistice has yet been reached, and the war has lasted for nearly three months. With Finland's application to join NATO, the situation has become even more complicated and subtle. Regardless of the views of the two sides, the Ukrainian-Russian war led to a stormy chain reaction in all aspects of the world.

Although NATO under the leadership of the United States did not rush to war with Russia directly, it imposed all-round sanctions and dizzying containment on Russia. Not to be outdone, Russia resisted and countered sanctions, triggering a financial war in full swing. The areas involved in the financial war between the two include energy, stocks, gold, interest rates, exchange rates, futures, international payments, foreign exchange, national debt, cryptocurrencies and other markets, having had a great impact on the world financial landscape.

#### 2. New changes of the global financial landscape

##### 2.1. Competition of the global settlement systems

On February 26, the United States and the European Union jointly announced that Russia was prohibited from using the SWIFT system, which meant that Russia could not carry out US dollar settlements and international trade under the US dollar system. The impact on Russia's international trade and finance in the short term has been very substantial and direct, including the sharp depreciation of the Russian currency, Ruble. By March 7, the depreciation peaked at 154.25 Rubles per dollar (Figure 1). In response to the SWIFT sanctions, Russia announced that it may deny the legal currency status of the US dollar, which means, if realized, that the US dollar may not be used in all trades with Russia in or outside Russia. Subsequently, Russian President Putin announced that natural gas can only be purchased with Rubles and gold. As a result, the Ruble appreciated rapidly while, all major currencies in the world have depreciated rapidly against the US dollar due to the recent interest rate hike by the Federal Reserve (Figure 2-Figure 4). Tearing open the financial sanctions of Europe and the United States, Russia pegs each gram of gold to 5,000 rubles with fixed exchange rate to stabilize the Ruble exchange rate and financial system thus breaking away from the swirls of US dollar interest rate hikes and stepping out as an independent market. The ruble exchange rate has now recovered, even surpassing pre-war levels.



图 1 美元/俄罗斯卢布汇率走势

USD/Ruble Exchange

图 2 日元/美元汇率走势

YEN/USD Exchange Rate



图 3 欧元/美元汇率走势

EUR/Ruble Exchange



图 4 人民币/美元汇率走势

RMB/USD Exchange Rate

实际上，在“去美元化”的路上，俄罗早已有所准备。近年来，开始建立了自己的金融信息传输系统（SPFS）。俄罗斯央行的数据显示去年已将其美元储备削减，目前仅持有 39 亿美元的美国政府债券。

美国的“无限印钞”模式和美联储的加息漩涡效应把其他国家也逼上了“去美元化”的道路。欧盟早于 2018 年底启动了新的支付渠道 SPV13 机制的建设。俄乌冲突爆发后，土耳其与俄罗斯联手，宣布两国之间的合作除了用美元和欧元进行结算之外，还可以采取如卢布、黄金进行结算；印度将从俄罗斯采购更多的石油和商品，并将采用卢比或者卢布作为结算货币；巴基斯坦也表示要继续进口俄罗斯小麦和推进俄巴之间的天然气管道项目；沙特也加快跟中国石油交易人民币结算的谈判；另外，欧亚经济联盟跟中国磋商，加快制定独立的国际货币金融体系方案。

另一方面，俄罗斯外汇被冻结给其他国家敲醒了警钟，人们认为把外汇和黄金储备放在美国或者其他国家是不安全的，加速了金融去全球化的速度。同时，由于美国不断发债，加上持续的高通胀也使得债券资产贬值，各国开始加速减持美债。跟去年最高峰比，日本减持了 255 亿美元，中国减持了 441 亿美元，英国减持了 386 亿美元（图 5）。总体上，外国持有者今年 1 月共持有美债规模 7.6617 万亿美元，跟去年 12 月相比，减少了 860 亿美元。

中国近年来一直“去美元化”，并加速人民币国际化进程。2012 年以来，中国与五十多个国家签署了货币互换协议，逐渐建立了人民币跨境支付体系。随着中国经济的信心增加，中国央行数字货币（DCEP）在世界贸易清结算体系的角色日趋重要。

In fact, Russia has already been preparing for the "de-dollarization". In recent years, it has started to build its own Financial Information Transmission System (SPFS). Russia's central bank has cut its dollar reserves last year to just \$3.9 billion in U.S. government bonds shown by the data from Russia's central bank.

The "unlimited money printing" of the U.S. and the US dollar interest rate hikes have forced other countries into "de-dollarization". The EU launched a new payment channel SPV13 at the end of 2018. After the beginning of the Russian-Ukrainian conflict, Turkey and Russia jointly announced that in addition to Dollars and Euros, cooperation between the two countries can also settle in Rubles and gold; India was to purchase more oil and commodities from Russia using Rupees or Rubles as the settlement currency; Pakistan also said that it would continue to import Russian wheat and to promote natural gas pipeline projects between Russia and Pakistan; Saudi Arabia has also accelerated negotiations with China on the settlement of oil transactions in Renminbi; the Eurasian Economic Union has consulted with China to accelerate the development of an independent international monetary and financial system.

On the other hand, the freezing of Russia's foreign reserves has rung the bell for other countries, who no longer consider it safe to put foreign currencies and gold reserves in the United States or other countries, accelerating the financial deglobalization. At the same time, as the US government bond started to depreciate due to excessive issuance and high inflation expectation, some countries have begun to accelerate their reductions in U.S. debt. Compared with the peak of last year, Japan has reduced its holdings by US\$25.5 billion, China by US\$44.1 billion, and the UK by US\$38.6 billion (Figure 5). Overall, foreign holders held \$7.6617 trillion in U.S. Treasuries in January, a decrease of \$86 billion from December last year.

China has also been "de-dollarizing" in recent years and accelerating the internationalization of the Renminbi. Since 2012, China has been signing currency swap agreements with more than 50 countries, gradually establishing a cross-border payment system for the Renminbi. As confidence in the Chinese economy increases, the role of the Central Bank of China's digital currency (DCEP) in the global trade clearing and settlement systems is becoming increasingly important.

MAJOR FOREIGN HOLDERS OF TREASURY SECURITIES  
(in billions of dollars)  
HOLDINGS 1/ AT END OF PERIOD

| Country         | Jan 2022 | Dec 2021 | Nov 2021 | Oct 2021 | Sep 2021 | Aug 2021 | Jul 2021 | Jun 2021 | May 2021 | Apr 2021 | Mar 2021 | Feb 2021 | Jan 2021 |
|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Japan           | 1303.1   | 1304.0   | 1328.6   | 1320.4   | 1299.6   | 1319.7   | 1310.2   | 1279.7   | 1266.2   | 1276.8   | 1240.5   | 1258.0   | 1276.9   |
| China, Mainland | 1060.1   | 1068.7   | 1080.8   | 1065.4   | 1047.5   | 1047.0   | 1068.3   | 1061.8   | 1078.4   | 1096.1   | 1100.4   | 1104.2   | 1095.2   |
| United Kingdom  | 608.8    | 647.4    | 621.9    | 580.2    | 566.4    | 568.9    | 541.6    | 533.6    | 467.6    | 431.7    | 443.1    | 459.4    | 438.7    |
| Luxembourg      | 310.8    | 325.6    | 333.3    | 314.3    | 312.0    | 294.2    | 291.7    | 302.1    | 287.6    | 290.4    | 282.8    | 282.1    | 280.9    |
| Ireland         | 308.3    | 334.3    | 330.0    | 324.1    | 309.6    | 326.4    | 319.8    | 322.7    | 304.9    | 307.0    | 309.8    | 316.0    | 313.6    |
| Switzerland     | 299.0    | 288.0    | 292.1    | 289.9    | 294.4    | 292.6    | 296.2    | 302.0    | 264.8    | 260.9    | 254.7    | 257.7    | 254.0    |
| Cayman Islands  | 271.1    | 261.9    | 262.1    | 271.9    | 266.8    | 263.5    | 263.8    | 260.1    | 229.4    | 226.4    | 215.2    | 216.0    | 216.8    |
| Taiwan          | 248.6    | 251.0    | 248.6    | 242.4    | 239.4    | 237.2    | 242.2    | 239.3    | 236.3    | 234.0    | 231.5    | 234.5    | 239.6    |
| Belgium         | 243.0    | 271.7    | 224.9    | 225.8    | 220.9    | 227.7    | 220.5    | 228.5    | 236.4    | 234.8    | 235.8    | 236.7    | 248.2    |
| Brazil          | 239.7    | 244.5    | 248.8    | 247.7    | 249.0    | 248.9    | 248.5    | 249.1    | 251.8    | 255.3    | 255.5    | 259.0    | 260.4    |

图 5 美联储主要美债持有国持有情况 (2021.1-2022.1)

The holdings of major U.S. bond holders of the Fed (2021.1-2022.1)

## 2.2 加密货币的两极分化

欧美在禁止俄罗斯使用 SWIFT 的同时发现，俄罗斯还可以利用加密货币进行国际贸易。于是美国对加密货币交易所施压，确保俄罗斯无法通过加密货币来逃避制裁。Cex.io、DMarket、Binance、Kraken 和 Coinbase 等加密货币交易所纷纷加入制裁俄罗斯的行列，冻结了俄罗斯用户的账号。

人们越来越发现，加密货币与传统金融市场的相关性越来越高，2月上旬，彭博社数据显示加密货币与纳斯达克的相关性达到 73%，与标准普尔 500 的相似性也最高达到 54%。在俄乌冲突中，加密资产并没有起到避险的作用。尤其是随着 2021 月 4 月，美国证券交易委员会批准 Coinbase 上市，10 月 18 日，又批准推出比特币期货 ETF。比特币被主流市场接受的过程中，逐渐被驯化成了一种另类风险资产。随着加密货币交易所集体制裁俄罗斯，加密货币的去中心化、匿名性、不可篡改、信用机器等特性受到了质疑。

事实上，人们混淆了“公链比特币”与“交易所比特币”。公链比特币是中本聪所设计，但交易速度过低而无法大规模应用，交易所应运而生，解决了公链比特币应用效率的问题。但是，交易所比特币本质上是公链比特币的“影子”，它们并存在于比特币公链上。一旦交易所跑路了或者被黑客攻击了，投资者的交易所比特币也就没了。尽管加密货币交易所声称他们按照 1:1 的比例在公链上存储了储备金，但由于很多交易所处于法律灰色地带，缺乏监管，因此是否真的备有足够的储备金，也是无从得知。另外，为了防范风险，交易所均要求注册时候提供真实的个人信息，这与中本聪所设计的比特币已经背道而驰。这次制裁标志着加密货币交易所与最早的先驱发生重大决裂，慢慢演变成围绕公链比特币衍生出来的一个传统金融市场。

### 2.2. The polarization of cryptocurrencies

While banning the use of SWIFT in Russia, Europe and the United States found out that Russia can use cryptocurrencies for international trade. The United States put pressure on cryptocurrency exchanges to ensure that Russia cannot evade sanctions. Cryptocurrency exchanges such as Cex.io, DMarket, Binance, Kraken and Coinbase have joined the ranks of sanctions against Russia by freezing the accounts of Russian users.

Cryptocurrencies are increasingly correlated with traditional financial markets, with Bloomberg data showing a 73% correlation between cryptocurrencies and Nasdaq in early February, and a high similarity of 54% to the S&P 500. In the Russian-Ukrainian conflict, crypto assets have not played a safe haven role. As signaled by the approval of Coinbase listing by the U.S. Securities and Exchange Commission in April 2021, and the launch of a Bitcoin futures ETF on October 18, 2021, Bitcoin has been accepted by the mainstream markets and gradually been domesticated into an alternative risk asset. As cryptocurrency exchanges collectively sanctioned Russia, the advantages of cryptocurrency such as decentralization, anonymity, immutability, and credit mechanism have been questioned.

People often confuse "Bitcoin on the public chain" with "Bitcoin in the exchange". Bitcoin on the public chain was designed by Satoshi Nakamoto, but the transaction speed is too low on large-scale trading. The exchange came to solve the problem. The bitcoin in the exchange is a "shadow" of the Bitcoin on the public chain and both should exist on the Bitcoin block chain. But once the exchange-related bank-run happened or the exchange is hacked, the investor's bitcoin in the exchange would be gone. Although cryptocurrency exchanges claim that they store reserves on the public chain in a 1:1 ratio, many are in a legal gray area and lack of supervision. It is impossible to know whether they really have enough reserves. In addition, to prevent such risks, exchanges require real personal information at the time of registration, which is contrary to the bitcoin designed by Satoshi Nakamoto. The sanctions marked a major break between exchanges and the earliest pioneers, slowly evolving into a traditional financial market derived from the Bitcoin blockchain.



但是，欧美可以要求加密货币交易所制裁俄罗斯，但无法要求公链上的比特币账号配合制裁。基于此，有部分专业人士认为公链比特币是真正的去中心，无法被控制，比特币的价值会持续上涨。但是，要实现真正的去中心化，需要打破加密货币与传统金融的连接，而连接两者的桥梁就是加密货币中的稳定币。5月12号，稳定币中的佼佼者 UST 被狙击者利用其算法漩涡进行了绞杀，市值暴跌，市值第一的稳定币 USDT 也被连累，在当天与1美元价值严重脱钩，整个加密货币圈市值也严重萎缩。<sup>1</sup>由此，隐约可看到了加密货币圈未能挣脱传统金融控制的行动。

However, Europe and the United States can require cryptocurrency exchanges to sanction Russia but cannot require Bitcoin users on the public chain to cooperate with sanctions. Based on this, some professionals believe that the Bitcoin on the public chain is truly decentralized and cannot be controlled, and the value of Bitcoin will continue to rise. However, to achieve true decentralization, the connection between cryptocurrency and traditional finance needs to be broken, and the bridge connecting the two is the stablecoin mechanism. On May 12, UST, a leading stablecoin, was strangled by snipers by exploring its algorithm shortcomings, and its market cap plummeted. USDT, the stablecoin with the largest market cap, was also involved in the market crash. The market cap has also shrunk severely. From this, it is vaguely seen that the cryptocurrency circle has failed to break free from traditional financial control.



图 6 稳定币 UST 的暴跌

UST Price



图 7 稳定币 USDT 的巨幅震荡

USDT Volatility

### 2.3. 国际金属交易定价中心的转移

俄罗斯的镍板出口量位居世界第一，是伦敦金属交易所(LME)的主要交割品，但由于俄罗斯被踢出 SWIFT 系统，无法进行国际贸易，同时俄罗斯货船运输也受影响，导致俄罗斯镍的交割受阻。看涨的投资者（多方）利用这些天时地利对镍期货进行了逼空，导致价格暴涨。镍价由2万美元/吨急剧飙升，一度飚到了10万美元/吨，3月7日和8日两天内累计涨幅达到了248%（图8）。

据媒体消息，中国镍生产商青山集团持有20万吨的看跌头寸（空方），遭到了多方逼仓。巨幅震荡迫使LME紧急宣布暂停所有镍合约交易，并取消英国时间3月8日伦敦时间0:00后所有的场内场外交易，并将3月9日的交割推迟。

价格发现和风险对冲是期货市场两个基本功能。本次 LME 镍期货的多逼空造成镍价严重失灵。自3月16日恢复交易以来，又连续多次出现技术故障，跌破当日跌停板限制。LME 多次取消部分交易，这大大的激怒了押注镍价上涨的投资者。一边是投资者发出灵魂拷问“LME 取消交易是在帮中国公司吗？”另一边是 LME 镍价失去了指导现货交易的作用，造成实体企业难以进行正常交易，进一步加剧了期货的价格，使得避险功能也没有正常发挥。

#### 2.3. Possible Move of International Metal Futures Trading Center

Russia's nickel plate export volume ranks first in the world and is the main delivery product of the London Metal Exchange (LME). However, due to Russia being kicked out of the SWIFT system, international trade cannot be carried out, and Russian cargo shipping is also affected, resulting in Russian nickel delivery was blocked. Bullish investors took advantage of the timing to short nickel futures, sending prices skyrocketing. Nickel prices soared from US\$20,000/ton to US\$100,000/ton at one point, with a cumulative increase of 248% in two days on March 7 and 8 (Figure 8).

Price discovery and risk hedging are two basic functions of the futures market. The long-short squeeze of nickel futures at LME caused a serious distortion of nickel prices. Since the resumption of trading on March 16, there have been several technical failures, leading to the price falling below the daily limit. The LME had to cancel some deals, angering investors who were speculating on the price appreciation. On the one hand, investors want to know, "Is the LME helping Chinese companies by canceling the transaction?". On the other hand, the LME nickel price has lost its role as a guide to spot trading. This also makes it difficult for the nickel industry to perform normal trading for hedging purposes.

<sup>1</sup> 数据和图表来源于 Binance



图 8 LME 镍交易的巨幅震荡

LME 历史悠久，一直以来都是国际金属定价中心。但这次它没有看到日益增加的风险规模，尽管 LME 宣称这次危机是因为银行拒绝透露场外交易头寸而导致，但也暴露了 LME 交易机制的缺陷：

- 1、没有大户报告制度，无法防止大户操纵市场的行为，对场内和场外交易头寸规模和风险积累没有进行联动检测；
- 2、价格没有涨跌停限制，导致在战争的背景下，两天暴涨 248%；
- 3、技术故障使得连续多个交易日均有超出限价区间的交易，LME 5 天均取消这部分交易，使 LME 名誉扫地；
- 4、LME 合约直到到期日才结算，追加保证金追加也只是为浮亏提供准备金，并非将它当成已经实现了的亏损，这可能会削弱了盈利一方的权益。
- 5、最后，与国内交易所每个合约固定交割日不同，LME 的交割日根据持仓时间不同有所区别：持仓在三个月内的，任何一个交易日均可交割；持仓在 3-6 个月合约，交割日为每个星期三；6 个月以上的交割日为每个月第三个星期三。这种灵活性使得交易所具有更大的旋转余地，但可能会遭受投资者法律诉讼。

一连串事件威胁到了 LME 在全球金属市场的主导地位，大量投资者迅速抛掉手中合约，导致 LME 未平仓量达到 15 年来最低<sup>2</sup>。尽管美国 COMEX 交易所在国际上影响力也很大，但金属交易品种较少。因此，金属交易品种相对齐全的上海期货交易所有望接棒 LME 成为下一个金属交易中心。

The LME has long been the center of international commodity futures trading. But it failed to manage the risks in this event. LME data shows that before the incident, one company held 50%-80% of the long positions. It gradually increased its long positions, and finally used futures and spot to squeeze positions. This exposed the flaws in the LME trading management system:

There is no reporting requirement for large accounts, so large players cannot be prevented from manipulating the market. There is no detection mechanism for accumulated exposure of futures and OTC positions;

There is no price change limit, which led to a 248% surge in two days because of the war;

The technical glitches led to the execution of transactions which breached the price limit range for several consecutive trading days. The LME had to cancel these transactions for 5 days, which undermines the credit of the LME;

The LME contract is not settled until the trade expiry, and the margin call only serves the purpose of covering the unrealized losses. It is possible that the rights of investors with unrealized profit is protected properly.

Finally, unlike the fixed delivery date on Chinese domestic exchanges, the delivery date of LME varies according to the holding time of the futures contract: if the contract is within three months, it can be delivered on any trading day; if the contract is 3-6 months, the delivery day is every Wednesday; for contracts more than 6 months, the delivery day is the third Wednesday of each month. This flexibility gives exchanges more wiggle room, but may be subject to investor legal action.

A spate of events threatened the LME's dominance in the global metals futures market. Investors quickly dumped contracts, leading to LME open interest to a 15-year low. Although the COMEX exchange in the United States also has a great international influence, there are less trading products for metals.

<sup>2</sup> 数据来自新浪财经。

### 3. 金融风险管理的启示

我们能从这场金融战中学到什么？如何进行风险防范？

#### 3.1. 国家风险管理

从俄乌冲突的表现，至少有 6 个指标可供参考与借鉴。除了平时大家比较关注的汇率、国债、股票指数、支柱产业的表现之外，还应该考虑两个方面：

##### 3.1.1. 经济地位

据媒体报告的数据，2021 年，俄罗斯的 GDP 为 1.77 万亿美元，乌克兰的 GDP 约为 0.2 万亿美元，乌克兰的 GDP 只有俄罗斯的 11%，在欧洲各国中排名垫底。在人均收入方面，俄罗斯为 1.2 万美元，乌克兰为 0.45 万美元，只有俄罗斯的 37.5%。无论是经济还是其它方面，乌克兰都无法与俄罗斯抗衡。

但是，这不意味着俄罗斯的金融风险小，因为乌克兰背后是强大的北约组织。2021 年的 GDP 中，光美国的 GDP 就约 23 万亿美元，人均收入为 3.8 万美元。德国则 4.2 万亿美元，英国超过 3 万亿美元，法国接近 3 万亿美元。在人均收入方面，俄罗斯也远远低于这些国家。因此，俄罗斯与整个北约组织成员国相比，经济地位完全处于弱势，蕴含着很大的金融风险。

##### 3.1.2. 主权 CDS

主权 CDS（Credit Default Swap, 信用违约互换）是衡量一个国家违约可能性的一个非常直接的指标，反映了国际投资人对该国的违约预期的实时定价。CDS 本质是给债务购买保险，如果发生违约，则买方可以从卖方那里获得债务全额赔偿，代价是每固定周期（比如半年）按约定的费用支付一次保费。

CDS 通常以基点来衡量，最被人关注的是五年期的 CDS，因为其反映了标的主体信用风险的情况。2月 23 日俄罗斯的主权 CDS 基点为 343.62，到战争爆发当天上升到 412.48，随着对俄罗斯的金融制裁，CDS 也持续迅速攀升，在 3 月 11 号达到高峰 6954.17，是战前的 1923%，到了 3 月 24 号回落到 5162.14。而一年期的 CDS 波动更加剧烈，从战前的 415.35，最高达到过 31130.961（图 9）。可见市场对俄罗斯主权债务的违约风险预测非常高。

### 3. Thoughts for Financial Risk Management

What can we learn from this financial product trading war? How to manage the associated risk?

#### 3.1. Country Risk Management

How to measure the country risk, when a country is under severe sanctions and overly negative rating actions by foreign rating agencies? From the Russian-Ukrainian conflict, there are at least 6 indicators for references, in addition to the aforementioned exchange risk. They are performance of government bonds, stock indexes, key industries, and two factors which are:

##### 3.1.1. Economic status

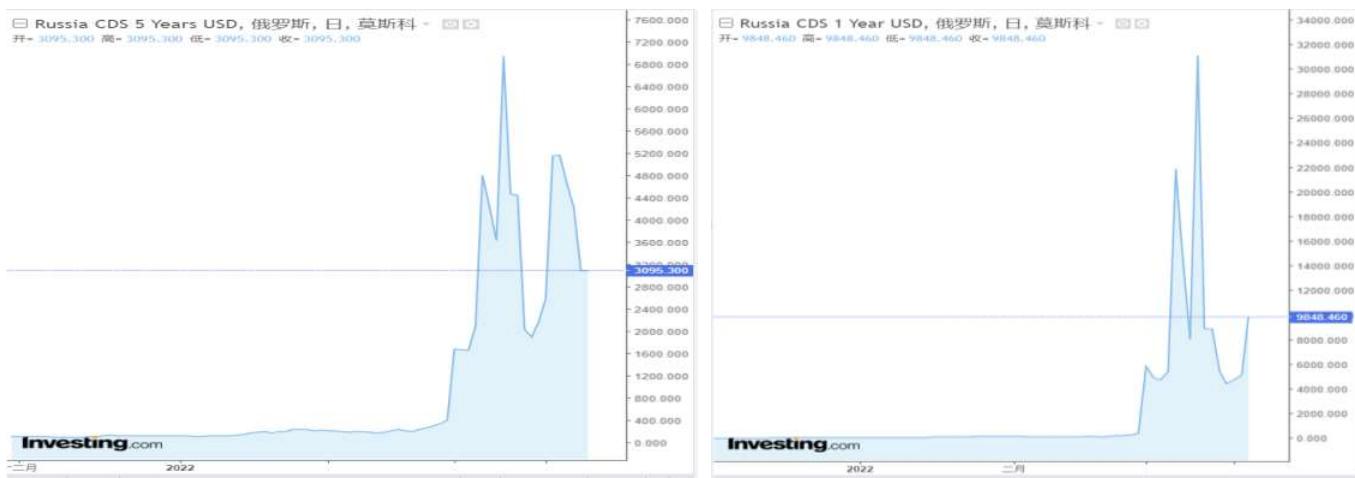
According to data from media, in 2021 Russia's GDP was 1.77 trillion US dollars, and Ukraine's GDP was about 0.2 trillion US dollars. Ukraine's GDP is only 11% of Russia's, ranking last among European countries. In terms of per capita income, Russia is 12,000 US dollars, Ukraine is 4,500 US dollars, only 37.5% of Russia's. Ukraine cannot compete with Russia economically.

However, Russia's financial risk is not low, because Ukraine is supported by the mighty NATO. In the GDP of 2021, the GDP of the United States alone is about 23 trillion US dollars, and the per capita income is 38,000 US dollars. Germany is \$4.2 trillion, the UK is over \$3 trillion, and France is close to \$3 trillion. Russia is far below these countries in terms of per capita income. Therefore, compared with the NATO member states, Russia's economic status is weak. The conflict has led to a very high financial risk to Russia.

##### 3.1.2. Sovereign CDS

Sovereign CDS (Credit Default Swap, credit default swap) is a direct indicator to measure the possibility of a country's default, reflecting the investors' speculation. A sovereign CDS is to buy insurance for sovereign debts. In the event of a default, the buyer can obtain full compensation of the defaulted debt from the seller at the cost of paying the insurance premium for a fixed period (such as half a year).

CDS is usually measured in basis points (bps) of the credit spread, with the five-year contract being the most interesting as it reflects the credit risk profile of the underlying entity. Russia's sovereign CDS was 343bps on February 23, and rose to 412bps on the day the war broke out. With the financial sanctions against Russia, the CDS continued to climb rapidly, reaching a peak of 6954bps on March 11, which is a 1923% increase before the war. On March 24, it fell back to 5162bps. The one-year CDS fluctuated even more dramatically, from 415bps before the war to a maximum of 31130bps (Figure 9). It can be seen that the market's speculation of the default of Russia's sovereign debt is very high.

图 9 俄罗斯 5 年期和 1 年期的主权 CDS<sup>3</sup>

### 3.2. 股市风险防范

尽管中国一再强调中立态度，但战争依然祸及到了中国股市，港股，甚至在美的中概股也没有幸免。开战当天，上证指数从 3474.37 最低跌到 3400.21，到了 16 号最低探底 3023.24，最大回撤达到 13%。而深证成指则达到 18%。港股更是跌跌不休，过去三个月从最高点到最低点的跌幅为 41%。中概股在此前已经饱受折磨，受战争和美国《外国公司问责法案》出台的影响，更是哀鸿遍野（图 10）。目前已有 40 家公司被列入预摘牌名单，百度、爱奇艺、微博等著名企业都在名单中。

因此，我们应运用大数据方法加强外资流向的监测和动态风险评估，加强境外交易对手的研究，模拟被攻击的场景和制定应对方案，同时培养风险管理科技人才，并且利用舆论正确引导股民避免踩踏。另外，关系到国内重大数据安全的企业应该考虑逐步回归港股上市，规避外国审计风险。

#### 3.2. Risk management for equity markets

Despite China's repeated emphasis on neutrality, the equity market in mainland China and Hong Kong and Chinese companies listed in the US were affected. On the day when the war started, the Shanghai Composite Index fell from 3474.37 to 3400.21. It reached a minimum of 3023.24 on the 16th, a 13% of retreat. The retreat of Shenzhen Component Index was 18%. Hong Kong stocks fell even more, with a drop of 41% from the highest point in the past three months. The Chinese concept stocks listed in the US have been beaten down before. This time the performance of these stock become worse, as both the war and the introduction of the "Foreign Company Accountability Act" in the United States (Figure 10). Five companies are currently at risk of being forced to delist.

Therefore, we should apply big data algorithms to strengthen the monitor of foreign capital flows, enhance the dynamic risk assessment, strengthen research on foreign counterparties, design and simulate the scenarios of possible attacks and countermeasures, at the same time train the risk management talents. It is also important to use public opinion to guide market stakeholders. In addition, companies that possess sensitive domestic data should consider gradually return to the Hong Kong stock market to avoid foreign audit risks.

图 10 与中国相关的股市走势<sup>4</sup>

<sup>3</sup> 数据和图表来源于彭博数据库

<sup>4</sup> 数据和图表来源于 Investing.com

### 3.3. 衍生品风险防范

在这次伦敦金属交易所镍期货大战中，LME的百年声誉却毁于一旦。从交易所角度，以下几点风险需要谨防：

1、场外头寸监管穿透问题。LME宣称这次镍期货风险是来自于场外市场，是因为银行拒绝透露场外头寸的情况。因此，交易所应对场外头寸和现货市场情况建立联动检测机制。

2、监管反应时效问题。3月7号镍期货合约已经一飞冲天，涨幅达到74%。到了8号，涨幅突破110%。但是LME一直到8号晚间才发布公告取消部分交易，反应速度迟钝。应建设大数据人工智能检测系统，在交易异常时候及时做出反应，最大限度减少不利影响。

3、制度完善的问题。LME将市场的稳定寄托于交易者的自律是不稳妥的，需要制度层面来约束人性的贪婪。对重要的生产资料在海外衍生品交易中，应从行业角度出台管理制度，避免悲剧重演。

上海期货交易所要成为全球金属交易定价中心，还需要做好以下几个方面：

1、海外交割仓库的建设。要成为国际定价中心，吸引国外的交易者，中国需要在海外布局交割仓库，但是目前还没有海外交割仓库。

2、增加国际交易品种。目前金属交易只有国际铜，因此需要大力开发新的国际金属品种。另外，还需增设海外市场拓展部，加大海外交易者市场宣传和培育。

我们期待和平，也为乌克兰、俄罗斯和其他地区饱受战争之苦的人们祈祷！

### 3.3. Risk management of derivatives markets

The LME's century-old reputation was ruined in this nickel trading chaos. From the perspective of both investors and the exchange, it has triggered our review on about risk management of the derivatives markets.

From the perspective of exchanges, the following risks need to be considered carefully:

1. The penetration of the OTC positions. The LME said that the nickel futures risk was from the OTC market because banks refused to disclose the status of their OTC positions. The lack of detection mechanism for OTC positions and spot market conditions lead to high risks.
2. The slow response of the exchange. The nickel futures contract skyrocketed rising 74% on March 7 and increased further to 110% on March 8. However, the response of the LME was slow. It did not issue an announcement to cancel some transactions until the evening of the 8th. A big data AI detection system should be built to respond in a timely manner when transactions are abnormal.
3. The problem of the regulatory system. It is not safe for the LME to rely on the self-discipline of market participants for the stability of the market. It needs the institutional level to manage the greed of human nature. A robust regulatory system should be introduced by the industry to prevent market disruption at this scale from happening again.

The following aspects should be done well, if the Shanghai Futures Exchange intends to replace the LME and become the global metal trading pricing center:

1. Construction of oversea delivery warehouses. To become an international commodity trading center and attract foreign traders, Chinese exchanges need to have warehouses overseas, but currently there none.
2. Increase the internationally traded commodity products. At present, only copper and aluminum are traded internationally. It is necessary to add more products. In addition, it is necessary to add an overseas market development department to promote market and attract of international market participants.
3. Increase the trading of non-fungible digital assets. Based on the blockchain non-fungible (NFT) technology, the central bank's digital currency DCEP, and the real rights and interests of the physical assets, gradually launch the sandbox exercise of digital asset trading. Under the legal and regulatory compliance, attract capital inflow and train talents in blockchain from practice.

We hope for peace and pray for the war-torn people in Ukraine, Russia and beyond!

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# When old patterns break, opportunities emerge

Why challenging market conditions mean it is precisely the right time to invest



## 打破陈旧模式，机会应运而生

为什么严峻的市场环境意味着现在正是投资的最佳时机

Polina Kurdyavko, Head of Emerging Markets at RBC Global Asset Management, BlueBay Asset Management

BlueBay 资产管理公司 RBC Global Asset Management 新兴市场主管

There are decades when nothing happens and there are weeks when decades happen. As we write, a new wave of geopolitical risk is hitting the global economy as the Russia/Ukraine conflict escalates. Investors are also battling growing inflationary pressures, while the US Federal Reserve embarks on a rate-hiking cycle. Emerging market (EM) debt investors approach this landscape having been operating in pandemic-driven fear mode for the past 12 months, as evidenced by negative index returns across most EM assets.

Do today's headwinds mean they should steer clear for another 12 months?

### The EM investment landscape – is ‘fear mode’ still justified?

With headlines reporting multiple unexpected or unlikely risk – so-called ‘fat-tail’ events – it is easy to have an emotional response as an investor. But instead of reaching for the panic button, our approach is to step back and consider the facts:

- What is being priced into risk-asset valuations?
- How can we think about these events in terms of downside and upside?
- How can we make an objective assessment on what has already been priced in?
- Are there potentially opportunities that other investors are discounting?
- Where are the real risks – and do they indicate investors should stay on the sidelines?

有时候几十年什么都没发生，也有时候几周却什么都发生了。就在我们写这篇文章的时候，随着俄罗斯和乌克兰冲突的升级，新一轮的地缘政治风险正在冲击全球经济。在美联储启动加息周期之际，投资者还在与日益加大的通胀压力作斗争。而与此期间的过去 12 个月，新兴市场债务投资者一直处于受疫情影响的恐慌下，大部分新兴市场资产的收益为负。今天的逆风是否意味着未来 12 个月内应该避开？

### 新兴市场投资格局——“恐惧模式”仍然合理吗

新闻头条报道了许多个意外风险或小概率事件——所谓的“肥尾”极端震荡行情——作为投资者很容易产生情绪反应。但我们的方法不是按下恐慌按钮，而是后退一步，考虑事实：

- 风险资产估值中什么已经被计价在内？
- 我们如何从负面和正面的角度看待这些行情？
- 我们如何对已经计入的价格做出客观评估？
- 是否有其他投资者低估的潜在机会？
- 真正的风险在哪里？是否提示投资者应该保持观望？



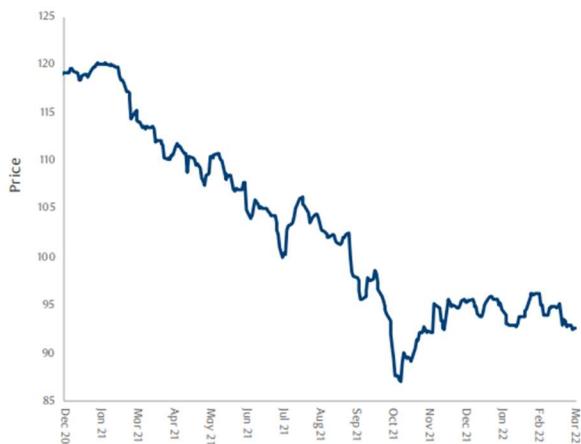
## Regional headwinds

- Escalating geopolitics are creating challenges from every direction. The reality of war has hit Europe, with the Russian invasion of Ukraine perhaps the biggest shift in the region's geopolitical landscape since the fall of the Berlin Wall in 1989. At the time of writing, it is driving huge volatility across global markets.
- Elsewhere in the CEEMEA region, Turkey's unorthodox policy approach is bringing the country to the brink of a crisis, while a number of countries, including South Africa, face growth challenges.
- In Latin America, we have seen several leftist leaders coming to power, notably in Peru and Chile. This year's election calendar looks equally precarious, with Colombia and Brazil's presidential elections potentially bringing a stronger leftist tilt to the region, which could unsettle markets.
- Across Asia, zero-Covid policies continue to cause supply chain disruptions, while in China, the government's policy solution for the real estate sector remains unclear. Most bonds in the sector are trading at distressed levels.
- Among the high yield markets, Sri Lanka and Ethiopia could potentially face debt reprofiling in 2022.

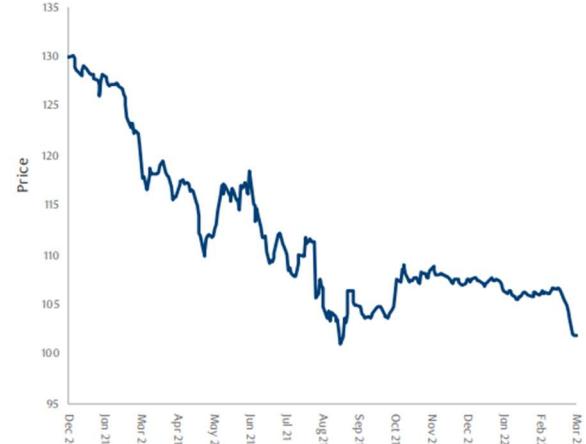
Do these headwinds mean investors should steer away from EM for the next year?

Absolutely not. This is precisely the time to actively invest in EM. Here is why and how:

**Chile: Fiscal slippage ahead of tight election in November**



**Peru: Castillo's election victory pushed the country to the left**



Source: Bloomberg, BlueBay Asset Management, as at 10 March 2022

## 各地的逆风

- 不断升级的地缘政治正在从各个方向制造挑战。战争的现实打击了欧洲，俄罗斯入侵乌克兰可能是自 1989 年柏林墙倒塌以来，该地区地缘政治格局发生最大变化。在撰写本文时，它正在全球市场引发巨大波动。
- 在中欧，东欧，中东以及非洲地区的其他地方，土耳其的非正统政策正将该国推向危机的边缘，包括南非在内的一些国家正面临增长挑战。
- 在拉丁美洲，我们已经看到一些左翼领导人上台，特别是在秘鲁和智利。今年的选举日历看起来同样不稳定，哥伦比亚和巴西的总统选举可能会给该地区带来更强烈的左翼倾向，这可能会令市场不安。
- 在亚洲各地，新冠清零政策继续造成供应链中断，而在中国，政府对房地产行业的政策解决方案仍不明朗。该行业大多数债券的交易价格都处于令人沮丧的水平。
- 在高收益债券市场中，斯里兰卡和埃塞俄比亚可能在 2022 年面临债务重组。

这些不利因素是否意味着投资者明年应该避开新兴市场？

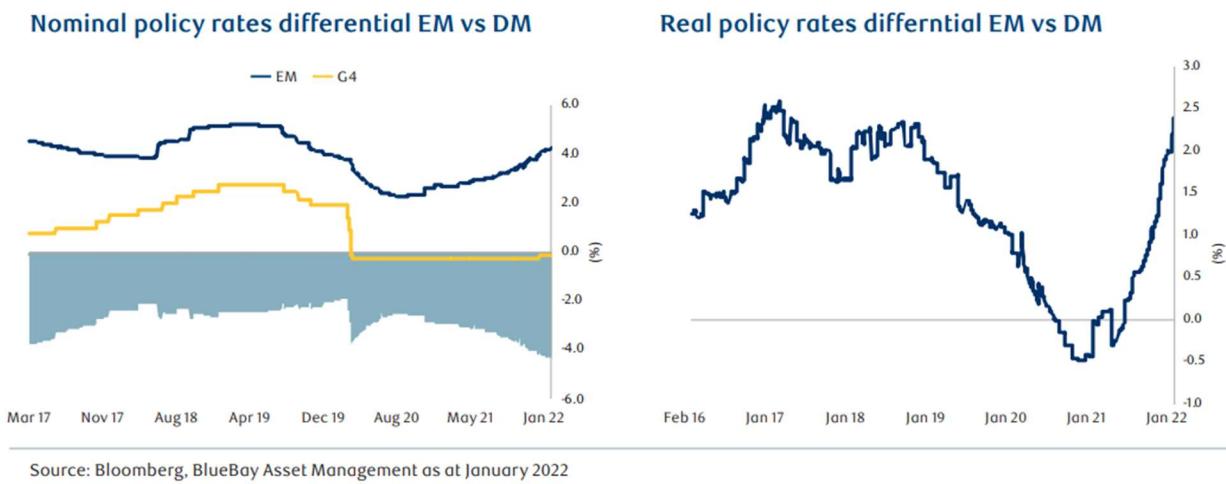
绝对不是。现在正是积极投资新兴市场的时候。以下是为了什么以及如何投资：

## Why Invest?

While the US is just starting its hiking cycle, most EM countries have been hiking rates throughout 2021. As such, the impact of higher US rates on EM countries is largely priced in within local currency markets. We have witnessed the front-end curves of EM local rates markets repricing by 300-400bps. Today, most EM local currency markets have positive real rates and reflect the highest historical real rate differential with developed markets. EM currencies should be further supported by the improving current account flows given that the majority of EM countries are commodity exporters.

What are the implications of the higher cost of funding on debt sustainability in EM?

Overall, the rising cost of debt doesn't put in question debt sustainability per se, but it does put greater emphasis on the policy mix. Regional differences are important considerations in the overall analysis.



Source: Bloomberg, BlueBay Asset Management as at January 2022

## 为什么投资？

虽然美国才刚刚开始加息周期，但大多数新兴市场国家在 2021 年全年都在加息。因此，美国加息对新兴市场国家的影响在很大程度上已反映在当地外汇市场的价格中。我们目睹了新兴市场本地利率市场以 300-400 个基点重新定价的前端曲线。如今，多数新兴市场本币市场的实际利率为正，与发达市场的实际利率差距达到历史最高水平。鉴于大多数新兴市场国家都是大宗商品出口国，经常账户流动的改善应该会进一步支持新兴市场货币。

融资成本上升对新兴市场债务可持续性有何影响？

总的来说，债务成本的上升并不会对债务的可持续性产生问题，但它确实更强调了政策组合。区域差异是全面分析的重要考虑因素。

### An 80 country universe – taking EM's regional differences into account

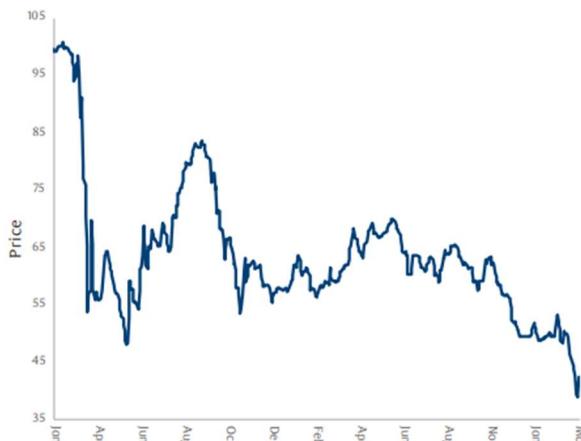
#### *Emerging Asia sovereigns*

These markets won't be immune to rising core rates as global financial conditions tighten. But at the same time, the region stands out for its very low sovereign default rates. During periods of global economic uncertainty, economies such as **South Korea, Malaysia, Thailand and Taiwan** tend to benefit from their current account surplus positions, low inflation, comfortable real rates, favourable balance of payments and a stable local investor base.

**China** isn't immune from rising US rates either. However, the pandemic and associated zero-Covid policy approach has provided a boost to its current account surplus, which had been steadily declining for the last 10 years, as Chinese exports continue to outperform. A lack of overseas travel has also fundamentally improved China's balance of payments. We believe that even with the deleveraging policy affecting China's real estate sector and the importance of the 20th Party Congress in the autumn, China is likely to be on the cusp of an easing cycle that would be positive for growth.

One country in this region that is facing debt repayment challenges and is likely to need to reprofile its debt is **Sri Lanka**. But with bonds trading at a historical recovery rate of 50 cent on a dollar, we feel this is already well telegraphed.

**Sri Lanka: Bonds struggling to recover due to inability of government to articulate a recovery plan**



Source: Bloomberg, BlueBay Asset Management, as at 10 March 2022.

## 全球有 80 个国家—考虑新兴市场的地区差异

### 新兴的亚洲国家主权债

随着全球金融环境收紧，这些市场将无法免受核心利率上升的影响。但与此同时，该地区因其极低的主权违约率而引人注目。在全球经济不稳定时期，韩国、马来西亚、泰国和台湾等经济体往往受益于其经常账户盈余、低通胀、舒适的实际利率、有利的国际收支平衡和稳定的本地投资者基础。

中国也无法免受美国利率上升的影响。然而，相关的新冠清零政策让中国出口在 2021 年继续走强，中国的经常账户盈余得到了提振。一改过去 10 年的颓势。缺乏海外旅游也从根本上改善了中国的国际收支状况。我们认为，即使去杠杆化政策影响到中国的房地产行业，以及今年秋季召开的第二十次党代会的重要性，中国仍可能处于宽松周期的顶点，这将对经济增长产生积极影响。

该地区有一个国家正面临债务偿还方面的挑战，可能需要调整其债务结构，那就是斯里兰卡。但鉴于债券交易的回收率达到了历史最高的 50%，这一点我们已经说得很明白了。

### Latin American sovereigns

Higher US policy rates should not pose a terminal threat for the financing positions of Latin American sovereigns. The region's economies have historically been vulnerable to US rate policy shifts because they have run fiscal and current account deficits that have left them dependent on capital flows. Today, the region has better defences compared to 20 years ago, with most currencies floating freely with comfortable levels of international reserves and more developed domestic capital markets as a source of financing.

The bigger challenge lies in the implications of policy mix. So far, indications are that even the left-leaning leaders like Chile have reverted to more orthodox policy choices when confronting the potential ramifications of alternative outcomes. The greatest concerns lie with those countries that faced debt sustainability challenges even before US Federal Reserve tightening and have steered away from an orthodox policy mix. In this context, Argentina and Ecuador reprofiled their debt in 2020, leaving them free of any debt payment obligations for another three years.

That said, getting on a more orthodox policy footing is crucial for making debt payments sustainable in the medium term. Another country that is veering towards an unorthodox policy mix is El Salvador. International Monetary Fund (IMF) support is paramount for sustainability of the policy mix. Relying on Bitcoin as an alternative source of funding is hardly a credible solution.

### 拉丁美洲国家主权债

美国政策利率上调不应对拉美主权国家的融资状况构成致命威胁。这个地区经济历来容易受到美国利率政策变化的影响，因为它们一直存在财政和经常账户赤字，依赖于资本流动。与 20 年前相比，如今该地区的防御能力更强，多数货币自由浮动，国际储备水平适中，以及比国内资本市场更为发达的融资来源。

政策组合带来更大的挑战。到目前为止，有迹象表明，即使是智利这样的左倾领导人在面对替代结果的潜在后果时，也已恢复了更正统的政策选择。最令人担忧的是那些甚至在美联储收紧政策之前就面临债务可持续性挑战、并已偏离正统政策组合的国家。譬如阿根廷和厄瓜多尔在 2020 年重新安排了债务，使它们在未来三年内免于任何债务支付。

也就是说在政策基础上采取更为正统的做法，对于使债务偿还在中期内可持续至关重要。另一个正在转向非正统政策组合的国家是萨尔瓦多。国际货币基金组织(IMF)的支持对政策组合的可持续性至关重要。依赖比特币作为替代资金来源几乎不是一个可靠的解决方案。

**Central & Eastern Europe, Middle East & Africa (CEEMA)**

If we look at default risk across CEEMEA based on macroeconomic fundamentals and debt ratios, the region appears well placed to ride out a period of higher US and global rates. The Arab states that make up the GCC region are most favourably positioned given this trend comes amid a period of elevated oil and energy prices and an unprecedented era of fiscal reforms across the region.

Central and Eastern Europe benefit from relatively low leverage, high nominal GDP growth and strong EU support via various Covid support programmes, which significantly underpin financing needs across the region. Further east, the former Soviet states (Kazakhstan, Azerbaijan and Uzbekistan) generally have lower public sector debt/GDP ratios and large sovereign wealth buffers.

As also seen in Latin America, the main challenge for some CEEMA countries comes not from higher US rates but unorthodox policy choices. Turkey presents a clear case study.

In theory, Turkey benefits from a favourable public finance profile, with a public sector debt/GDP ratio of less than 40%. However, its external financing position is challenging, with annual gross external financing needs of close to USD200bn. The current unorthodox policy setting – minus 22% real policy rates – raises the risk of further capital flight. And with limited FX reserve cover, the system becomes acutely vulnerable.

Tighter global financing conditions could reduce roll-over ratios on some of Turkey's USD180bn worth of short-term debt and risk turning a currency devaluation story into a broader, systemic crisis and place additional stress on the banking sector. Higher global rates would make an already difficult situation that much more challenging. While higher core rates may not be the cause of a systemic crisis, they could easily prove to be the straw that breaks the camel's back.

**Sub-Saharan Africa (SSA)**

It's likely that most SSA issuers will be able to see out higher borrowing costs in 2022 without defaulting, but for some countries this should not be a foregone conclusion. Debt sustainability is one of many challenges; those SSA countries with the highest debt burdens and policy inaction could face a tough choice between enacting difficult policy measures and heightened external liquidity pressure. International bi-lateral and IMF support will be key in Tunisia and Egypt.

**中东欧、中东和非洲(CEEMA)**

如果我们根据宏观经济基本面和债务比率来审视整个 CEEMEA 的违约风险，就会发现该地区似乎能够安然度过美国和全球利率走高的一段时期。鉴于这一趋势的出现，海湾合作委员会地区的阿拉伯国家处于最有利的地位。目前，该地区的石油和能源价格处于上涨阶段，整个地区正进入前所未有的财政改革时期。

中欧和东欧受益于相对较低的杠杆率、较高的名义 GDP 增长以及欧盟通过各种新冠支持计划提供的强有力支持，这些支持显著支撑了整个地区的融资需求。再往东，前苏联国家(哈萨克斯坦、阿塞拜疆和乌兹别克斯坦)的公共部门债务/GDP 比率普遍较低，主权财富缓冲也较大。

与拉丁美洲的情况一样，一些 CEEMA 国家面临的主要挑战并非来自美国加息，而是非正统的政策选择。土耳其是一个明确的案例研究。

从理论上讲，土耳其受益于良好的公共财政状况，公共部门债务/GDP 比率不到 40%。然而，其外部融资状况具有挑战性，每年的外部融资总需求接近 2000 亿美元。当前非正统的政策设定——实际政策利率为 -22%——增加了进一步资本外逃的风险。由于外汇储备不足，金融体系变得非常脆弱。

全球融资环境趋紧，可能会降低土耳其 1800 亿美元短期债务中部分债务的展期比率，并有可能将货币贬值演变为一场更广泛的系统性危机，给银行业带来额外压力。更高的全球利率将使本已困难的形势更具挑战性。虽然较高的核心利率可能不是系统性危机的原因，但他们很容易成为压垮骆驼的最后一根稻草。

**撒哈拉以南非洲地区(SSA)**

大多数 SSA 发行方很可能在 2022 年能够在不违约的情况下承受更高的借贷成本，但对一些国家来说，得不到同样的结论。债务可持续性是众多挑战之一；那些债务负担最高、政策不作为的南部非洲国家可能面临一个艰难的选择——是实施困难的政策措施，还是增加外部流动性压力。国际双边援助和国际货币基金组织的支持对突尼斯和埃及至关重要。



## Why invest in EM hard currency sovereign debt?

First, in our view, over 90% of the issuers are able to cope with higher US rates and deliver higher carry than developed market (DM) credits without debt sustainability issues.

Second, those that do have debt sustainability concerns or unorthodox policy mix are already, on average, trading at 50–70 cent on the dollar, i.e. close to historical recovery rates. The high yield segment of the sovereign index is offering a yield of over 10%, or 800bps spread. This implies a default rate in the high single digits for EM high yield sovereign debt – something that is unlikely to materialise in our base case. Given the level of spreads, the breakeven point would imply yields rising to double-digit territory – a level that has only been reached twice in the last 20 years and then only lasted for a few months.

## Why invest in EM hard currency corporate debt?

Outside of Chinese real estate that trades below 50 cents on the dollar, the expected corporate default rate remains in the low single digits.

A sector-by-sector view.

**Financials:** Higher interest rates are positive for EM financials, where profitability would benefit from higher net interest margins.

**Utilities:** Companies look broadly well positioned to face a rising US rate environment. Utility names generally tend to be investment-grade, making them less susceptible to changes in investor risk appetite and possible lower access to market. One potential headwind for the sector would be sustained weakness in EM currencies, but this is often mitigated by foreign currency-denominated contracts.

**Industrials:** Higher interest rates should not present a major risk as most companies have already taken advantage of the favourable low interest rate environment to refinance their capital structures. However, a source of weakness for the sector would be the driving force behind higher interest rates – mainly broad inflation pressures – with higher commodity and input prices, higher labour costs and supply chain disruptions all impacting margins.

## 为什么要投资新兴市场硬通货主权债务？

首先，超过 90% 的发行方能够应对美国更高的利率，并且在没有债务可持续性问题的情况下，可以提供比发达市场信贷更高的利差。

其次，那些的确存在债务可持续性问题或者非传统政策组合的国家已经以接近历史复苏率的价格进行了交易，平均交易价格为 50-70 美分。主权指数的高收益部分提供超过 10% 的收益率，或者说 800 个基点的价差。它意味着新兴市场高收益主权债务的违约率高达个位数，而这在一般来说是不可实现的。考虑到利差水平，盈亏平衡点将意味着收益率将升至两位数，这一水平在过去 20 年间仅达到过两次并且只持续了几个月。

## 为什么要投资新兴市场硬通货公司债务？

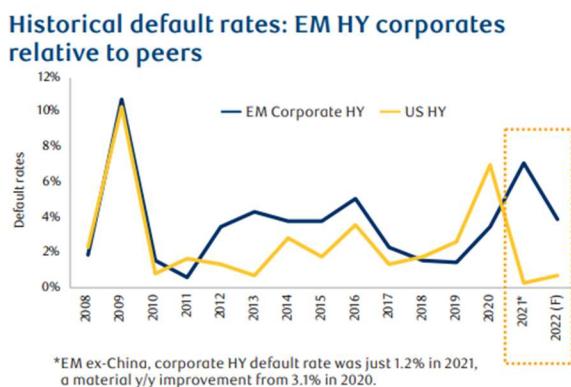
除了交易价格低于 50 美分的中国房地产外，预计企业违约率保持在较低的个位数水平。

让我们逐个板块来看。

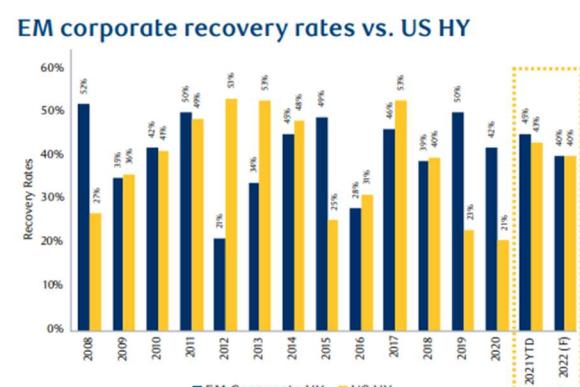
**金融：**较高的利率对新兴市场的金融股有利，其盈利能力将受益于较高的净利差。

**公用事业：**在面对美国利率上升的环境下，公用事业公司似乎处于有利地位。公用事业股通常倾向于投资级，因此不易受到投资者风险偏好变化的影响，也可能降低进入市场的门槛。该行业的一个潜在不利因素是新兴市场货币的持续疲软，但这一般可以通过以外币计价的合约来缓解。

**工业：**由于大多数公司已经利用有利的低利率环境为其再融资，所以较高的利率不会对其构成重大风险。然而，该行业的一个疲软来源是利率上升背后的驱动力——广泛的通胀压力。它会造成商品和投入价格的上涨，劳动力成本上升以及供应链的断裂，从而影响利润率。



Source: JP Morgan. Latest data at 31 December 2021.



**Commodities:** Theoretically, higher US rates are negative for commodities (increasing the cost of storage and the risk of USD strengthening relative to other currencies). The spike in oil following the Russia/Ukraine conflict changes this calculation for now and, at any rate, US rate hikes would be occurring in response to high inflation which, while elevated, should continue to support commodities. Supply shortages also support an upward trajectory in commodity prices.

Across the EM corporate universe, most businesses in this sector should comfortably withstand the most direct impacts of higher US and global rates. For fuel distributors, the impact of rising rates is not significant as contract negotiations and cash cycles are much shorter.

**Consumer goods:** This is a heterogeneous sector where the sub-sectors are experiencing uneven post-Covid recovery profiles. But to take a generalised view, rising interest rates are not a key hurdle for the sector, although for certain domestically oriented companies they can dampen revenue growth prospects, as the combination of slower growth in EM economies and eroding purchasing power from higher inflation weakens consumer demand.

On the **liabilities** front, many companies have taken advantage of a protracted period of low interest rates by extending near-term maturities and generally have healthy balance sheets despite potentially higher funding costs.

**TMT:** From a funding perspective, TMT corporates are typically not overly exposed to rising rates due to their healthy margins, unless they carry high leverage.

**Infrastructure:** Infrastructure companies are in a very similar situation to TMT names regarding margins, cost structure and inelastic demand profile, with the addition of longer maturity profiles.

**大宗商品:** 理论上，较高的美国利率对大宗商品不利（增加了存储成本以及美元相较于其他货币升值的风险）。俄罗斯/乌克兰冲突后的石油价格飙升暂时改变了这一看法。无论如何，美国加息是为了应对高通胀。尽管通胀上升，但是美国利率的上升应该会继续支持大宗商品。供应短缺也使得大宗商品价格上涨。

在整个新兴市场的企业领域，该行业的大多数企业应该能够轻松承受美国和全球利率上升的最直接影响。对于燃料分销商而言，由于合同谈判和现金周期要短得多，因此利率上涨的影响并不显着。

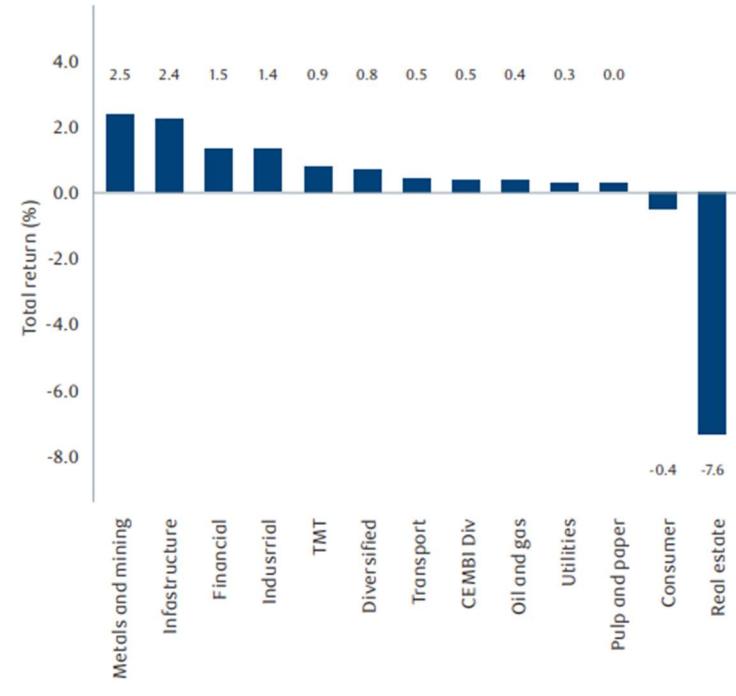
**消费品:** 这是一个异质性行业，其子行业在疫情过后的复苏情况不均。对某些以国内为导向的企业而言，由于新兴市场经济体增长放缓和通胀上升导致购买力下降，削弱了消费者需求，所以利率上升可能会抑制收入增长的前景。但总体而言，它并不是该行业的主要障碍。。

在负债方面，许多公司利用长期的低利率，延长了短期到期日。尽管融资成本可能更高，但资产负债表总体上保持健康。

**科技媒体和通信 (TMT) :** 从融资角度来看，由于 TMT 企业利润率较高，所以除非是拥有高杠杆的企业，通常它们不会过度受到利率上升的影响。

**基础设施:** 基础设施公司与 TMT 公司在利润率、成本结构和非弹性需求方面的情况非常相似，此外还有更长的偿还期。

### 2021 sector returns



Source: JP Morgan, as at 31 December 2021

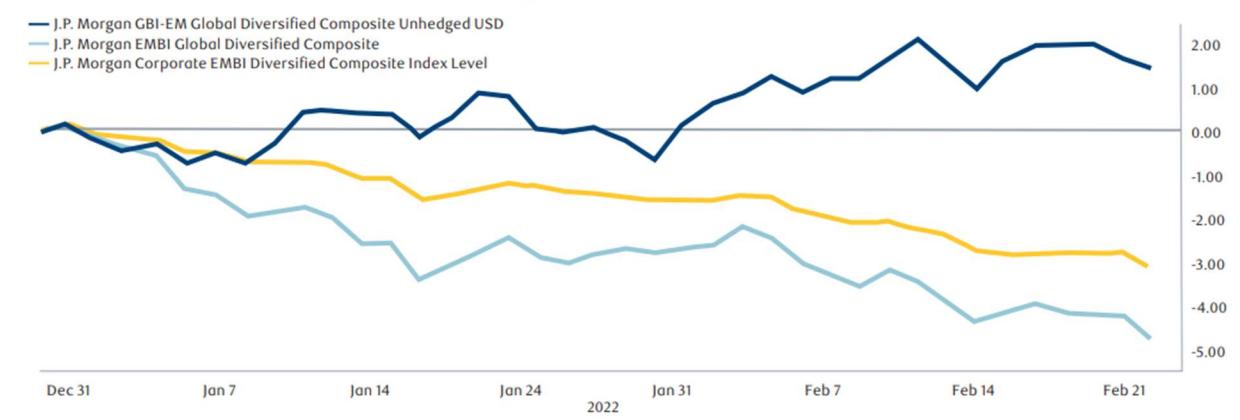
## Why invest in EM local currency debt?

Local currency is the most unloved of the EM sub-asset classes. It has delivered negative sovereign returns at the beta level for the last 12 years, leaving investors understandably lacking in enthusiasm. Somewhat ironically, it is the leading asset class year-to-date across global fixed income markets and it is the only asset class that is in positive territory, up 2%. US rates are down close to 4%, US investment grade debt is down some 4.6% and CEMBI HC indices are down 2-3.5% (as at Feb 2022).

*Conventional wisdom would say that EM local debt should underperform in a rising rates environment, so what's driving the positive performance and can it be maintained?*

There are three indications suggesting that a large part of the damage has already been done and that the flow dynamic, combined with positive fundamentals, could support continued performance for the asset class.

### EM local market indices are outperforming EM hard currency indices



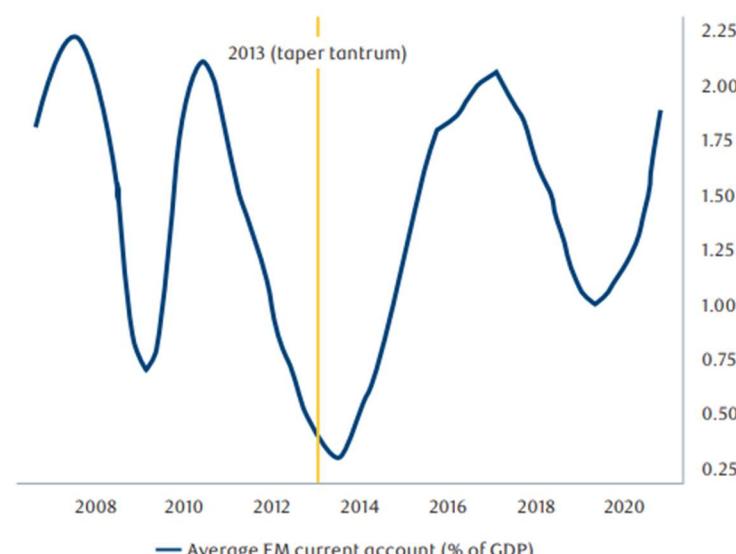
Source: Bloomberg, as at 18 February 2022

1. In response to inflation fears, EM central banks took a pre-emptive hiking stance last year. EM local rates at the front end of the curve (2-year rates) repriced between 300-400bps as a result –some are now half way through their hiking cycle now, some are fully materialised. This pre-emptive approach has created an FX buffer. In key EM beta currencies, the cost of shorting has become prohibitively expensive – the highest it has been in 10 years. It ranges from 5-6% in the likes of Mexico, South Africa and Chile to a whopping 11% for Brazil. It would cost you 11% to short the Brazilian real, meaning if you wanted to express a negative view on the currency, you'd have to take a hard bet of an extreme event, such as a domestic crisis, to justify the cost of a short position.

2. The current account dynamics remain supportive in the majority of EM countries that have local issuance. The chart to the right shows the average EM current account is nearing the highs seen in the past 15 years and is well off the lows seen around the taper tantrum. With significantly larger buffers than in 2013 on both the rates and current account fronts, EM FX is in much better shape to withstand Fed normalisation

3. We are starting to see a stabilisation of some of the flow dynamics that have contributed to the underperformance in EM local markets. Over the last few years, US equities captured the bulk of global flows, while the move to include China in several DM and EM indices created demand for CNY assets – to some degree, at the expense of other EM local assets. Today, the US has a 0.25% policy rate and 7% inflation, with inflation risks pointing to the upside and growth risks to the downside. This could put more pressure on US equity flows as witnessed by NASDAQ's 15% drawdown at the beginning of the year. These flows, in the absence of an EM-specific crisis, could find their way back into EM local debt.

### Average EM current account is near 15yr highs



Source: JP Morgan, as at 31 December 2021

## 为什么投资新兴市场本币债务？

本币是新兴市场子资产类别中最不受欢迎的。在过去的 12 年里，它在 beta 水平上实现了负主权回报，这使得投资者缺乏热情是可以理解的。具有讽刺意味的是，它是迄今为止全球固定收益市场上领先的资产类别，也是唯一处于正值区域的资产类别，上涨了 2%。美国利率下降近 4%，美国投资级债务下降约 4.6%，企业新兴市场体债券硬通货指数下降 2-3.5%（截至 2022 年 2 月）。

传统观点认为，新兴市场本地债务在利率上升的环境中会表现不佳。那么，是什么推动了这种积极的表现？这种表现又能够保持下去吗？

有三个迹象表明：大部分损失已经造成，并且流动动态和积极的基本面可以支持资产类别的持续表现。

1. 为应对通胀担忧，新兴市场央行去年采取了先发制人的加息立场。因此，处于利率曲线前端的新兴市场本地利率（2 年期利率）重新定价在 300-400 个基点之间——有些现在已经完成了加息周期的一半，有些已经完全实现。这种先发制人的方法创造了一个外汇缓冲。在主要的新兴市场 beta 货币中，做空的成本已经变得高得令人望而却步——达到了 10 年来的最高水平。在墨西哥、南非和智利等国，做空成本为 5-6%，而在巴西，这一成本高达 11%。做空巴西雷亚尔的成本是 11%，这意味着如果您认为雷亚尔货币会贬值，您就必须在极端事件上押注（比如国内危机），以证明做空雷亚尔的成本是合理的。
2. 大多数拥有本地发行的新兴市场国家的经常账户动态仍然支持。右图显示，平均新兴市场经常账户接近过去 15 年的高点，远离缩减恐慌的低点。由于在利率和经常账户方面的缓冲比 2013 年大得多，所以新兴市场外汇在承受美联储货币政策正常化方面的状况要好得多。
3. 我们开始看到一些导致新兴市场本地市场表现不佳的流动动态趋于稳定。在过去几年间，美国股票占据了全球流动的大部分份额。将中国纳入多个发达市场和新兴市场指数的举措创造了对人民币资产的需求——在某种程度上，以牺牲其他新兴市场本地资产为代价。如今，美国的政策利率为 0.25%，通胀率为 7%，通胀风险上行，增长风险下行。这可能会给美国股票流动带来更大压力，纳斯达克在年初下跌 15% 就说明了这一点。在没有针对新兴市场的危机的情况下，这些资金流可能会重新回到新兴市场的本地债务中。

### How to capture the EMD opportunity set

When dissecting risks in EM countries and companies, our view is that while volatility is likely to remain high, there are at least as many tailwinds for the asset class as there are headwinds. If investors can be patient and look through the market volatility, they should be able to pick up attractively priced assets with positive return potential.

### Maximising return potential

Investors who aim for higher absolute returns should ideally be in a position to look across the entire credit spectrum and roll up their sleeves on recovery analysis for both corporate and sovereign debt.

This requires deep experience and expert credit skills but, when approached correctly, investing in distressed assets can potentially provide outsized rewards for the level of risk undertaken.

For example, in the EM hard currency universe, performing countries like Tunisia and El Salvador offer 30-40% return on a one-year basis. On a sector view, carefully considered Chinese real estate investments also offers significant upside potential. Doing the deep credit work can give investors opportunities to earn double-digit returns in an asset class with inherent risk/reward asymmetry.

## 如何捕捉新兴市场债务的机会组合？

在剖析新兴市场国家和公司的风险时，我们的观点是，尽管波动性可能仍然很高，但该资产类别的有利因素至少与不利因素一样多。如果投资者能够有耐心并看穿市场波动，他们应该能够选到具有正回报潜力且价格有吸引力的资产。

### 最大化回报潜力

理想情况下，追求更高绝对回报的投资者应该能够纵观整个信贷领域，并对公司债和主权债的复苏进行分析。这需要丰富的经验和专业的信贷技能，一旦方法正确，投资不良资产可能会为所承担的风险水平提供超额回报。例如，在新兴市场硬通货领域，突尼斯和萨尔瓦多等表现良好的国家一年的回报率为 30-40%。从行业角度来看，经过深思熟虑的中国房地产投资也具有巨大的上行潜力。深度信贷业务可以让投资者有机会在固有风险/回报不对称的资产类别中获得两位数的回报。

There are four approaches that we believe particularly suit the current market environment.

### 1. Absolute return

For those looking to take full advantage of the volatility and the return potential in the market, we believe absolute return strategies are the most appropriate vehicles to capture this. They allow investors to take advantage of negative moves in credit by positioning short cash credit, as well as holding long views. They also can mitigate rate risks and duration concerns. If you are looking to capitalise on fat tails on the downside and the upside, absolute return approaches are the only ones that can achieve this.

## 2. Illiquid loans

The latest addition to the EM fixed income product set – EM illiquid loans should also do well in the current environment. These are senior secured loans that are sold at distressed valuations because the issuing bank is going through a liquidity squeeze, rather than needing to dispose of the asset because of a credit quality concern. Investors can earn an illiquidity premium as a result, rather than be paid to take on additional credit risk for buying loans below par. The lock-up nature of the loans protect investors against redemption risks, so the strategies don't have to crystallise mark-to-market losses or take duration bets.

It is also worth noting that, because these loans are predominately issued as a floating-rate instruments, they offer protection against higher rates.

## 3. Unconstrained

Unconstrained strategies capture a degree of market beta, so they are unlikely to match the double-digit return potential of illiquid loans and absolute return approaches across 2022. However, unconstrained strategies aim to harness the leading ideas across the hard and local currency EM universe. We feel the current environment provides a rich, uncorrelated opportunity set across both markets.

## 4. Hard currency aggregate

While the beta environment is expected to remain fairly muted through 2022, EM's rich landscape should offer plenty of opportunities for portfolio differentiation by region and sector. A high conviction active management approach spanning the sovereign and corporate universe can take advantage of macro inputs to deliver constructive return potential.

我们认为有四种方法非常适合当前的市场环境。

### 1. 绝对回报

对于那些希望充分利用市场波动性和回报潜力的人来说，我们认为绝对回报策略是最合适的工具。它们允许投资者通过做空现金信贷头寸以及持有多头来利用信贷的负面变动。它们还可以减轻利率风险和久期问题。如果您希望在下行和上行中利用厚尾，那么绝对回报方法是唯一可以实现这一目标的方法。

### 2. 非流动性贷款

新兴市场固定收益产品组合的最新成员——新兴市场非流动性贷款在当前环境下也应该表现良好。这些是高级担保贷款，由于发行银行正在经历流动性紧缩，而不是因为信贷质量问题需要处置资产，因此以不良估值出售。因此，投资者可以获得非流动性溢价，而不是因购买低于面值的贷款而承担额外的信用风险。贷款的锁定期特性保护投资者免受赎回风险，因此这些策略不必具体化盯市损失或进行久期押注。

同样值得注意的是，由于这些贷款主要作为浮动利率工具发行，因此它们为利率上升提供保护。

### 3. 不受约束

不受约束的策略会获得一定程度的市场贝塔，因此它们在 2022 一整年中不太可能达到非流动性贷款和绝对回报策略的两位数的潜在回报。然而，不受约束的策略旨在利用硬通货和本地货币新兴市场领域的领先理念。我们认为当前的环境为两个市场提供了丰富且不相关的一系列机会。

### 4. 硬通货总量

尽管 beta 环境在 2022 年预计将保持相当低迷，但新兴市场的丰富形势会为不同地区和行业的投资组合提供大量机会。跨越主权和企业领域的高信念主动管理方法可以利用宏观投入带来建设性的回报潜力。

### From fear mode to focus mode – investing with a clear head

The investor pendulum tends to swing at a relatively fast pace between greed and fear. While there are challenges ahead, pressing the panic button on EM and withdrawing from the market to sit on the sidelines until the dust settles is likely to result in missing the opportunity. Indeed, it is usually when sentiment is cautious, and investors can't see the light at the end of the tunnel that the opportunity set in EM tends to be most attractive. The fight or flight response is helpful when faced with a physical threat but going into panic mode when it comes to EM investing tends to yield higher transaction costs, not higher returns.

As one seasoned investor once said, "*In investing, what is comfortable is rarely profitable*".

### 从恐惧模式到专注模式——用清醒的头脑投资

投资者的钟摆往往在贪婪和恐惧之间快速摆动。尽管前方仍存在挑战，但在新兴市场按下恐慌按钮并退出市场，观望直到尘埃落定，可能会导致错失良机。事实上，当市场情绪谨慎且投资者看不到隧道尽头的曙光时，新兴市场的机会往往最具吸引力。当面临实际威胁时，战斗或逃跑反应是有益的，但在新兴市场投资时，进入恐慌模式往往会产生更高的交易成本，而不是更高的回报。

正如一位经验丰富的投资者曾经说过的那样，“在投资中，舒适的东西很少能盈利”。

# “三重压力”之下的中国经济走向

*Economic trends under the “threelfold pressure”*



伍戈博士，长江证券首席经济学家。曾长期任职中国央行货币政策部门，并在国际货币基金组织担任经济学家。中国经济学最高奖—孙冶方经济科学奖获得者，曾获浦山政策研究奖和刘诗白经济学奖，蝉联“远见杯”中国经济与全球市场预测双冠军。

**About the author.** Dr. Ge Wu, Chief Economist of Changjiang Securities, has long served in the central bank's monetary policy department, and served as an economist in the International Monetary Fund. The winner of the Sun Yefang Economics Award, the highest award in Chinese economics; the Pushan Policy Research Award and the Liu Shibai Economics Award, etc.

| 中国经济月度前瞻 |     |        |        |      |      |      |
|----------|-----|--------|--------|------|------|------|
|          |     | 5月（预测） | 4月（预测） | 3月   | 2月   | 1月   |
| 内需       | 工业  | 4.5 ↑  | -0.3 ↓ | 5    | 12.8 | -    |
|          | 投资  | 4.0 ↓  | 4.7 ↓  | 9.3  | 12.2 | -    |
|          | 消费  | -2.0 ↑ | -4.0 ↓ | -3.5 | 6.7  | -    |
| 外需       | 出口  | 13.0 ↑ | 5.0 ↓  | 14.7 | 6.3  | -    |
|          | 进口  | 6.0 ↑  | -2.0 ↓ | -0.1 | 10.5 | -    |
| 价格       | CPI | 1.8 —  | 1.8 ↑  | 1.5  | 0.9  | 0.9  |
|          | PPI | 5.6 ↓  | 7.1 ↓  | 8.3  | 8.8  | 9.1  |
| 货币       | M2  | 10.0 ↑ | 9.9 ↑  | 9.7  | 9.2  | 9.8  |
|          | 社融  | 10.9 ↑ | 10.7 ↑ | 10.6 | 10.2 | 10.5 |

注：工业为工业增加值当月同比，投资为固定资产投资累计同比，消费为社会消费品零售总额当月同比，出口与进口都是美元计价当月同比，物价为当月同比，货币为存量同比。

伍戈经济笔记

2021 年年末，中国中央经济工作会议指出了中国经济面临“三重压力”：一是供给冲击，二是需求收缩，三是预期转弱。如今，2022 年进入第二季度，这三个方面有没有改善的迹象？是朝着我们预期的方向在走，还是超乎预期？

## 疫情再袭，似曾相识又如此陌生

海外方面，防疫管控明显放松，经济修复持续。美国失业率降至疫前，欧洲则创历史新高。俄乌冲突缓和但制裁犹在，全球供应链紧张。美国通胀创 40 年新高，欧洲已是历史最高。市场隐含的美、欧央行今年加息次数提升为 9 次和 2 次，流动性加速收紧。值得关注的是，海外开始担心疫情持续扰动下中国供应链的稳定性，或将对外贸外资产生影响。

经济下行与通胀上升并存，“滞胀”风险凸现，但通胀更是主要矛盾。美国一季度经济增速转负，仍不改其 5、6 月份大幅加息步伐甚至叠加缩表操作，美元指数创近 20 年来新高。

At the end of the year of 2021, China's central economic work conference pointed out that China's economy faces "a threefold pressure" : A, the supply shock; B the contraction of demand; and C, the weakening of expectations. Today, as we move into the second quarter of 2022, are there any signs of improvement on all three fronts? Is it moving in the direction we expected, or against what we thought?

## The pandemic strikes again, what a strange feeling of déjà vu!

Overseas, pandemic prevention controls much looser, ongoing economic repairs. Unemployment in the United States has fallen to pre-pandemic levels, while in Europe it is at a record low. Russia-Ukraine conflict eased but sanctions remained, straining global supply chains. Inflation is at a 40-year high in the US and an all-time high in Europe. Market anticipates American and the European central bank will raise interest rates this year 9 times and 2 times, respectively. The action will accelerate the tightening of liquidity. What is noteworthy is that overseas people are beginning to worry about the potential impact on foreign trade and investment that the continued disturbance of the epidemic may have on stability of China's supply chain.

Slowdown economy and "stagflation"? Will Q1 U.S. negative growth change the pace of continuing interest hike? No matter what, the dollar index hits the 20 years record high.

内需方面，近期中国疫情管控程度达到新冠爆发以来最高水平。PMI 生产项弱于季节性的程度已超去年能耗双控最强期，货运物流量、上市公司停产数、居民储蓄意愿等指标表明经济正面临 2020 年初以来最严峻的探底过程。房地产加速纠偏，基建进一步发力。一旦管控松绑，内需有望阶段性反弹，但病毒强传染性及其严控显著增加经济的不确定性。

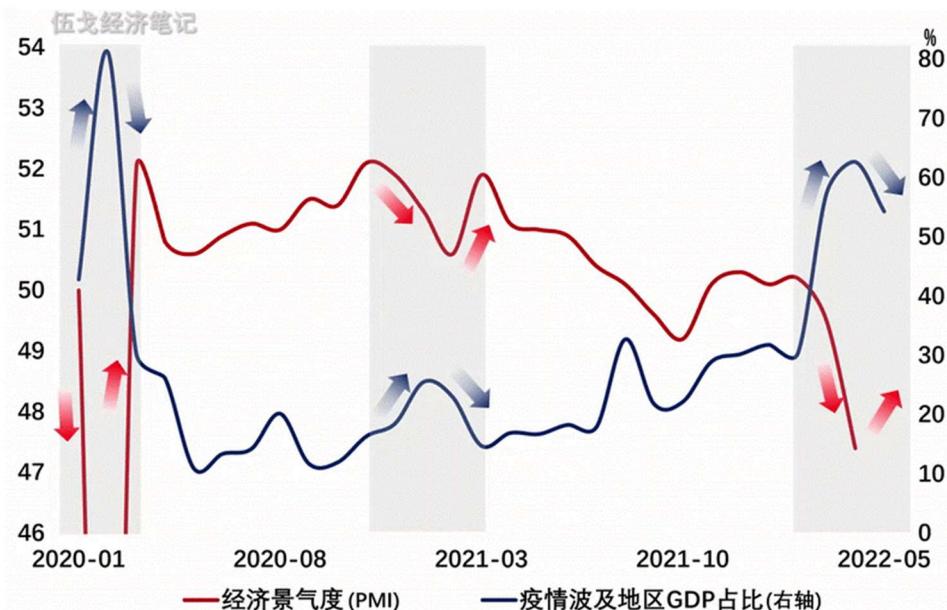
价格方面，全球遭遇上世纪 70 年代以来最严重的供给冲击。第二大原油输出国俄罗斯的原油出口已大幅低于历史同期，欧佩克仍无明显增产，页岩油产能短期难有突破。第二大粮食出口国乌克兰播种面积减少约 30%，多国开始管控粮食出口。能源、有色及农产品价格仍存上行风险。我国难独善其身，预计 PPI 环比涨幅扩大，CPI 同比下半年将提速。

政策方面，美联储加息缩表容易引致中国资本流出并累积人民币贬值压力，或在一定程度上制约中国利率工具的使用空间，这也使得倚赖更广泛的政策组合来对冲经济下行压力成为可能。近期票据利率抬升预示信贷投放边际改善。今年财政发力明显前置，政府债券发行保持较快进度。土地出让收入明显下滑，但去年财政结余等将支撑地方财政支出扩张。

**Domestic demand**, China's control has recently reached the highest level since the outbreak of COVID-19. The weaker than usual PMI production and indicators such as energy consumption, freight flow, the number of listed companies suspending production and households' willingness to save suggested that the economy is facing the bottom-out since the beginning of 2020. The real estate market continues correction and infrastructure-related investment may again become the economy booster once the restriction eases. Domestic demand is expected to rebound quickly. However, the measures of related pandemic restrictions may also increase the uncertainty of growth.

**Prices**, the world has suffered its worst supply shock since the 1970s. As the second largest oil exporting country, Russia's oil exports have been substantially below historical level during the same period. OPEC still has no intention to increase production, and shale oil production capacity is difficult to break through in the short term. The planting area of Ukraine, the second largest grain exporter, has decreased by about 30%, and many countries have begun to control grain exports. Upside risks remain for energy, nonferrous metals and agricultural product prices. China is hard to stay out of the way, with PPI inflation expected to expand month-on-month and CPI to pick up in the second half of the year.

**Policy**, the Fed raising interest rates and shrinking its balance sheet will easily lead to capital outflows from China and accumulate pressure on RMB depreciation, or restrict the use of domestic interest rate tools to a certain extent, which also makes it possible to rely on a broader policy mix to hedge the downward pressure on the economy. The recent rise in bill rates indicates a marginal improvement in credit availability. This year's fiscal stimulus measures were implemented obviously ahead of schedule, and the issuance of government bonds has maintained a relatively rapid progress. Revenue from land sales has declined significantly, but the fiscal balance of last year will support the expansion of local fiscal expenditures.



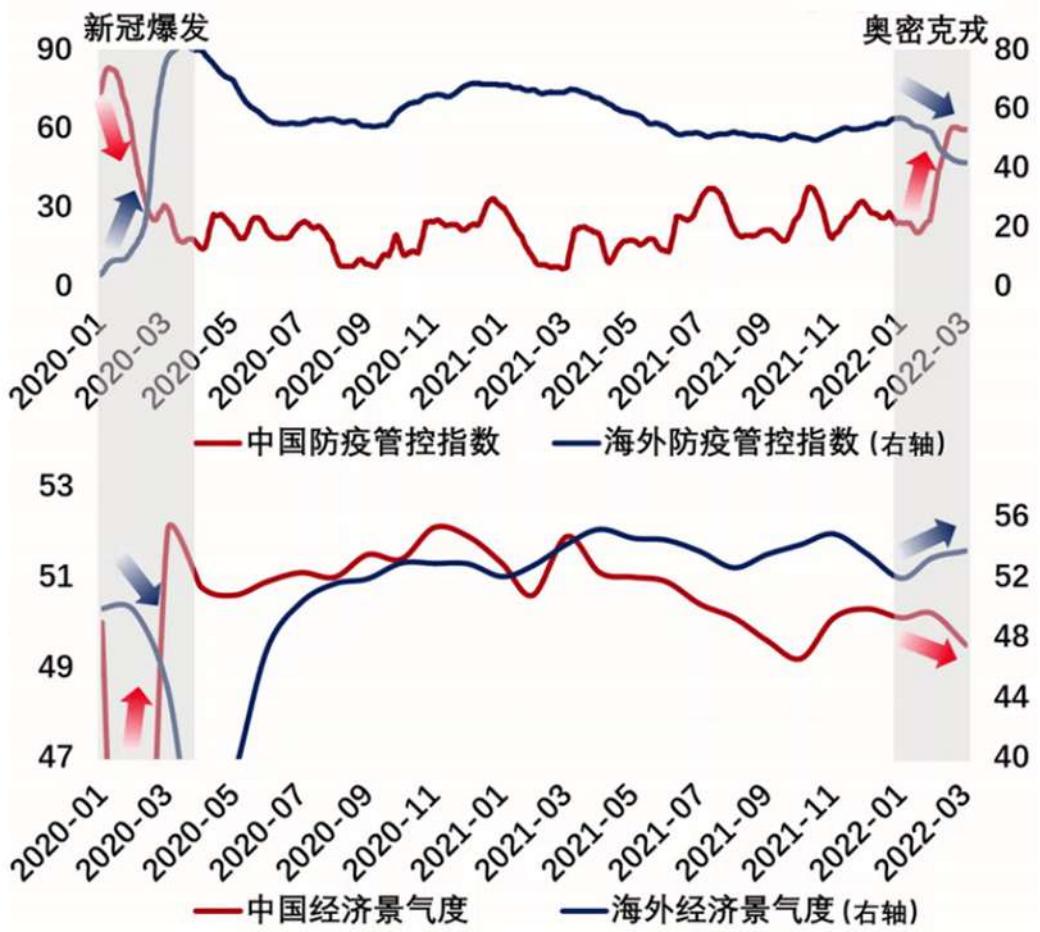
### 这波疫情，管控措施有何变化？

与过往几轮疫情显著不同，本轮奥密克戎毒株确实呈现传染性增强、致死率下降的病理学特征。据英国统计局等机构测算，奥密克戎的传染性约为流感 10 倍、德尔塔毒株 2-3 倍，但其致死率较德尔塔毒株下降约 67%。

### How have the control measures changed in this wave of pandemic?

Significantly different from previous outbreaks, the omicron strain does show pathological features of increased infectivity and reduced mortality. According to the UK Statistics office and other institutions, omicron is about 10 times more infectious than the flu and two to three times more infectious than the Delta strain, but its death rate is about 67% lower than the Delta strain.

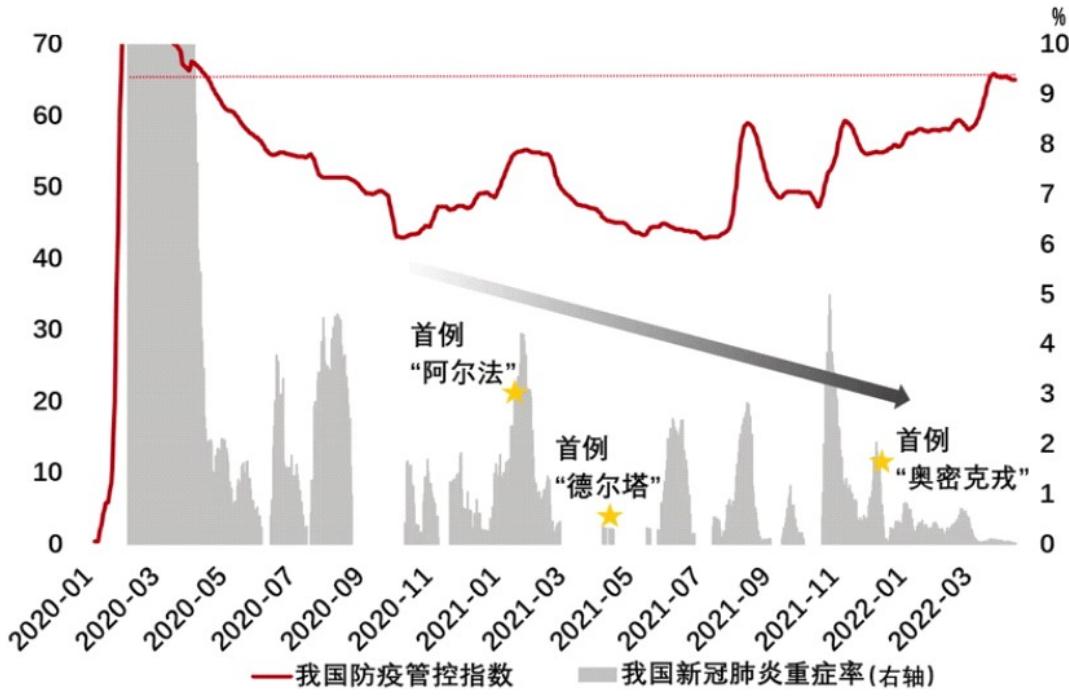
图：分化的疫情，分化的经济



来源：WIND, CEIC, Our World in Data

注：经济景气度以PMI表征。

图1. 更少的重症，更严的防控



来源：WIND, Our World in Data, 笔者测算

注：重症率=现有重症人数/现有感染人数（含确诊和无症状患者）

## 疫情峰值过后，经济将如何？

在“动态清零”不变的前提下，更早介入、更严管控对疫情峰值及其持续时间的压降效果更显著，上海、深圳、吉林、天津等已有对比印证。鉴于此，近期各地防控措施明显收紧。4月份以来除上海外的全国新增疫情虽不断回落，但出行受阻的城市数量却较3月继续上升。即便尚未出现明显新增病例的省市，也加强辖区内外的人员流动管控，多地还提升了核酸检测次数、申请报备期限等标准。

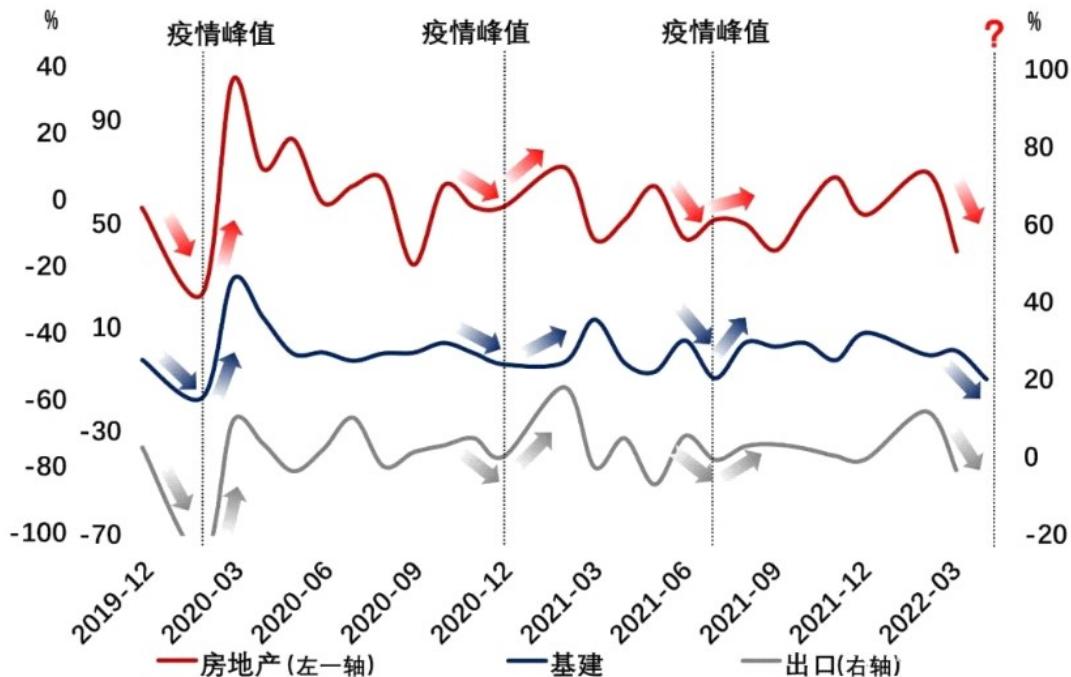
历史可见，一旦疫情峰值过后，经济往往出现阶段性反弹。如，深圳3月下旬“解封”以来，其商品房成交显著反弹，同比增长约18%，为去年10月以来最高。对于资本市场而言，每轮疫情峰值的筑顶回落时，风险偏好也往往会出现一定程度的修复。

### Economy after the Peak of Pandemic

With the "dynamic zero clearance" approach remains unchanged, people believe that control at an earlier date will be more effective, as Shanghai, Shenzhen, Jilin and Tianjin had proved. As a result, recent prevention and control measures have been tightened significantly. Since April, the newly infected cities reported less except Shanghai, but the cities with travel restrictions increased compared with March. Even those provinces and cities without much new cases have decided to tighten controls on people's entering and exiting the jurisdictions, and many have raised standards on testing validation.

History shows that once the pandemic eases from the peak, the economy often rebounds in stages. Shenzhen, for example, has seen a significant rebound in residential property transactions since its relieve in late March, up about 18 per cent year on year and the highest since October. For the capital market, as each round outbreak eases, the risk appetite also tends to recovery.

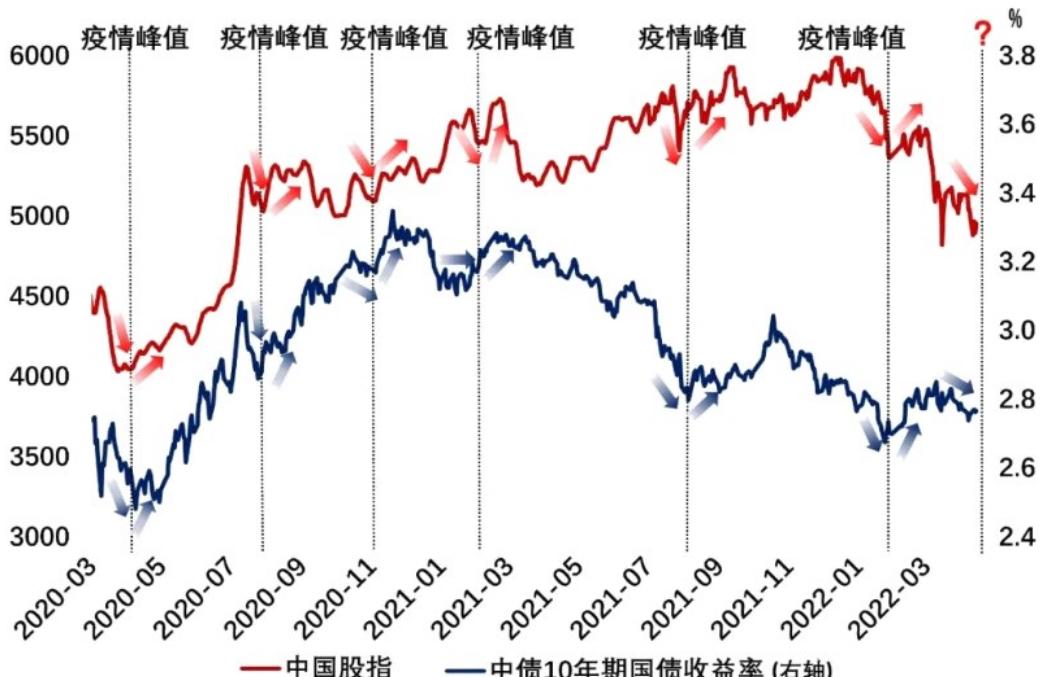
图2. 疫情峰值过后，经济短期反弹



来源：WIND，笔者测算

注：各指标为当期环比较历史均值的差值。

图3. 疫情峰值后，风险偏好短期修复



来源：WIND，笔者测算

图4. 更深层次的“疗伤”仍需时日



来源：WIND，笔者整理

冰冻三尺，非一日之寒。疫情的反复及随时可能引致的管控，明显扰乱了微观主体对未来的预期，进而对其经济行为产生“累积效果”或“疤痕效应”。今年一季度的居民储蓄意愿达到历史最高，超过武汉封城、次贷危机、欧债危机等重大事件时期。

Rome was not built in a day. Outbreaks repeatedly and could lead to control at any time, obviously affect the future expectations and the economic behavior of "cumulative effect" or "scar effect". In the first quarter of this year's household savings hit an all-time high, well above the Wuhan lockdown time, the subprime crisis, the European debt crisis, and other market risk events.

## 外因，当然重要

既然谈及跨境资本流动，外部因素固然是重要的。根据当前市场一致性预期，美联储二季度有望连续2次实施分别不低于50bp的加息。美东时间5月4日，美联储宣布加息50个基点。此外，其年内缩表规模或接近上一轮缩表总规模，大致相当于加息75bp，而这未必是市场充分预期的。中美政策利差将确定性地明显收窄甚至倒挂，预示着短期资本流出的压力。

## 内因，更为关键

外因是条件，内因是根本，辩证法同样适用于我们对于资本流动的理解。从国内情况看，当前影响经济运行最关键因素是疫情。“动态清零”之下，各地趋于更早介入、更严管控。当前全国300余地级以上城市中约有48城处于不同程度的封控状态，其中33城处于局部管控，15城的主城区甚至全域处于管控状态。

近期政策着力疏通物流堵点，但港口拥堵、公路货运等指标仍接近疫情爆发以来的最差状况，过去两年我国具有优势的外贸供应链也受到冲击。相较而言，海外疫情管控措施持续放松，我国出口份额及增速的回落或将更为迅速。这些基本面更能诠释当下资本流动的格局。

### External factors matters, of course

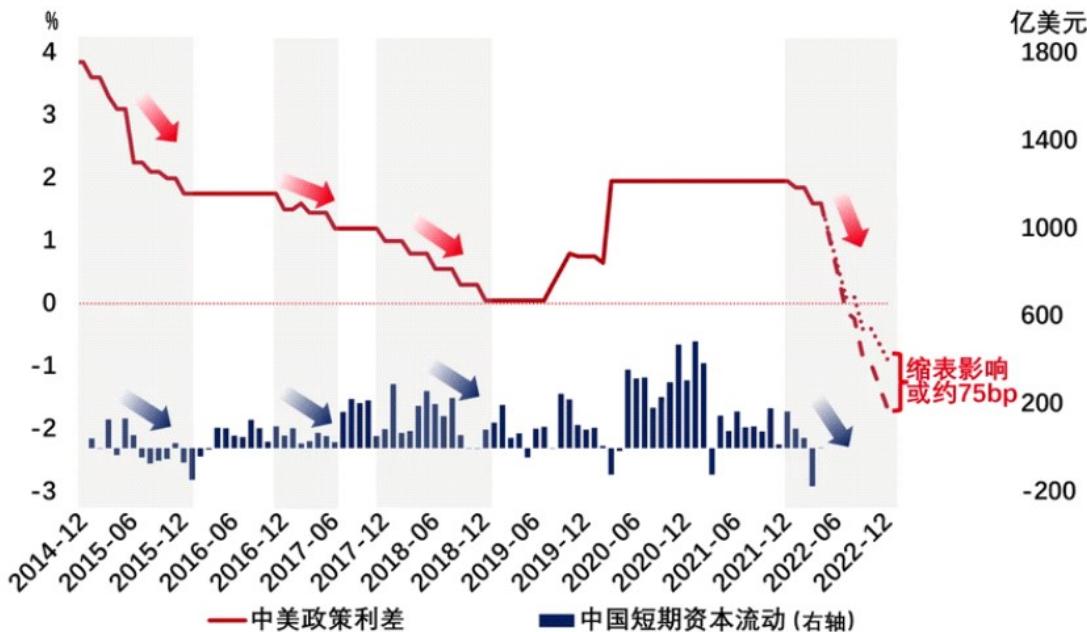
From a cross-border capital activity perspective, external factors matter. Current market expected FED to carry out two consecutive rate hikes of no less than 50bp in the second quarter. On May 4th the Federal Reserve announced that it would raise interest rates by 50 basis points. In addition, the size of the balance sheet reduction this year may be close to the total size of the previous round, which is roughly equivalent to a 75bp interest rate hike that is not necessarily priced in by the market. Policy spreads between China and the US will definitely narrow down, indicating short-term capital outflow pressure.

### Internal factors are more critical

Domestically, the internal factors are most crucial. "dynamic reset" tends to be early intervention and strict controls. At present, about 48 cities in China with more than 300 million-level are under lockdown control to varying degrees, among which 33 cities are under partial control, and 15 cities' main urban areas or even the whole region are under lockdown control.

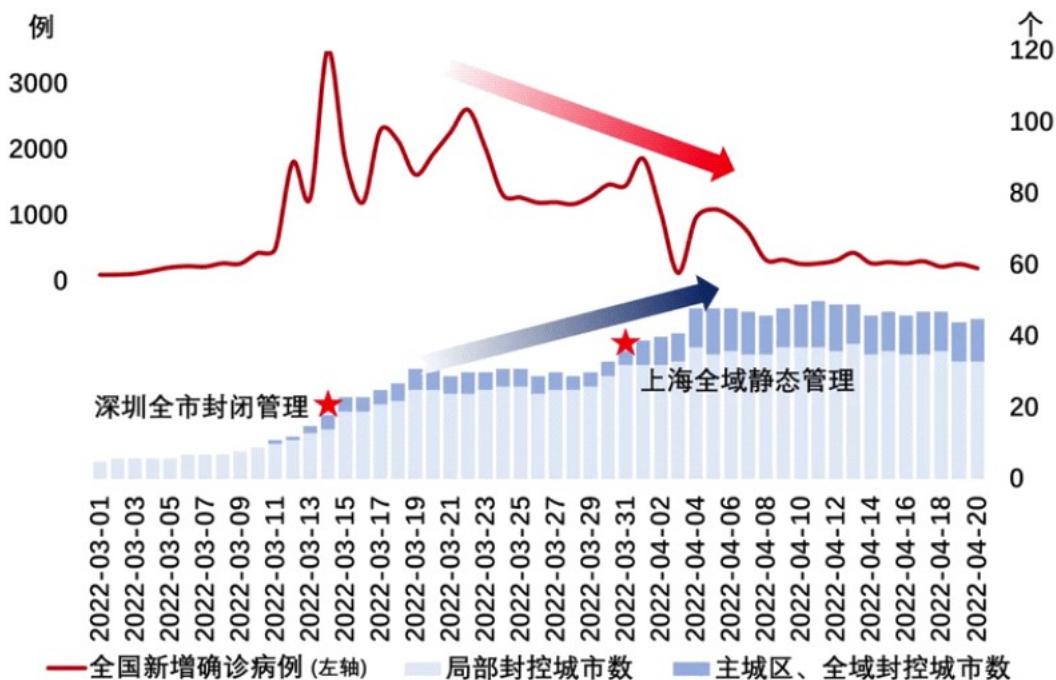
While recent policy focused on keeping logistics plugging point clear, port congestion, road freight transport and other indicators are still close to the worst since the outbreak began. In the past two years, supply chain issues resulted in a negative impact on foreign trade. By contrast, overseas outbreak controls continue to relax, The contract in China's export sector will accelerate. The pattern of economic fundamentals can be used to explain the current capital flows.

图1. 中美利差迅速收窄，资本流出压力加大



来源：WIND, IIF, 笔者测算

图2. 城市封控，屡见不鲜



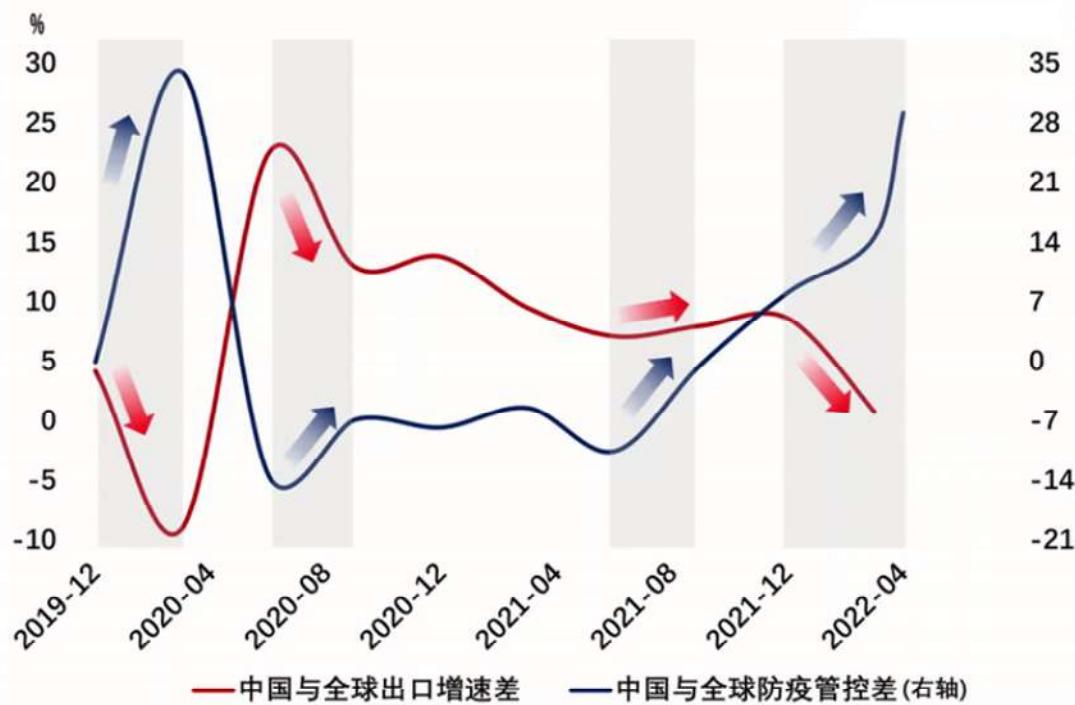
来源：WIND, 政府官网, 笔者整理

注：图中没有包括上海、深圳、长春和吉林市。

展望未来，国内经济加速探底，海外流动性剧烈收缩，二季度也许是内外交集最为严峻的时期。此后若疫情削弱，稳增长进一步体现，资本流出压力或将缓解。值得一提的是，本轮贬值中人民币汇率似更灵活，在一定程度上能对冲负向冲击。

Looking forward the domestic economy has accelerated to bottom out, and overseas liquidity has contracted sharply. The second quarter may be the most severe period both domestically and internationally. If the pandemic weakens and the growth is steady, the pressure on capital outflow may ease. It is worth mentioning that the RMB exchange rate seems to be more flexible in this round of devaluation, which can hedge against negative shocks to a certain extent.

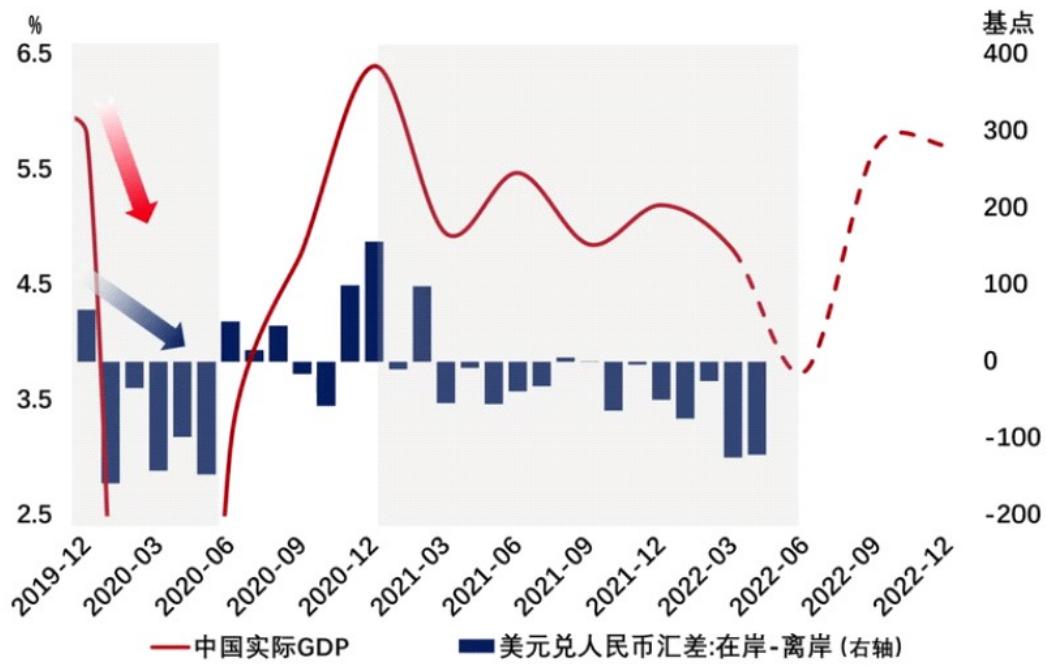
图3. 疫情管控加速出口下行



来源: WIND, WTO, Our World in Data

注: 防疫管控指标来自牛津大学。

图4. 二季度后, 可能会改善



来源: WIND, 笔者测算

Translated by Han Li

志愿者 李晗翻译

# Using Skew Stickiness Ratio to Fine-tune Options Risk

## 使用波动度倾斜粘性比微调期权风险

Tomiko Murk, CMA CPA



**Abstract** Vega Margin Interval (VMI) and Delta Margin Interval (DMI) are key inputs to scenario-based margin methodologies (e.g., CME SPAN and OCC TIMS). The current Volatility Scan Range (VSR) VSR methods adopted by clearing houses does not recognize the volatility skew. In this paper, we revised the VSR calculation by segmenting the observations into 4 categories, with co-movement of price and volatility considered. The findings suggest that the current methods can result in an understatement of volatility for options writers and overstatement of volatility for options buyers. The impact of SSR is significant and should not be ignored.

【Vega Margin Interval (VMI) 和 Delta Margin Interval (DMI) 是基于情景分析保证金计算方法（例如 CME SPAN 和 OCC TIMS）的关键输入。目前清算所广泛应用的 VMI 方法，Volatility Scan Range (VSR)，没有考虑到隐含波动率的倾斜。在本文中，我们修改了 VSR 计算方法，考虑到价格和市场波动率的关系，将观察结果分为 4 类。研究结果表明，当前的方法可能会导致期权卖方波动率被低估，而期权买方波动率被高估的情况。进一步讲，现货价格与期权波动率的关系对于保证金的计算方法的影响是明显的，不应该被忽视】

### Introduction

The scenario-based margin methodologies are widely adopted by clearing houses around the globe. Vega Margin Interval (VMI) and Delta Margin Interval (DMI) are key inputs for options and futures. The VMI represents the potential variation of market volatility and is calculated by observing implied volatilities at several moneyness levels over a historical period. The DMI is the potential variation of spot prices and is calculated based on historical price movements.

Scenario based methodologies use on a set of hypothetical scenarios where the DMI and VMI are moved up/down. The trades are repriced under the expected spots and expected implied volatilities and the worst-case losses are required as margin against future price movements. The standard SPAN methodology is to move the price up/down +/-100% of the DMI and VMI.

Volatility Scan Range (VSR), which is the VMI methodology used in the CME SPAN® methodology, is defined as the maximum change reasonably likely to occur for the volatility of each option's underlying price (Peter Fortune (2003) and JSCC 2020).

The SPAN® based methodology uses 16 scenarios where scenarios 11 to 14 represent 4 possible combinations of prices and volatilities moving up or down.

### 前言

基于情景的保证金计算方法被全球清算所广泛采用。Vega Margin Interval (VMI) 和 Delta Margin Interval (DMI) 是基于情景的期权和未来合约保证金计算方法的关键输入。VMI 代表市场波动率的潜在变化，通过观察历史时期内同一期权在多个价值上的 (moneyness) 的隐含波动率来计算。DMI 代表现货价格的潜在变化，根据历史现货价格变动计算。

基于场景的方法基于一组假设的场景，其中 DMI 和 VMI 向上/向下移动。这些交易在预期的现货和预期的隐含波动率下重新定价，最坏情况下的损失需要作为对未来价格变动的保证金。标准的 SPAN 方法是将价格上调/下调 +/-100% 的 DMI 和 VMI。

在 CME SPAN® 方法中，Volatility Scan Range (VSR)，作为 VMI 的计算方法，被定义为每个期权标的的价格波动率可能发生的最大变化。

基于 SPAN® 的方法使用 16 种场景，其中场景 11 到 14 表示价格上涨或下跌的价格和波动率的 4 种可能组合。

As shown in Table 1 below, the +1 in price refers to a full up movement in prices, generally 99th percentile of daily historical movements adjusted for MPOR (i.e.,  $\sigma\sqrt{t}z$ ). The +1 movement in Volatility refers to the full up movement by VSR described above.

The impact on trading varies with scenarios. For example, Scenario 12 represents ‘Price moves Up while Volatility moves Down’ (UD). The scenario is bad for long put and good for short put.

如下表 1 所示，价格的+1 是指价格的全幅上涨，通常是根据保证金风险期调整的每日历史变动的第 99 个百分位（即.,  $\sigma\sqrt{t}z$ ）。波动率中的+1 变动是指上述 VSR 的全幅上涨变动。

对交易的影响因情况而异。例如，场景 12 表示“价格上涨，波动性下降”（UD）。这种情况对多头看跌期权不利，对空头看跌期权有利。

**Table 1**  
**Hypothetical Scenarios and Risk Impact**

|                   | <b>Scenario 11</b>                         | <b>Scenario 12</b>                       | <b>Scenario 13</b>                       | <b>Scenario 14</b>                         |
|-------------------|--|--|--|--|
|                   | Price Up & Volatility Up (UU)              | Price Up & Volatility Down (UD)          | Price Down & Volatility Up (DU)          | Price Down & Volatility Down (DD)          |
| Price             | +1   | +1                                       | -1                                       | -1   |
| Volatility        | +1   | -1                                       | +1                                       | -1   |
| Impact on Trading | Bad For: Short Call<br>Good For: Long Call | Bad For: Long Put<br>Good For: Short Put | Bad For: Short Put<br>Good For: Long Put | Bad For: Long Call<br>Good For: Short Call |

This methodology, however, does not recognize the volatility skew or the asymmetrical and dynamical properties of implied volatility and its relationship with spot prices.

The presence of the skew strongly suggests that applying movements shown in Table 1 could understate or overstate risk from option implied volatilities, which we will show through numerical examples documented in this paper.

然而，这种方法没有认识到隐含波动率的波动率偏斜或不对称的动态特性及其与现货价格的关系。

偏斜的存在强烈表明，应用表 1 中所示的变动可能会低估或高估期权隐含波动性的风险，我们将通过本文记录的数字示例来证明这一点。

## Methodology

The implied volatilities for an option depend on the volatility skew which tends to price out-of-the-money options at a higher volatility, which can be modelled by volatility skew models like Heston model (Heston 1993). The Skew Stickiness Ratio (SSR) was introduced by Bergomi in 2009 to address the relationship between spot and volatility movements. The relationship is expressed in the following equation:

$$R_T = \frac{E[d\hat{\sigma}_F^T d \ln(S)]}{\frac{d\hat{\sigma}_{KT}}{d \ln \ln K} |_F E[(d \ln \ln S)^2]} \quad (1)$$

Where  $R_T$  is the regression coefficient of  $\Delta\hat{\sigma}_F^T$  (daily increments of the ATM volatility with maturity T) on  $\Delta\ln S$  (daily log returns of the underlying).

Mauro Cesa of Barclays (2021) indicated SSR is a measure of the covariance between the spot price and the ATM forward volatility:

$$SSR = cov(X, Y) = \rho(X, Y) \sigma(X)\sigma(Y) \quad (2)$$

This paper uses covariance to define SSR (Equation 2 above) and for these purposes will use positive or negative values to separate “Sticky Strike” from “Sticky Delta”.

## 方法

期权的隐含波动率取决于波动率倾斜，而波动率倾斜往往会使价外期权在较高的波动性下定价（参考赫斯顿模型 [Heston 1993]。SSR 由 Bergomi 于 2009 年提出，旨在解决现货和波动率变动之间的关系。该关系用等式(1)表示，

$$R_T = \frac{E[d\hat{\sigma}_F^T d \ln(S)]}{\frac{d\hat{\sigma}_{KT}}{d \ln \ln K} |_F E[(d \ln \ln S)^2]} \quad (1)$$

其中， $R_T$  是  $\Delta\hat{\sigma}_F^T$ （平值期权波动率的每日增量，给定到期日 T）在  $\Delta \ln S$ （期权标的资产每日对数回报）上的回归系数。

巴克莱银行 (Barclays) 的 Mauro Cesa (2021) 提出，公式 (2) SSR 是现货价格与平值期权远期波动率之间协方差的衡量标准。

$$SSR = cov(X, Y) = \rho(X, Y) \sigma(X)\sigma(Y) \quad (2)$$

本文使用协方差来定义 SSR (上面的等式 2)，为此将使用正值或负值来区分“粘性行权价格”和“粘性 Delta”。

Instead of considering volatility movements on its own, the study linked volatility movements to movements by using SSR in the underlying prices, segmented into the 4 scenarios.

该研究没有单独考虑波动性变动，而是将波动性变动与基础价格的变动联系起来，分为 4 种情况。

While this paper refers to the scenario-based methodologies widely adopted by clearing houses around the globe, the observations made are applicable to the wider industry.

虽然本文提到了全球清算所广泛采用的基于情景的方法，但所发表的意见适用于更广泛的行业。

## Results and Discussions

The sample consists of 337 US (90 major equities and ETFs) and 247 Canadian (out of 300 TMX equities and ETF's) options covering a variety of sectors. The following historical data between Dec 5, 2011, to Dec 3, 2021, were sourced from Bloomberg L.P.

- Spot Price:  $S_t$
- Implied volatility:  $\sigma_t$  for 1-month, and 12-month based on moneyness of 80%, 90%, 95%, 97.5%, 100%, 102.5%, 105%, 110%, 120%, respectively.
- The average number of days observed was 1946 with a minimum of 64 days

For the purposes of the covariance analysis, only equities with Significance-F below .05 were considered. This is to ensure that the chance of the null hypothesis (there is no correlation between prices and implied volatility) was very low.

Of the 337 equities, 68% met the significance test and were included in SSR calculation. 87% had negative SSRs, ie. prices were inversely correlated with volatility. The positively correlated equities were either “bearish” ETF's, metals, or pharmaceuticals. Of the 198 equities with Significance F < .05, 85% of sample securities selected had SSR's equal to or less than zero, reflective of strong ‘sticky deltas’ effect.

## 结果和讨论

该样本包括 337 个美国 (90 个主要股票和 ETF) 和 247 个加拿大 (在 300 个 TMX 股票和 ETF 中) 期权，涵盖各个行业。以下从 2011 年 12 月 5 日到 2021 年 12 月 3 日期间的历史数据来源于彭博社。

- 现货价格:  $S_t$
- 隐含波动率:  $\sigma_t$  基于 1 个月和 12 个月平价波动度的 80%, 90%, 95%, 97.5%, 100%, 102.5%, 105%, 110%, 120%
- 平均观察天数 1946 天；最短观察天数 64 天

出于协方差分析的目的，仅考虑显著性 F 低于 .05 的股票。这是为了确保原假设（价格与隐含波动率之间没有相关性）的可能性非常低。

在 337 只股票中，68% 符合显著性检验，并被纳入 SSR 计算。87% 的人有负面的 SSR，即。价格与波动性成反比。正相关的股票要么是“看跌”的 ETF，要么是金属行业或药品行业。在重要性为 F<0.05 的 198 只股票中，85% 的样本证券的 SSR 等于或小于零，反映了强烈的“sticky deltas”效应。

Outlined below are key steps followed for the analysis:

下面概述了分析所遵循的关键步骤。

| Step | Description  |
|------|--|
| A    | <ul style="list-style-type: none"> <li>Download sample data <math>S_t, \sigma_t</math> as specified above. 下载现货价格隐含波动率数据</li> <li>Convert downloaded to log daily price <math>\ln(S_t/S_{t-1})</math> and implied volatility (<math>\ln(\sigma_t/\sigma_{t-1})</math>) returns 转换成对数回报率</li> </ul>   |
| B    | <p><b>Calculate VSR:</b></p> <ul style="list-style-type: none"> <li>For each equity selected the implied volatility data was averaged across the moneyness indicated above. 对于所选的每种股票，隐含波动率数据均按上述 赢利度取平均值 As an example, for 1 MM SPX Index:</li> </ul> $\sigma_{SPX \text{ Index, 1 MM}} = (\sigma_{80\%} + \sigma_{90\%} + \sigma_{95\%} + \sigma_{97.5\%} + \sigma_{100\%} + \sigma_{102.5\%} + \sigma_{105\%} + \sigma_{110\%} + \sigma_{120\%})/9$ $\sigma_{SPX \text{ Index, 12 MM}} = (\sigma_{80\%} + \sigma_{90\%} + \sigma_{95\%} + \sigma_{97.5\%} + \sigma_{100\%} + \sigma_{102.5\%} + \sigma_{105\%} + \sigma_{110\%} + \sigma_{120\%})/9$ <ul style="list-style-type: none"> <li>Each equity therefore contained a historical set of spot prices and average implied volatility for 1-month and 1-year, respectively. 因此，每只股票分别包含一组 1 个月和 1 年的历史现货价格和平均隐含波动率。</li> <li>The VSR is calculated as the 99<sup>th</sup> percentile of the volatility returns over the entire lookback period for the base case. The data was then sorted into the 4 groups in Table 1. E.g. "UU" consists of all days where both price and volatility movements were positive. The 99<sup>th</sup> percentile was used for positive changes in volatility and the 1<sup>st</sup> percentile for negative changes in volatility. 计算为基本情况的整个回溯期内波动率回报的第 99 个百分位数。然后将数据分类到表 1 中的 4 组。例如，“UU”由价格和波动性变动均为正的所有日期组成。第 99 百分位用于波动性的正变化，第 1 百分位用于波动性的负变化。</li> </ul> |
| C    | <p><b>Calculate SSR:</b></p> <ul style="list-style-type: none"> <li>Calculate correlation and Skew Stickiness Ratio (SSR) as the covariance between the daily price returns and the daily implied volatility returns for all returns for the equity. 计算相关性和倾斜粘性比率 (SSR) 作为股票所有回报的每日价格回报率和每日隐含波动率回报率之间的协方差。 <ul style="list-style-type: none"> <li>计算相关性和倾斜粘性比率 (SSR) 作为股票所有回报率的每日价格回报率和每日隐含波动率回报率之间的协方差。</li> </ul> </li> <li>Calculate Significance-F and use it to filter securities. Results with a Significance F of less than .05 were selected, which suggest that there is a 95% chance that the results are significant. 计算重要性-F 并使用它来过滤证券。选择显著性 F 小于 0.05 的结果，这表明结果显著的可能性为 95%。</li> </ul>  |

The results for the two selected securities, SPX and SDS, are provided for one-month volatilities in Table 3. The SPX measures the value of the 500 largest public companies by market capitalization. SDS – ProShare UltraShort S&P 500 is a fund that is aggressively short the S&P 500, which seeks a return that is 2 times the inverse of the daily performance of the S&P 500. SDS represents the opposite view of S&P 500. Table 3 summarizes the results for the above noted specific securities.

两种选定证券 SPX 和 SDS 的结果，用于一个月的波动率。SPX 按市值衡量 500 家最大上市公司的价值。SDS – ProShare UltraShort S&P 500 是一只激进的做空标准普尔 500 指数的基金，其寻求的回报是标准普尔 500 指数每日表现反向的 2 倍。表 3 总结了上述特定证券的结果。

**Table 3**  
**Summary of 2 Specific Securities**

| Specific Security                     | Lookback<br>(Year) | $\rho$ | SSR      | VSR              |                 |        |       |        |
|---------------------------------------|--------------------|--------|----------|------------------|-----------------|--------|-------|--------|
|                                       |                    |        |          | All <sup>1</sup> | UU <sup>2</sup> | UD     | DU    | DD     |
| SPX – S&P 500                         | 1                  | -.85   | <0       | 19.4%            | 4.7%            | -17.3% | 30.9% | -5.6%  |
|                                       | 2                  | -.75   | <0       | 30.3%            | 5.4%            | -18.9% | 34.9% | -10.0% |
|                                       | 5                  | -.83   | <0       | 20.2%            | 6.4%            | -17.0% | 33.0% | -10.1% |
|                                       | 10                 | -.75   | <0       | 18.1%            | 7.2%            | -16.0% | 29.2% | -8.7%  |
| Average                               |                    |        |          | 22.0%            | 5.9%            | -17.3% | 32.0% | -8.6%  |
| SDS - ProShares<br>UltraShort S&P 500 | 1                  | .72    | $\geq 0$ | 28.8%            | 33.9%           | -11.7% | 16.1% | -22.8% |
|                                       | 2                  | .44    | $\geq 0$ | 41.2%            | 45.7%           | -40.5% | 56.5% | -35.2% |
|                                       | 5                  | .36    | $\geq 0$ | 43.7%            | 53.0%           | -43.0% | 44.2% | -42.6% |
|                                       | 10                 | .27    | $\geq 0$ | 38.1%            | 51.1%           | -48.9% | 55.3% | -42.6% |
| Average                               |                    |        |          | 38.0%            | 45.9%           | -36.0% | 43.0% | -35.8% |

Note:

1. Original Method: no securities were filtered.
2. UU = Price Up & Volatility Up

Table 3 suggests the following patterns of volatility movements when calculated based on individual scenarios:

- For SPX under 1-Year Lookback, when spot price is down, market vols may increase another 30.9% as compared with 19.4% suggested by the original method (column All); when spot price is up, market vols may only increase another 4.7% as compared to 19.4% suggested by the original method.
- With SPX, higher up volatility movements occur when prices fall and SSR  $< 0$ ; With SDS, the opposite is true, that is, higher up volatility movements occur when prices rise for SSR  $> 0$ .
- Use of the same VSR across all scenarios is not appropriate.

表 3 根据个别情形计算时，我们有以下波动率变动模式的观察：

- 对于 1 年期回溯下的 SPX，当现货价格下跌时，市场波动率可能会再增加 30.9%，而原始方法建议的为 19.4%（全部列）；当现货价格上涨时，市场波动率可能只会再增加 4.7%，而原始方法建议为 19.4%。
- 对于 SPX，当价格下跌且 SSR  $< 0$  时，波动性会更高；对于 SDS，情况恰恰相反，即当 SSR 的价格  $> 0$  时，会出现更高的波动率变动。
- 在所有方案中使用相同的 VSR 是不合适的。

The above observations appear consistent to the market performance. As the S&P 500 falls, there is greater demand for SPX put options and conversely greater demand for SDS call options. Local volatility surfaces for the above examples illustrate the skew to the left for the S&P 500 and the skew to the right for the SDS Ultra Short S&P 500. The results for the one-month volatility are shown below.

上述观察结果似乎与市场表现一致。随着标准普尔 500 指数的下跌，对 SPX 看跌期权的需求增加，相反，对 SDS 看涨期权的需求也越来越大。上述示例的局部波动性表面说明了标准普尔 500 指数的左偏斜和标普 500 指数超空头标普 500 指数的右倾斜。一个月波动率的结果如下所示。



- Chart to the left indicates a sticky delta, and to the right a sticky strike.
- Equities in the “Bearish” category had high SSRs -consistent to with market observation when SDS prices rise, S&P shares fall, and volatilities rise.
- Graphs are used with permission of Bloomberg Finance L.P

The impact on Profit/Loss of SPX is shown in Table 4. The risk is the maximum and minimum with short and long, respectively. Short Risk means risk to seller of the option as prices increase, and Long Risk means risk to the holder of an option when the price decreases.

In comparing the P&L's the put position risk for short is understated by 13.42% (i.e., ln [-124.79/-109.12]). The long-put P&L is not materially different (i.e. -77.81 vs -76.10). However, call position risks for both short and long are overstated by about 16.8% (i.e., ln (-97.31/-115.15) and 16.47% (i.e., ln (-65.25/-76.94)).

对 SPX 损益的影响见表 4。空头和多头的风险分别趋于最大和最小化。空头风险是指随着价格上涨而对期权卖方的风险，而多头风险是指当价格下跌时期权持有人面临的风险。

在比较损益时，空头看跌头寸风险被低估了 13.42%（即 ln [-124.79/-109.12]）。长看跌损益没有实质性差异（即-77.81 vs -76.10）。然而，空头和多头的看涨头寸风险被夸大了约 16.8%（即 ln (-97.31/-115.15) 和 16.47%（即 ln (-65.25/-76.94)）。

**Table 4**  
**SPX – S&P 500 Profit/Loss**

|   | Market | Scenario |        |        |        | Risk   |        | P & L   |         |
|---|--------|----------|--------|--------|--------|--------|--------|---------|---------|
|   |        | UU       | UD     | DU     | DD     | Short  | Long   | Short   | Long    |
|   | Spot   | 4,538    | 4,690  | 4,690  | 4,391  | 4,391  |        |         |         |
| Original Method                             | VSR    |          | 19.40% | 19.40% | 19.40% | 19.40% |        |         |         |
|   | Vol    | 22.50%   | 27.30% | 18.50% | 27.30% | 18.50% |        |         |         |
|   | Put    | 119.02   | 82.11  | 41.21  | 228.14 | 189.21 | 228.14 | 41.21   | -109.12 |
|   | Call   | 114      | 230    | 189    | 76     | 37     | 230    | 37      | -115.15 |
| Individual Movement                         | VSR    |          | 4.70%  | 17.30% | 30.90% | 5.60%  |        |         |         |
|   | Vol    |          | 23.60% | 18.90% | 30.70% | 21.30% |        |         |         |
|   | Put    |          | 64.27  | 42.92  | 243.81 | 200.9  | 243.81 | 42.92   | -124.79 |
|   | Call   |          | 212    | 190    | 92     | 49     | 212    | 49      | -97.31  |
| Profit/Loss Overstatement /(Understatement) |        |          |        |        |        |        | Put    | -13.42% | 2.22%   |
|   |        |          |        |        |        |        | Call   | 16.83%  | 16.47%  |

Summarized below are the parameters for the calculations:

- Use Black-Scholes option model for the 252-day lookback period and one-month volatilities
- The spot price movements are determined as 3 standard deviations of the historical spot price movement multiplied by the square root of the holding period equal to two days.
- Interest rates for the one-month option is 0.25%, the dividend yield is 1.5% and zero for SPX and SDS, respectively.

Impact on Broader Market is shown by the VSR calculations for all 337 equities per lookback period, with values averaged to illustrate SSR effect for the broader market, as shown in Table 6.

以下是计算的参数：

- 对 Black-Scholes 期权模型中的波动率使用了 252 天和 1 个月的回溯期
- 现货价格变动确定为历史现货价格变动的 3 个标准差乘以等于两天的持有期的平方根。
- 一个月期权的利率为 0.25%，SPX 和 SDS 的股息收益率分别为 1.5% 和零。

每个回溯期对所有 337 只股票的 VSR 计算显示了对大盘的影响，其平均值用于说明 SSR 对大盘的影响，如表 6 所示。

**Table 6**  
**One-Month Volatilities - Average VSRs**

| Lookback<br>(Year) | VSR Vol Up<br>337 equities | SSR | No. of<br>Equities | VSR<br>Vol Up | VSR                |                      |                      |                        |
|--------------------|----------------------------|-----|--------------------|---------------|--------------------|----------------------|----------------------|------------------------|
|                    |                            |     |                    |               | Price Up<br>Vol Up | Price Up<br>Vol Down | Price Down<br>Vol Up | Price Down<br>Vol Down |
| 1                  | 26.8%                      | < 0 | 202                | 18.9%         | 20.4%              | - 22.8%              | 23.3%                | - 18.9 %               |
|                    |                            | = 0 | 29                 | 30.0%         | 43.7%              | - 29.7%              | 31.5%                | - 32.3%                |
| 2                  | 35.6%                      | < 0 | 262                | 33.0%         | 34.9%              | - 38.4%              | 49.0%                | - 35.2%                |
|                    |                            | = 0 | 17                 | 38.0%         | 55.7%              | - 38.0%              | 42.5%                | - 47.0%                |
| 5                  | 28.5%                      | < 0 | 267                | 24.8%         | 30.6%              | - 32.5%              | 39.3%                | - 32.2%                |
|                    |                            | = 0 | 18                 | 34.0%         | 47.4%              | - 38.8%              | 41.1%                | - 44.6%                |
| 10                 | 26.0%                      | < 0 | 248                | 20.7%         | 26.7%              | - 34.2%              | 30.5%                | - 33.4%                |
|                    |                            | = 0 | 13                 | 32.5%         | 48.1%              | - 51.1%              | 46.8%                | - 40.4%                |

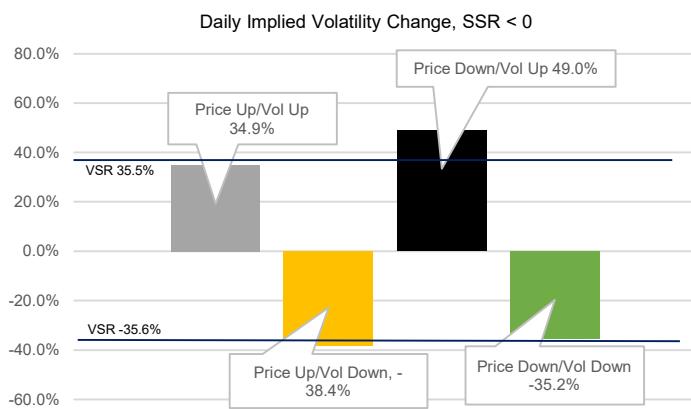
As summarized in Table 7, The impact of the VSR is dependent on the type of risk position, that is, the risk to an option is directional and depends on whether an option is a put or a call, written or purchased. Figure 1 below illustrates the 2-year lookback results (shaded) for equities where SSR is less than zero. The lines represent the VSR Vol for 337 equities. Figure 2 provides the results where SSR is greater than zero.

The risk on short call positions is understated since the worst risk is when prices are up and vols are up at 55.7% which is greater than the 35.6% indicated by the single VSR. In addition, the worst case for calls purchased is when price is down and vols are down, and the call would be valued at 35.6% although the results indicate the value of the call is overstated since vols are down 47%.

如表 7 所示，VSR 的影响取决于风险头寸的类型，即期权的风险是定向的，取决于期权是看跌期权还是看涨期权，是卖出还是买入。下图 1 显示了 SSR 低于零的股票的 2 年回溯期的结果（阴影）。这些线代表 337 只股票的 VSR Vol。图 2 提供了 SSR 大于零的结果。

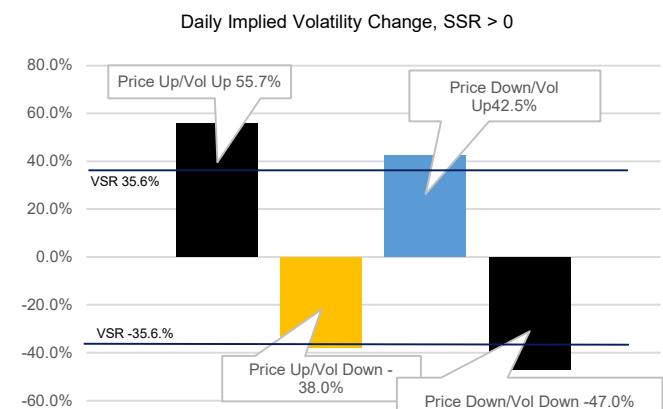
**Figure 1**

**Equity Price Changes Inversely Correlated with Implied Volatilities**



**Figure 2**

**Equity Price Changes Positively Correlated with Implied Volatilities**



## Conclusions

We revised the approach to the VSR calculation by segmenting the observations into 4 categories: price up and volatility up, price up and volatility down, price down and volatility up, price down and volatility down. We further segmented the results into groups with SSRs  $< 0$  and SSR's  $\geq 0$ . We found volatilities were higher than those calculated following the current approach when prices were down and SSR is negative, and when prices were up and SSR is zero or positive.

The findings suggest that the current VSR methods adopted by clearing houses can result in an understatement of volatility for options writers and overstatement of volatility for options buyers. Understatement of volatility for options writers can lead to inadequate margin coverage. For options buyers, an overstatement of volatility can lead to overstatement of the benefits provided by purchased options in a portfolio of options, thereby also leading to inadequate margin coverage.

In managing risks associated with options products, market participants such as market makers, portfolio managers and risk managers, should take into consideration the correlation between price changes and volatility changes in scenario-based methods.

## 结论

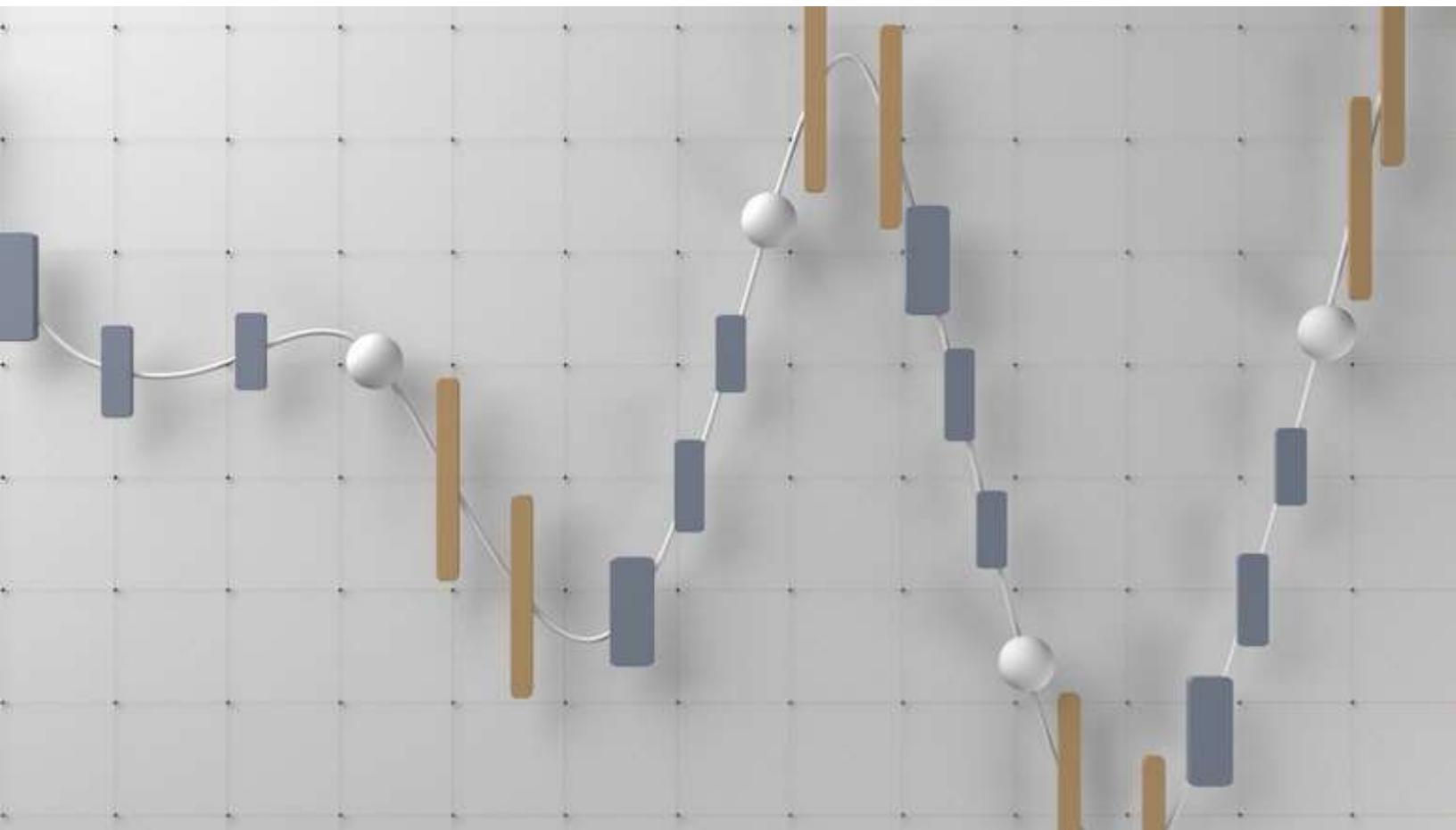
在本文中，我们修改了 VSR 计算方法，将观察结果分为 4 类：价格上涨和波动性上升，价格上涨和波动性下降，价格下跌和波动性上升，价格下跌和波动性下降。我们进一步将结果细分为组：当 SSR  $< 0$  或 SSR 的  $\geq 0$ 。我们发现，当价格下跌且 SSR 为负时，以及当价格上涨且 SSR 为零或正时，波动率高于按照当前方法计算的波动率。

研究结果表明，清算所目前采用的 VSR 方法可能导致期权卖方波动性被低估，对期权购买者则相反。对期权卖方的波动性低估可能导致保证金覆盖率不足。对于期权购买者而言，对波动性的夸大可能导致在期权组合中夸大购买期权所带来的好处，从而导致保证金覆盖率不足。

在管理与期权产品相关的风险时，市场参与者，如做市商、投资组合经理和风险管理者，应考虑价格变化与基于情景的方法的波动性变化之间的相关性。

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## Machine Learning in Banking – Derivative Pricing with Neural Network

# 机器学习在银行业应用—神经网络与衍生品定价



**Ernest Lok, Manager, RBC Group Risk Management, RBC 风险管理部经理**

### Executive Summary:

Neural network is a machine learning/deep learning technique used often in predictive analytics. Due to the advancement in technology, they are widely used in different industries these days. Today, we will explore one of its applications in capital markets.

This presentation covers 4 different things including the motivations and drawbacks of using machine learning on derivative pricing, brief introduction to neural network, application of Monte Carlo Simulation on traditional derivative pricing and application of neural network in pricing derivative.

**【提要】**神经网络是一种机器学习及深度学习的技术，在预测分析中被大量使用。由于技术的进步，近年来它已广泛应用于不同的行业。今天，我们将探讨其在银行业资本市场中的应用之一。

### Motivations and Drawbacks of Using Machine Learning on Derivative Pricing

First of all, derivatives such as basket options, barrier options and other kinds of exotic options are often mispriced due to low trading liquidity. As long as the machine learning predicted price lies within a reasonable range, it is a great way for pricing options. Second, pricing derivatives with neural network saves time. Once the model is trained, instant results can be obtained by plugging in new sets of values for the input variables. Compared to the traditional pricing method “Monte Carlo Simulation” which can take half a day to update prices of the options, neural network is more efficient. Third, with neural network, we can approach derivative pricing in a more objective way without making tons of assumptions about the financial mechanics, such as assuming Log-Normal Distributions for Stock Prices and Normal Distributions for Stock Returns. Fourth, neural network is a wonderful tool to deal with non-linear data and large number of inputs which are the basics of derivative pricing.

Neural networks also come with some drawbacks. For instance, a lot of the time will be spent on training and validating the model depending on how much data we are analyzing and how many variables we will include. Also, periodic update is required as the market is changing rapidly in such a fast-paced industry. Another well-known issue is that neural network is a black box. It is very difficult to explain and interpret the results from neural network predictions. Since original inputs and operations are not directly observable to the users, we are simply giving the model our sets of input values and in return we get the predicted outcomes from the neural network. As the saying goes, “garbage in, garbage out”. It implies that neural network performance will highly depend on the quality of the training data.

### 衍生品定价中使用机器学习的优点和缺点

首先，篮子期权、障碍期权和任何种类的奇异期权等衍生品由于交易流动性低而经常被错误定价。只要机器学习预测的价格在合理范围内，它就是定价期权的好方法。其次，使用神经网络为衍生品定价可以节省时间。训练模型后，可以通过为输入新的数据来获得即时结果。与传统的定价方法“蒙特卡洛模拟”需要半天时间来更新期权价格相比，神经网络的效率更高。第三，借助神经网络，我们可以以更客观的方式处理衍生品定价，而无需对数据做出大量假设，例如假设股票价格的对数正态分布和股票收益的正态分布。第四，神经网络是处理非线性数据和大量数据的绝佳工具，这也是衍生品定价的基础。

神经网络也有一些缺点。例如，大量时间将用于训练和验证模型，具体时间取决于我们正在分析的数据量以及我们将包含多少变量。此外，由于市场瞬息万变，模型因此需要定期更新。另一个众所周知的问题是神经网络是一个黑盒子。这让人很难解释神经网络预测的结果。由于用户无法直接观察到原始输入和操作，因此我们只是为模型提供了输入数据，并从神经网络中获得了预测结果。俗话说，“垃圾进，垃圾出”，这意味着神经网络的性能将高度依赖于训练数据的质量。



## Introduction to Neural Network

A neural network consists of four major components and they are the input layer, hidden layer, output layer and neurons (in the layers). It is a computational model that is inspired by the human brain. Inside each layer, there will be an activation function which helps transform the input variables from the previous layer (or raw data) into different desirable forms and decide the outputs for the neurons. The input layer will take the data and pass it to the next layer of the network. The hidden layer is responsible for improving performance. The output layer is final layer that gets us the outputs. Meanwhile, a neuron in each layer contain the weight and bias terms and it helps to compute the weighted average of its input and this sum is then passed through the activation function and go to another neuron in the next layer.

Besides, there are also parameters whose values control the learning process and determine the values of model parameters that a neural network ends up learning, namely hyperparameters. Some of the popular hyperparameters are the activation function, loss function, optimizer, regularizer, early stopping, number of neurons, number of layers, batch size, epochs, learning rate and dropout rate, etc. For example, loss function measures how well the neural network models the dataset; optimizers are functions that help to control weights and learning rate of the neural network and they help to reduce overall loss and improve accuracy; regularizers control how well the model can generalize the relationships between the inputs and outputs; early stopping is a technique to put a stop to the model training when overfitting starts to become a problem.

To build a neural network with great performance, it is important to choose a set of optimal hyperparameters for it. Therefore, it is needed to have a hyperparameter tuning process to optimize the data learning process for a neural network. There are three main methods. The first one is manual search, which is an ad-hoc approach to find the best values of hyperparameters based on personal judgement. The second one is automated search. An automated search method, grid search, is used a lot in practice. With grid search, different combinations of hyperparameters will be compared and the best one will be chosen.

When it comes to training the model, it is important to have the right sets of data. Once the data collection is done, it is recommended to divide the datasets into three sets: training data, validation data and testing data. Training data is the first set of data going into the model and it allows the neural network to learn the structure of the data. Then, there will be validation data that is used to determine the values for the parameters of the model. Finally, there are testing data which is treated as some unseen data set for evaluating how well the neural network performs.

To improve performance, there are things that can be done to the model and data. In terms of model-wise improvement, increasing the number of hidden layers, having the right number of neurons and using some regularization techniques can help to improve the performance of a neural network. For example, the more complicated the data structure, the more hidden layers are needed to improve the prediction accuracy; having too many neurons will lead to overfitting problems while too few neurons will cause underfitting problems; regularizations such as Ridge and Lasso regressions can be used to tackle the overfitting problem. In terms of data-wise improvement, it will be useful to include more data, normalize data and apply winsorization on data. For examples, more data helps the model to learn what outcomes will be in different scenarios, thus increase the accuracy of the model; normalizing data will speed up the learning process of the model and lead to faster convergence by converting the original data into data with a common scale; winsorization is a transformation to minimize the influence of outlier by setting extreme values to a specified percentile of the data (e.g. 90% winsorization).

## 神经网络简介

神经网络由四个主要部分组成，即输入层、隐藏层、输出层和神经元（在层中）。在每一层都会有一个激活函数将前一层的输入变量转换为不同的理想形式，并决定神经元的输出。输入层将获取数据并将其传递给网络的下一层。隐藏层负责提高性能。输出层是我们得到输出的最后一层。同时，每一层中的一个神经元包含权重和偏置项，它有助于计算其输入的加权平均值，然后这个和通过激活函数传递到下一层的另一个神经元。

此外，还有一些控制学习过程并确定最终学习的模型参数的值，即超参数。一些常用的超参数如激活函数、损失函数、优化器、正则化器、提前停止、神经元数量、层数、批量大小、时期、学习率和辍学率等。例如，损失函数衡量神经网络对数据集建模；优化器是有助于控制神经网络的权重和学习率的功能，它们有助于减少整体损失并提高准确性；正则化器控制模型对输入和输出之间关系的概括程度；早期停止是一种在过度拟合开始成为问题时停止模型训练的技术。

要构建具有出色性能的神经网络，为其选择一组最佳超参数非常重要。其主要有三种方法。第一个是手动搜索，这是一种基于个人判断找到超参数最佳值的临时方法。第二个是自动搜索。一种自动搜索方法，网格搜索，在实践中被大量使用。通过网格搜索，将比较不同的超参数组合并选择最佳组合。

在训练模型时，拥有正确的数据集非常重要。数据收集完成后，建议将数据集分为三组：训练数据、验证数据和测试数据。训练数据是进入模型的第一组数据，它允许神经网络学习数据的结构。然后，将有用于确定模型参数值的验证数据。最后，还有一些测试数据被视为一些看不见的数据集，用于评估神经网络的性能。

为了提高性能可对模型和数据改进。在模型方面，增加隐藏层的数量、拥有正确数量的神经元并使用一些正则化技术可以帮助提高神经网络的性能。例如，数据结构越复杂，就需要越多的隐藏层来提高预测精度；神经元过多会导致过拟合问题，而神经元过少会导致欠拟合问题；诸如 Ridge 和 Lasso 回归之类的正则化可用于解决过拟合问题。在数据方面，包含更多数据、规范化数据和对数据应用 Winsorization 将很有用。例如，更多的数据有助于模型了解不同场景下的结果，从而提高模型的准确性；规范化数据将加速模型的学习过程，并通过将原始数据转换为具有共同尺度的数据来加快收敛速度；Winsorization 是一种转换，通过将极值设置为数据的指定百分位数（例如 90% Winsorization）来最小化异常值的影响。

## Traditional Derivative Pricing with Monte Carlo Simulations

A traditional and original way to price derivatives such as exotic options and equity swaps is to model the possible paths of an asset price can go within a certain period of time before their maturities. Using a European basket call option as an example which the payoff of the option depends on the difference between the minimum price among the underlying stocks and the strike price, it will illustrate how some derivatives would be priced with Monte Carlo Simulations. One thing worth mentioning is that it is important to use Cholesky Decomposition on the Correlation Matrix to extract the Lower-Triangular Matrix and generate correlated random variables for Monte Carlo Simulations.

Once inputs such as underlying stock prices, option strike price, option maturity, stock volatility and correlation data are collected, correlated simulation paths for the underlying stocks in the basket options can be portrayed. With so many simulated paths and combinations, millions of possible option values can be generated. The average of these possible option values will then determine the price of this European Call Option.

## 传统衍生品定价方法：蒙特卡洛模拟

一种对衍生品（如奇异期权和股权互换）定价的传统方法是对资产价格在其到期前的特定时期内的可能路径进行建模。以欧式篮子看涨期权为例，期权的收益取决于标的几个只股票之间的最低价格与行使价之间的差异，我们可以从中知道如何使用蒙特卡洛模拟对一些衍生品进行定价。值得一提的是，在相关矩阵上使用科列斯基分解来提取下三角矩阵并利用蒙特卡洛模拟生成相关随机变量是非常重要的。

一旦收集到股票价格、期权行使价、期权到期日、股票波动率和相关矩阵等数据，就可以描绘篮子期权中股票的相关模拟路径。通过如此多的模拟路径和组合，可以生成数百万个可能的期权价值。这些期权价值的平均值将决定这个欧洲看涨期权的价格。

## Derivative Pricing with Neural Network

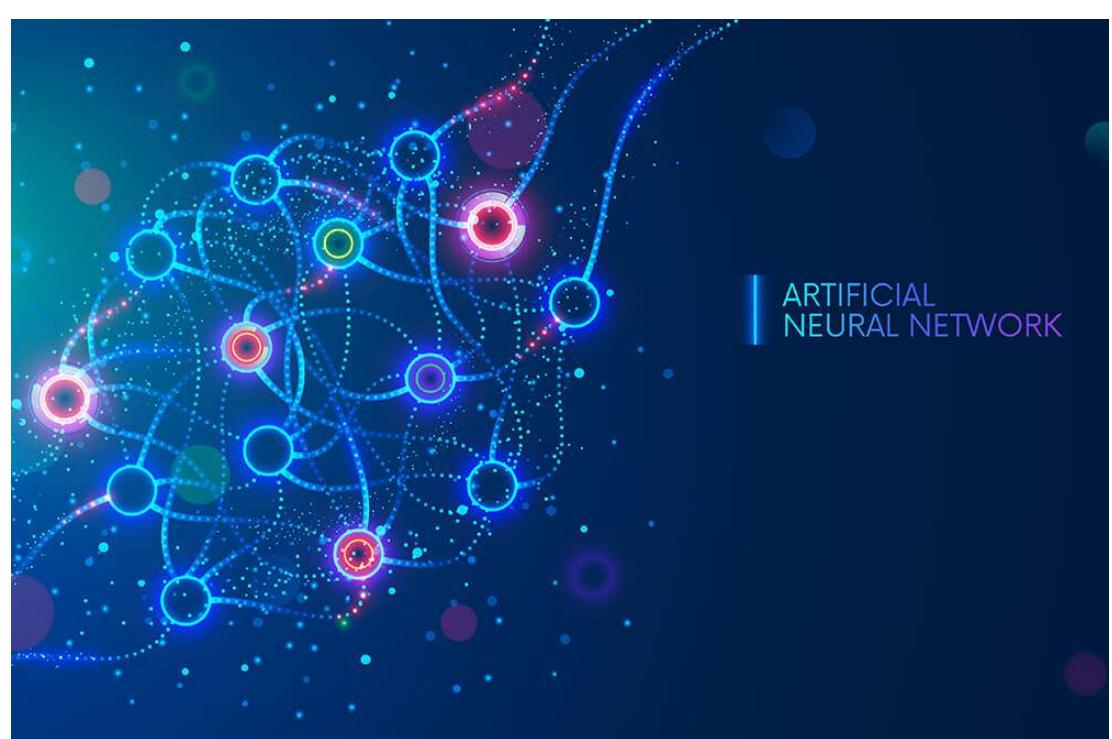
The major problem with the traditional derivative pricing method is that it requires huge computation power and it is time-consuming. Pricing derivative with neural network on the other hand is more efficient as prices of derivatives can be calculated instantly once the model is trained and it saves so much time for traders. Although periodic updates (i.e. retrain the neural network with latest data) are required, yet they can be done overnight or on the weekend.

Replicating the research paper “Deeply Learning Derivatives” can be a good place to start. Let’s use European Call Option as an example. First, it is required to randomly generate different inputs such as stock prices, strike prices, maturities, correlations and variances. All these variables are randomly picked from a set of predetermined probability distributions. It is also required to get the outputs by calculating the option prices with Monte Carlo Simulations. Then, hyperparameter tuning, model training and validation are the next steps.

## 利用神经网络对衍生品进行定价

传统衍生品定价方法的主要问题是计算量大、耗时长。另一方面，使用神经网络为衍生品定价更有效，因为一旦模型经过训练，衍生品的价格就可以立即计算出来，并且为交易者节省下大量时间。尽管模型需要定期更新（即用最新数据重新训练神经网络），但训练一般可以在一夜间或周末完成。

复制研究论文“Deeply Learning Derivatives”可能是一个很好的起点。让我们以欧式看涨期权为例。首先，我们需要随机生成不同的数据，例如股票价格、执行价格、期限、相关性和方差。所有这些变量数据都是从一组预先确定的概率分布中随机挑选出来的。还需要通过使用蒙特卡洛模拟计算期权价格来获得期权价值。然后，接下来的步骤便是超参数调整、模型训练和模型验证。



For data generation, there are three sets of data that can be generated which are A, B and C. Set A includes 5 millions of options and each option involves 1 millions of simulation paths; Set B includes 50 millions of options and each option involves 100 thousands of simulation paths; Set C includes 500 millions of options and each option involves 10 thousands of simulation paths. It will be tested later which set of data are best for training the neural network.

For hyperparameter tuning, loss curves can be used to determine which set of hyperparameters are optimal. In the graph, the y-axis represents the loss (i.e. value of the loss function, the difference between the predicted value and actual value) and x-axis represents the train epoch (i.e. how many times the data has gone through the neural network). In the graph, each set of hyperparameters comes with a test error curve and a training error curve. Usually, the curves will converge and lower loss curves indicates a better set. Early stopping can be applied when the test error curve stops converging and starts to U-turn. It helps to make sure the neural network doesn't train further and avoid the overfitting problem.

Lastly, for performance measurement, it is a good idea to look at the distribution of the loss terms using a histogram. The best result is a symmetric distribution with most loss terms centered at zero. This can be achieved through the training with the right data and optimal hyperparameter tuning.

在数据生成方面，可以生成甲、乙、丙三组数据。甲组包含五百万个期权价值，每个期权价值涉及一百万条模拟路径；乙组包含五千万个选项，每个选项涉及十万条模拟路径；丙组包含五亿个选项，每个选项涉及一万条模拟路径。最后，我们会测试哪组数据最适合神经网络作训练。

对于超参数调整，损失曲线可用于确定哪一组超参数是最好的。在损失曲线图中，y轴表示损失（即损失函数的值，预测值与实际值之间的差异），x轴表示训练期（即每笔数据经过神经网络的次数）。在图中，每组超参数都带有一条测试误差曲线和一条训练误差曲线。通常，曲线会收敛，较低的损耗曲线表示那组超参数更好。当测试误差曲线停止收敛并开始回升时，可以应用提前停止方法，有助于确保神经网络不会进一步去训练并避免过度拟合的问题。

最后，在神经网络性能测量方面，使用直方图查看损失项的分布是一个好方法。最好的结果是对称分布，其中大多数损失项以零为中心。这可以通过使用正确数据和最佳超参数调整的训练来实现。

本文的中文翻译是由 CCFA 义工 Yue Wu 提供的。

## *Application of Machine Learning in Fraud Detection and Anti-Money Laundering*



## 机器学习在欺诈侦察与反洗钱中的应用

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### Disclaimer

*The opinions expressed in this article are those of the author. They do not purport to reflect the opinions or views of the author's employer*

Artificial intelligence (AI) and machine learning (ML) are buzzwords of our day. AI is a branch of computer science that attempts to simulate human intelligence in machines so that they can perform tasks like humans. ML is one approach to achieving AI—it is the study of computer algorithms that “can automatically detect patterns in data, and then use the uncovered patterns to predict future data, or to perform other kinds of decision making under uncertainty” [1]. Thanks to advances in computing and abundance of data, ML has enjoyed tremendous development over the past decades and found successful applications in many industries. It is an indispensable tool for the financial industry, especially in areas of fraud detection and anti-money laundering (AML).

Fraud and money laundering are two criminal activities financial institutions (FIs) frequently encountered in daily operations. Fraud is deliberate and wrongful deception intended to achieve financial or personal gains (e.g., credit card fraud, check fraud) [2]. Money laundering is “the practice of integrating proceeds of crime into the legitimate mainstream of the financial community” by hiding the funds’ illicit origins [3]. Fraud and money laundering activities are well-considered, concealed, and time-evolving. They are rare events compared to legitimate activities. FI’s failure to mitigate them may cause financial losses, reputation damage, security breaches, or regulatory penalties.

人工智能和机器学习是当下热门词汇。人工智能是计算机科学的一个分支，它试图在机器中模拟人类智能，以便它们可以像人类一样执行任务。机器学习是实现人工智能的一种方法——它是对计算机算法的研究，“可以自动检测数据中的模式，然后使用发现的模式来预测未来的数据，或者在不确定的情况下执行其他类型的决策” [1]。由于计算技术的进步和数据的丰富，机器学习在过去的几十年中取得了巨大的发展，并成功应用于许多行业领域中。它是金融行业不可或缺的工具，尤其是在欺诈检测和反洗钱(AML)领域。

欺诈和洗钱是金融机构(FI)在日常运营中经常遇到的两种犯罪活动。欺诈是旨在实现经济或个人利益的故意和错误的欺骗（例如，信用卡欺诈、支票欺诈）[2]。洗钱是“通过隐藏资金的非法来源，将犯罪所得转入合法传统金融领域的做法”[3]。欺诈和洗钱活动是经过缜密思考的、隐蔽的和随着时间不断演变进化的。与合法活动相比，它们是罕见的事件。金融机构如未能防止欺诈和洗钱可能会导致财务损失、声誉受损、安全漏洞或监管处罚。

Traditional fraud detection or AML monitoring systems utilize business rules meticulously designed by subject-matter experts or rely on manual reviews conducted by trained analysts. Due to extensive human intervention required, such systems are difficult to maintain or expand. They are also less responsive to emerging trends in criminal behaviors. A criminal may even circumvent strictly rule-based detection if rule details are leaked. In contrast, ML can learn from data without being explicitly programmed. It is capable of recognizing complex patterns not apparent to human eyes and is thus more sensitive to new criminal activity patterns. As computing power is now cheap and readily available, after proper hardware and software deployment, ML-based systems can deliver scalable performance. Furthermore, an expanded throughput brings more data, which can be used to continuously improve ML algorithms to attain higher model precision. The automation and fast responses enabled by ML-based systems allow FIs to enhance their efficiency and reduce operation costs.

In practice, ML models are often used as one component of the entire fraud or AML monitoring process instead of standalone decision tools. Model output (typically risk scores) is fed into downstream business rules or procedures to determine how certain events should be treated. For example, it may help decide in real time whether a user's online payment should be declined. In another scenario, it may alert an analyst that a fund transfer deserves investigation for money laundering. Properly developed ML models can automate decision making and significantly reduce the burden on analysts so that they can focus on reviewing riskier activities. FIs' fraud detection and AML monitoring exercises complemented by ML models are more flexible, efficient, and robust.

ML models pose new challenges to model risk management at FIs. On one hand, regulators expect FIs to clearly understand their models, but on the other hand, some ML algorithms are rather complex. The results from a model based on neural networks, for instance, are much harder to interpret than those from decision trees. In the case of vendor models, the vendors tend to share only limited high-level model information with FIs. To demonstrate ML models' effectiveness with such incomplete information requires creativity. Model risk management frameworks at FIs must catch up with the rapid development of ML models.

The playing field of fraud and AML analytics is expanding. It is projected that the global fraud detection and prevention market will grow from \$27 billion in 2021 to \$75 billion by 2028 [4]. Meanwhile, the global AML market size is also forecasted to increase from \$2 billion in 2020 to \$5 billion by 2027 [5]. Multiple studies suggest that fraud detection and prevention are among the most common reasons for businesses' adoption of AI [6]. A recent report by SAS and KPMG shows 57% of the institutions surveyed have already deployed AI or ML in AML production or have plans to do so in the near future [7]. Given wider adoption of AI among FIs, one can expect ML to be a key driver behind this growth in fraud and AML analytics.

While extensive ML research and development constantly offer innovative tools to FIs, criminals can also adopt them in their illegal activities. In a 2020 swindle, fraudsters used deep voice technology to clone the voice of a company's director and easily tricked a bank into transferring \$35 million [8]. In the foreseeable future, the battle against financial crimes will unavoidably involve the struggle between AI technologies wielded by both the good and the evil.

传统的欺诈检测或反洗钱监控系统主要利用由专家精心设计的业务规则，或依赖经训练的分析师进行的手动审查。由于需要大量的人工干预，这样的系统难以维护或扩展，也无法及时发现犯罪行为的新趋势。如果规则细节被泄露，犯罪分子甚至可以规避严格基于规则的检测方法。相比之下，机器学习无需明确编程即可从数据中学习，它能够识别人眼看不到的复杂模式，因此对新的犯罪活动模式更加敏感。由于计算能力现在便宜且容易获得，在适当的硬件和软件部署之后基于机器学习的系统可以提供可扩展的性能。此外，扩大的吞吐量可以带来更多的数据，这些数据可以用于不断改进机器学习算法以获得更高的模型精准度。基于机器学习的系统实现的自动化和快速响应使金融机构能够提高效率并降低运营成本。

在实践中，机器学习模型通常被用作整个欺诈或反洗钱监控过程的一个组成部分，而不是独立的决策工具。模型输出（通常是风险评分）被输入到下游业务规则或程序中，以确定应如何处理某些事件，例如它可以帮助实时决定是否应该拒绝用户的在线支付。在另一种情况下，它可能会提醒分析师某一资金转移值得进行洗钱调查。适当开发的机器学习模型可以自动化决策并显著减轻分析师的负担，以便他们可以专注于审查风险较高的活动。金融机构的欺诈检测和反洗钱监测活动辅以机器学习模型能变得更加灵活、高效和稳健。

机器学习模型对金融机构的模型风险管理也带来了新的挑战。一方面，监管机构希望金融机构清楚地理解他们的模型，但另一方面，一些机器学习算法相当复杂难以理解。例如，基于神经网络的模型的结果比决策树的结果更难解释。在供应商模型的情况下，供应商倾向于仅与金融机构共享有限的大致的模型信息，用这种不完整的信息难以证明机器学习模型的有效性。金融机构的模型风险管理框架必须跟上机器学习模型的快速发展。

欺诈和反洗钱分析的应用正在扩大。全球欺诈检测和预防的市场预计将从 2021 年的 270 亿美元增长到 2028 年的 750 亿美元 [4]。同时，全球反洗钱市场规模也预计将从 2020 年的 20 亿美元增加到 2027 年的 50 亿美元 [5]。多项研究表明，欺诈检测和预防是企业使用人工智能的最常见原因之一 [6]。SAS 和毕马威最近的一份报告显示，57% 的受访机构已经在反洗钱生产中使用了人工智能或机器学习，或者计划在不久的将来应用 [7]。鉴于人工智能在金融机构中的广泛采用，机器学习预计将成为欺诈与反洗钱分析增长背后的关键驱动力。

虽然广泛的机器学习研究和开发不断为金融机构提供创新工具，但犯罪分子也在其非法活动中改进采用新技术。在 2020 年的一起骗局中，欺诈者使用深度语音技术来克隆公司董事的声音，并轻松欺骗银行转移 3500 万美元 [8]。在可预见的未来，打击金融犯罪的斗争将不可避免地涉及善与恶的人工智能技术之间的斗争。

Talents with relevant skill sets are in high demand in fraud and AML analytics. First, working with ML models entails solid quantitative skills (statistics, ML, data mining) and programming skills (e.g., Python, SAS, SQL). Second, creativity and critical thinking are essential for handling real-world complexities (e.g., working with incomplete data or poor data quality during model development). Third, because multiple business teams contribute to fraud and AML daily operations, excellent communication skills are needed for smooth and efficient collaboration among various stakeholders. Finally, deep business understanding is invaluable to the development and management of models, interpretation of model results, and design of business strategies. A combination of several aforementioned skills, if not all, may bring one competitive advantage in the job market. Do you want to join this adventure?

具有相关技能的人才在欺诈和反洗钱分析方面的需求量很大。首先，使用机器学习模型需要扎实的量化技能（统计、机器学习、数据挖掘）和编程技能（例如Python、SAS、SQL）。其次，创造力和批判性思维对于处理现实世界问题的复杂性至关重要（例如，在模型开发过程中需要使用不完整的数据或较差质量的数据）。第三，由于多个业务团队共同为欺诈和反洗钱日常运营做出贡献，因此需要出色的沟通技巧才能在各个利益相关者之间进行顺畅高效的协作。最后，深入的业务理解对于模型的开发和管理、模型结果的解释以及业务战略的设计都是非常宝贵的。上述几种技能的组合或者全部几项技能可能会在就业市场上带来竞争优势。你想加入这场探险吗？

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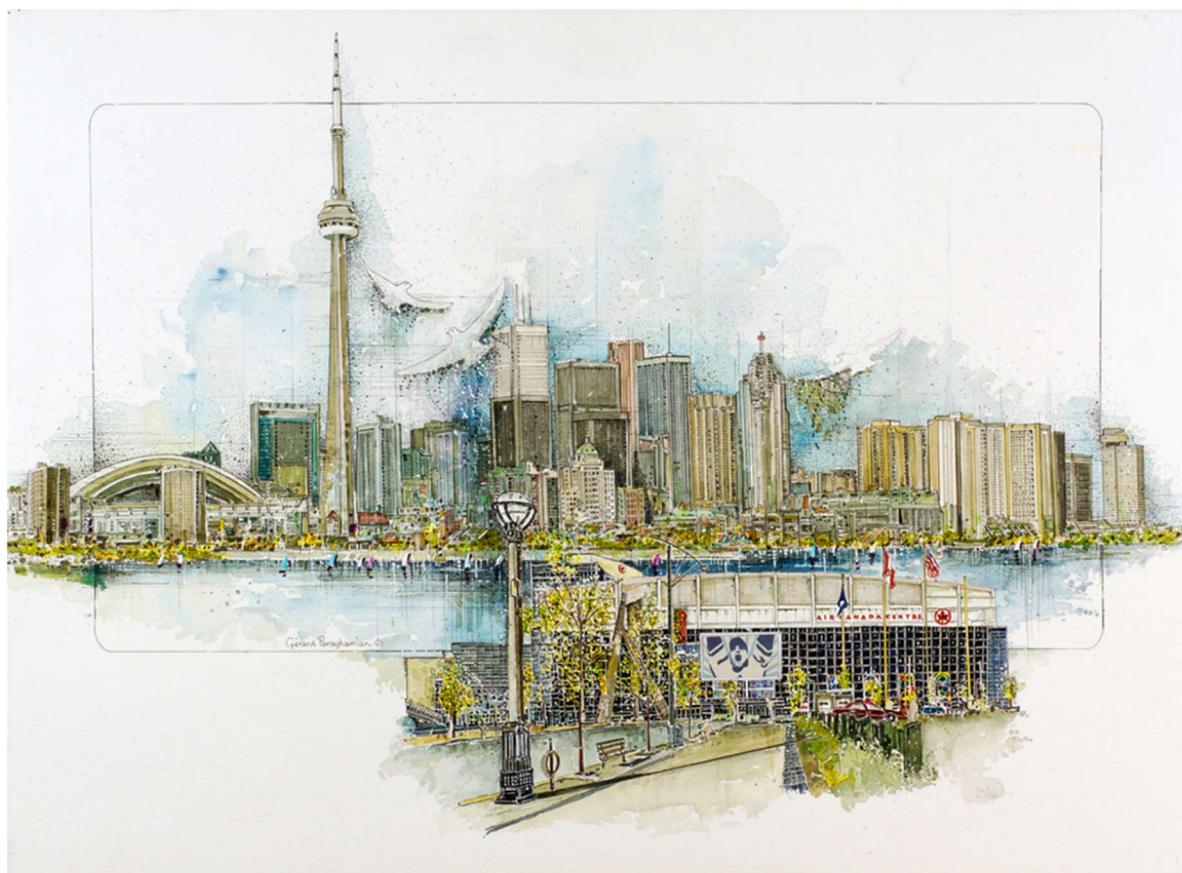
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