

Institution: London School of Economics and Political Science		
Unit of Assessment: 17 - Business and Management Studies		
Title of case study: New approaches to forecasting financial markets		
Period when the underpinning research was undertaken: 2006-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Ian Martin	Role(s) (e.g. job title) Professor of Finance	Period(s) employed by submitting HEI: 2012 to present
Period when the claimed impact occurred: 2014-2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact (indicative maximum 100 words) <p>Research by Professor Ian Martin introduces new ways to forecast the behaviour of stock markets and currency markets. His approaches have been used by the Bank of England's Monetary Policy Committee in formulating their views on exchange rates; by the European Central Bank in their monetary policy discussions; and by global asset management companies to improve aspects of their asset allocation and to inform their approach to foreign currency exposure. As well as improving understanding of risk premia, the research has informed changes in key aspects of financial practice in both the public and private sector. By helping investors take better-informed risks, supporting the development of more robust monetary policy, and helping central banks to spot destabilising market "bubbles", the work supports efforts to maintain stable financial systems in the UK and elsewhere.</p>		
2. Underpinning research (indicative maximum 500 words) <p>The research underpinning impacts described here was published between 2013 and 2020 in a series of papers introducing new ways to forecast a different type of financial asset. Several conclusions emerge from the papers, the most important of which is that risk premia are substantially more volatile, both over time and across stocks, than the literature has previously acknowledged.</p> <p>Research carried out between 2013 and 2017 (published in [1]) defined a new index of volatility - the SVIX index. This is similar to the VIX index created by the Chicago Board Options Exchange (CBOE), a real-time market index that represents the market's expectation of 30-day forward-looking volatility. Derived from the price inputs of the S&P 500 index options, Martin's SVIX index provides a measure of both market risk and investors' sentiments. The distinctive feature of the new index is that it has a natural application to measuring the expected return on the market - the so-called "equity premium". The properties of the index were studied empirically using the OptionMetrics database of historical option prices to construct the index for the period 1996-2012 (at that time the full period for which option price data was available). This showed that the equity premium is (even) more volatile than had previously been understood.</p> <p>A second paper [2] reported on work carried out from 2015 to 2018. This built on research published in [1] to derive a formula for the expected return on a stock, based on observable option prices. Martin and his co-author Christian Wagner (Professor of Finance, WU Vienna University of Economics and Business) then constructed the relevant option price indices called for by that new formula; that is, they extended the indices constructed in [1] to cover individual stocks. Specifically, the new approach supplies an inherently forward-looking measure of expected returns at the stock level, rather than the market level. This both outperforms other standard measures and makes distinctive predictions that challenge the conventional wisdom by showing that risk premia are extremely volatile across stocks (as well as over time, as was clear from the research reported in [1]). The model introduced in this paper can be contrasted with the Capital Asset Pricing Model (CAPM), which uses betas to make quantitative predictions about a stock's returns. However, CAPM betas are estimated over an historical horizon and are difficult to pin down during turbulent markets. Conversely, the option-based model set out in [2] can be estimated in real time because it <i>only</i> uses option prices; it also performs well empirically, unlike CAPM.</p>		

In parallel work conducted with PhD student Lukas Kremens between 2016 and 2018, Martin made new theoretical and empirical contributions to the classic - and notoriously difficult - challenge of forecasting exchange rates. The resulting paper [3] was published in 2019. Much of the existing literature in this field is organised around the theory of uncovered interest parity (UIP), which states that the difference in interest rates between two countries will equal the relative change in currency foreign exchange rates over the same period. The strictest form of UIP supposes risk neutrality, such that risk premiums should be identically zero. UIP is appealing for three reasons: 1) it is based on asset prices alone (so is observable in real time); 2) it has no free parameters (so does not require estimation); and 3) it has a straightforward interpretation (as the expected currency appreciation perceived by a risk-neutral investor). In [3], Martin and Kremens propose an alternative benchmark, the quanto theory, which shares these three features without also making the empirically highly implausible assumption that investors are risk-neutral. Their quanto theory model predicts that risk-neutral covariances between currencies and global stock markets should forecast excess currency returns. They demonstrate how to use a certain kind of derivative contract - quanto forward contracts - to measure these quantities. The resulting measure was shown to work very well empirically, outperforming the standard competitors (UIP, Random Walk, and PPP) in forecasting differential currency movements out-of-sample.

A fourth paper [4] resulted from research conducted jointly in 2018-2019 with Can Gao, a PhD student at Imperial College London. It provides a real-time, forward-looking measure of "bubblineess" in stock markets. Martin and Gao define a new sentiment indicator that exploits two contrasting views of return predictability and studies its properties. The indicator, which is based on option prices, valuation ratios, and interest rates, was unusually high during the late 1990s, reflecting dividend growth expectations that the researchers proposed were unreasonably optimistic. They interpreted this as helping to reveal irrational beliefs about fundamentals. This paper demonstrates that their measure is a leading indicator of de-trended volume, and of various other measures associated with financial fragility. The research published in [4] also makes two methodological contributions. First, it derives a new valuation-ratio decomposition that is related to the Campbell and Shiller (1988) log-linearisation, but which more closely resembles the traditional Gordon growth model, as well as having certain other advantages. Second, it introduces a volatility index that provides a lower bound on the market's expected log return.

A fifth paper [5] extends the novel framework introduced in papers [1]-[4] in a different direction. It provides an index of stock market return autocorrelation using yet another kind of derivative security, namely forward-start options.

3. References to the research (indicative maximum of six references)

[1] Martin, I. (2017). What is the Expected Return on the Market? *Quarterly Journal of Economics*, 132(1), pp. 367-433. DOI: 10.1093/qje/qjw034.

[2] Martin, I. and Wagner, C. (2019). What is the Expected Return on a Stock? *The Journal of Finance*, 74(4), pp. 1887-1929. DOI: 10.1111/jofi.12778. Wharton School-WRDS Best Paper Award in Empirical Finance, WFA 2017; Honourable Mention, AQR Insight Award 2017.

[3] Kremens, L. and Martin, I. (2019). The Quanto Theory of Exchange Rates. *American Economic Review*, 109(3), pp. 810-843. DOI: 10.1257/aer.20180019. Best Paper Award at the IF2017 Annual Conference in International Finance; SIX Best Paper Award 2018.

[4] Martin, I. and Gao, C. (2020). Volatility, Valuation Ratios, and Bubbles: An Empirical Measure of Market Sentiment. Forthcoming in *The Journal of Finance*. Preprint version available at http://personal.lse.ac.uk/martiniw/GM_latest.pdf

[5] Martin, I. (2020). On the autocorrelation of the stock market. Forthcoming in the *Journal of Financial Econometrics*. Working paper version available at: <https://personal.lse.ac.uk/martiniw/autocorrelation%20latest.pdf>

Papers [1], [2], [3], and [4] are published (accepted) in the very top economics or finance journals.

4. Details of the impact (indicative maximum 750 words)

The research published in [1]-[4] introduces new ways to forecast the behaviour of various financial asset markets. A distinctive feature of these new methods is their reliance only on observable asset prices, making the resulting forecasts observable in real time. This is in contrast to forecasts based on, say, macroeconomic or accounting data, which can only be exploited by investors or policymakers with a lag. The methods have been widely used by public and private financial institutions, including central banks, national investment funds, and global investment and asset management companies. Immediate impacts include the generation of a new debate about ways to forecast financial assets; an improved understanding within financial institutions of risk premia; and changed approaches to key aspects of professional practice including asset allocation and the forecasting of exchange rates. The use of the research in these contexts helps investors take better-informed risks. The research also supports the development of more robust monetary policy, including by providing monetary authorities with a more accurate and timely indication of market sentiment. By helping central banks to spot destabilising market “bubbles”, the work contributes to efforts to maintain stable financial systems in the UK and elsewhere.

Catalysing debate and changing practice in central banks: the principal insights of research published in [1]-[4] have been shared widely across and within both private and public financial organisations. High-profile examples include the invited presentation of research published in [2] and [4] at central banks including the Bank of England (BoE), the Federal Reserve Bank of New York (the Fed), and the European Central Bank. Work published in [2] has also been shared with Banca d'Italia. In April 2019, [4] was one of six papers selected for presentation to and discussion by members of the Behavioural Finance Working Group of the National Bureau of Economic Research (NBER), a non-profit research organisation “committed to undertaking and disseminating unbiased economic research among public policymakers, business professionals, and the academic community”. It was also included in a [Bank of England blog post](#) published in October 2020.

As well as generating discussion and debate, Martin’s research has directly supported changes in thinking and practice in the central banks with which he has worked. The work has, for example, provided central banks with **new tools to support the notoriously difficult task of forecasting exchange rates**. The research set out in [3], which provides a new way of approaching this, was presented at a conference at the BoE in June 2017. Separately, Martin was asked by the BoE in February 2017 to provide data required to compute the currency appreciation measure proposed in [3], so that forecasts based on the measure could be supplied to its Monetary Policy Committee (MPC).

As a result of these activities, the work has been used by the MPC in formulating its views on exchange rates [A]. Gertjan Vlieghe, a member of the MPC, reports using insights from the research, including [3], *“on numerous occasions in the discussions with other members of the Monetary Policy Committee to promote a more rigorous understanding of exchange rates and risk premia, arguing against the simple UIP framework which is still commonly used, but which fails both theoretically and empirically, as [Martin’s] research shows”* [A].

Vlieghe further notes the *“broader impact of influence [Martin’s] research has had within our institution by influencing work by staff that feeds through to policymakers”*. He particularly cites work published in [1], which has *“been the subject of internal staff workshops”*, and [4], which *“is to be incorporated into the staff’s toolkit on equity valuations”*, as well as forming the basis of a staff note [A].

Supporting the development of robust monetary policy: the impacts of Martin’s work on thinking and practice in central banks extend to its use to develop robust monetary policy. The use of his work at the **European Central Bank**, for example, is described by its Head of Capital Markets/Financial Structure (Directorate General Monetary Policy) as having had both conceptual and practical effects on the ways in which financial market briefings are prepared for monetary policy discussions:

“On a conceptual level we started to think about the term structure of the equity risk premium (ERP) as a useful indicator for monetary policy... [which] provides us with

additional information relevant for monetary policy. On a practical level we implemented several versions of SVIX-like indicators, developed by Ian Martin, for different jurisdictions. We regularly monitor the developments in these indicators...to detect changes in market perceptions on the economic outlook and report this analysis regularly to the policymakers.” [B]

The real-time, forward-looking measure of “bubblineess” in stock markets set out in [4] is also proving useful for monetary policymakers. Martin presented that work at the **Bank of England** in September 2019 and discussed it further in a series of follow-on meetings with staff there. According to a senior advisor at the BoE, it was clear that the indicator developed in [4] could be particularly helpful to the work of the Bank’s Financial Stability Strategy and Risk (FSSR) directorate, which monitors indicators of asset valuation for signs of bubbles inflating. Most of these are valuation ratios, which often fail to give a particularly clear signal because they can be explained by other factors: high price-to-earnings ratios, for instance, might be explained by low discount rates, rather than signalling a bubble. The particular qualities of Martin’s indicator, by contrast, mean that any bubble signals suggested by it could, the BoE believes, “be received with a high level of confidence” [C].

Martin took on a formal role as an academic consultant to the BoE in 2018-19 and is now helping its staff to operationalise the indicator developed in [4] for regular use in the Bank. This work includes computing the indicator for the FTSE 100 index (and possibly later for sector indices such as technology stocks). These sorts of indicators are used by policymakers in the BoE, including the Financial Policy Committee (FPC), in assessing risks to the UK financial system and considering whether policy measures are needed to strengthen its resilience. Martin’s measure is expected to “join or replace some of the existing asset-valuation measures” used to make these policy decisions [C]. By helping them to more accurately detect asset pricing bubbles in real time, the research contributes to efforts to maintain stability in the financial system. This contribution is confirmed by Vlieghe, who acknowledges “how much impact [Martin’s] work has had in furthering our understanding of the link between asset prices and macroeconomic fundamentals, and helping us implement practical tools can allow us to make up-to-date asset price assessments for financial and monetary stability purposes” [A].

Promoting a more rigorous understanding of risk premia and forecasting financial assets in private financial institutions: beyond its contributions to the work of central banks and monetary policymakers, the research has also been used by some of the world’s biggest private financial organisations. It has been shared with and used by global investment management corporations including BlackRock - the world’s largest asset manager - and quantitative investment giant AQR Capital Management. In 2017, the latter named [2] as one of five finalists for its Insight Award, which recognises “papers that provide the most significant, new practical insights for tax-exempt institutional or taxable investor portfolios”. Investment funds, including the Norwegian sovereign wealth fund, Norges Bank Investment Management, have also engaged with the work, which Martin presented to them on 30 June 2017. In June 2016, it was discussed at a [conference at the University of Gothenburg](#), organised by one of Sweden’s public pension funds.

Part of the interest in these organisations has been in the implications of the work for understanding risk premia. The equity premium - the difference between expected returns on risky portfolios or investments and the certain return on risk-free securities or portfolios - is one of the central quantities of finance and macroeconomics. Standard theories such as the CAPM and its successors imply that it is a central driver of asset prices, and hence one of the most important determinants of aggregate investment in a macroeconomic sense. The more accurate appraisal of forward-looking risk premia proposed by Martin makes an important contribution to the work of financial institutions as a critical component of investment processes within asset management firms.

The “meaningful impacts” on industry of Martin’s research are explained by Dr Brandon Bates, a former senior portfolio manager at BlackRock, who says his work: “teaches us how to think about markets, how to impose structure on a problem with formidable complexity” [D]. During his seven-year tenure at BlackRock, Bates “witnessed regular discussion, adoption, and adaptation of [Martin’s] ideas, especially [his] research programme of imputing measures of

market expectations from derivative instruments” [D].

The work also informs more specific aspects of understanding and practice which, because of the scale at which BlackRock and others operate, have very far-reaching effects. Examples identified by Bates include the application of the model described in [1] by staff at BlackRock in the context of asset allocation - the division of capital across asset classes - which Bates describes as “*the principal driver of long-run investment returns*”. Recognising that “*the dynamism of [Martin’s] measure suggested a much richer opportunity set for tactical asset allocation than anyone at BlackRock previously thought...at least two groups at the firm created a live monitor for the measures to use in their investment processes*” [D].

Paper [2] “*also generated notable excitement...Above the direct application of using [Martin’s] results as a stock-level return forecaster, it inspired an entire research agenda within the group of deriving model-free estimates of just about every key parameter*” [D].

Bates further acknowledges the use of Martin’s work at BlackRock in the context of foreign currency exposure. This he describes as being, after asset allocation, “*the most important consideration international investors weigh*”, with currency movements explaining “*somewhere between 20% and 40% of returns in international equity portfolios*”. He continues:

“What this means is that even modest skill in forecasting currencies promises meaningful improvements in portfolio-level performance. With approximately USD300 billion in international active equity mandates, you can imagine why [Martin’s] paper ([3])...generated excitement at BlackRock...I knew of two independent replication efforts. Additionally, two prominent investment banks created and then began circulating currency return forecasts based in part on [Martin’s] methodology.” [D]

An asset manager’s strategy for deploying planned trades to the market is informed by time series dependence in returns. In a mean-reverting market, it is best to wait for a favourable bounce to create better entry points; in a trending market, on the other hand, it is better to complete trades sooner. Many systematic investment strategies formalise this idea by using the degree of serial correlation in returns as a central parameter in trade-timing models. Typically, practitioners estimate this parameter using historical data, which is necessarily imperfect. According to Bates, paper [5] “*fills an important gap in practice by providing the first forward-looking estimate for this parameter*”. When he left BlackRock in 2019:

“...several research threads were underway to productionalise [Martin’s] insight for assets where the options market was sufficiently liquid to support forward-start options. If an improvement in model calibration improves returns in trade-timing performance by even 0.01 percentage points, the gains for BlackRock’s active equity clients would be approximately USD50 million per year.” [D]

Because it supports more efficient allocation of capital, this sort of improvement in appraisal ultimately delivers broader macroeconomic benefits, as well as benefits to investors.

5. Sources to corroborate the impact (indicative maximum of 10 references)

[A] Supporting statement from Gertjan Vlieghe, Member of the Monetary Policy Committee, Bank of England, 16 November 2020.

[B] Supporting statement from Thomas Werner, Head of Capital Markets/Financial Structure, Directorate General Monetary Policy, European Central Bank, 20 September 2019.

[C] Supporting statement from Nicholas Vause, Senior Advisor, Capital Markets Division, Financial Stability Strategy and Risk, Bank of England, 23 September 2019.

[D] Supporting statement from Dr Brandon Bates, formerly senior portfolio manager at BlackRock, now at Squarepoint Capital, 22 September 2019.