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RESEARCH INTERESTS

Market risk and volatility modelling, options markets, asset pricing, macro-finance, financial economics, market microstructure, the econometrics of high frequency data.

EDUCATION

- 2007** Ph.D. in Economics, Universidad Complutense de Madrid, Spain.
Thesis title: Volatility and Prices at the Spanish Option Market
Thesis Advisor: Alfonso Novales (PhD. Econ., University of Minnesota, 1983)
- 2001** M.A. in Quantitative Economics, Universidad Complutense de Madrid, Spain
- 1998** B.A. in Economics (Quantitative Economics), Universidad Complutense de Madrid

EMPLOYMENT

- 2019-present** *Senior Economist*, Bank of Spain (DG Operations)
- 2016-2019** *Tenured Associate Professor in Finance*, CUNEF, Madrid, Spain
- 2011-2016** *Assistant Professor*, CUNEF, Madrid, Spain
- 2009-2011** *Research Associate* in the Finance Department, Northwestern University, Kellogg School of Management, IL, USA
- 2001-2009** *Teaching Assistant/Trainee* in Quantitative Economics, Universidad Complutense de Madrid, Spain.
- 1999-2003** *Economic Analyst*, ERISTE-ICAE Group, Madrid, Spain.

OTHER APPOINTMENTS

- 2009-2011** *Visiting Scholar* at the “Zell Center for Risk Research,”
Kellogg School of Management, Northwestern University, IL, USA
- 01/2009-08/2009** *Post-doctoral Fellow* at the Finance Department
Kellogg School of Management, Northwestern University, IL, USA
- 08/2008-12/2008** *Visiting Post-doctoral Fellow* at the Finance Department
Kellogg School of Management, Northwestern University, IL, USA

ACADEMIC VISITOR

- 01/30/2018-02/02/2018** University of Vienna, Vienna, Austria
- 10/30/2017-11/03/2017** Kellogg School of Management, Northwestern University, IL, US
- 10/10/2016-10/21/2016** Kellogg School of Management, Northwestern University, IL, US
- 09/27/2014-10/05/2014** Kellogg School of Management, Northwestern University, IL, US
- 09/21/2012-10/03/2012** Kellogg School of Management, Northwestern University, IL, US

11/01/2012-11/30/2012 Institute for Statistics and Econometrics, Humboldt University, Berlin, Germany.

PUBLICATIONS IN ACADEMIC JOURNALS

[1] "An empirical assessment of proposed solutions for resolving scale problems in value relevance accounting research," working paper with Juana Aledo, Juan M. García Lara, and Christos A Grambovas. *Accounting & Finance*, 2019 (forthcoming)

[2] "Exploring Returns Dynamics via Corridor Implied Volatility," with Torben G. Andersen and Oleg Bondarenko. *Review of Financial Studies*, 2015, Vol 28(10): 2902-2945

[3] "Model-free Volatility Indexes in the Financial Literature: A Review," *International Review of Economics and Finance*, 2015, Vol 40, 141–159

[4] "Day of the Week Effect on VIX. A Parsimonious Representation," with David E. Guerrero. *The North American Journal of Economics and Finance*, 2013, Vol. 25, 243-260

[5] "The Information Content in a Volatility Index for Spain," with Alfonso Novales. *Journal of the Spanish Economic Association (SERIEs)*, 2011, Vol. 2 (2), 185-216

[6] "Are Volatility Indexes in International Stock Markets Forward Looking?" with Alfonso Novales. *RACSAM-Applied Mathematics Series*, 2009, Vol. 103 (2), pp. 339-352

WORKING PAPERS

[7] "Eurozone Prices: A Tale of Convergence and Divergence" working paper with *Alfredo Garcia-Hiernaux and David E. Guerrero*, 2019 (to be submitted to *Journal of Monetary Economics*)

Abstract: This study (i) tests price convergence (in mean and variance) based on a model of relative price levels that includes a transition path, and (ii) offers a way to measure the speed of price convergence across countries. By applying this test to the European Monetary Union (EMU) price indices from 2001 to 2011, we find empirical evidence of different price level patterns and the lack of price level convergence in the long run for most countries. In terms of the price gap between countries, only when we compare the German with French and Italian prices, do we get zero-gap price level convergence. A few other countries report non-zero (constant) gap price level convergence. These results underscore the existence of a "convergence cost" that EMU countries with lower price levels pay and that does not tend toward zero in the long term. This should be of concern to European monetary policymakers as it implies that their monetary policy does not affect (benefit/harm) all EMU members equally.

[8] "Measuring the spillovers of uncertainty shocks," (previously titled "Understanding the International Spillovers of Volatility Expectations") SSRN working paper, 2019

Abstract: Uncertainty shocks affect expectations and corporate profits and mostly transmit globally. This article provides an uncertainty shocks spillover index from the log-ratio of volatility indices to measure the transmission of uncertainty shocks across European financial markets from 2001 to 2018. The index confirms options markets' ability to price the spillover of political, economic, and financial uncertainty shocks, even those due to terror attacks. The role of the UK and Swiss (non-EMU) options markets explaining the transmission of uncertainty shocks declines after the Brexit, while higher uncertainty

results in uncertainty shock contagion depending on the moment of the business and financial cycles. Obtained results improve our understanding of the inter-market connectedness and the flow of uncertainty shocks, aiding central banks to explain the effectiveness of monetary policy (forward guidance), policymakers to design effective policies' implementation, and risk managers to buy risk (volatility) protection at the lowest cost.

[9] “A Corridor FIX for High-Frequency VIX: Developing Coherent Implied Volatility Measures,” working paper with *Torben G. Andersen* and *Oleg Bondarenko*, 2019 (to be submitted to *Journal of Financial and Quantitative Analysis*)

Abstract: The VIX index is computed as a weighted average of SPX option prices over a range of strikes according to specific rules regarding market liquidity. Using tick-by-tick observations on the underlying options, we document that this strike range varies substantially in how much coverage it provides of the distribution of future S&P 500 index prices, producing significant biases, or distortions, in the time series of VIX measures. We propose a novel high-frequency Corridor Implied Volatility index (CX) computed from a strike range covering an “economically invariant” proportion of the future S&P 500 index values and using only reliable option quotes. Comparing the time series properties of these alternative volatility indices from June 2008 through June 2010, we find that our CX measure is superior in terms of filtering out the noise and avoiding large artificial jumps. Consequently, the properties of the two series at both the daily and the intraday level are dramatically different in important dimensions of relevance for asset pricing, risk management, and real-time trading strategies

[10] “Extrinsic information asymmetries, accounting quality, and investment efficiency,” working paper with *Juana Aledo* and *Juan M. García Lara*, 2018

Abstract: We examine whether the presence of privately informed traders and information asymmetries between these traders and the rest of investors undermine the role of accounting information in mitigating financing constraints and reducing under-investment problems. In line with prior research, we show that among firms prone to under-investment, those with better quality earnings invest more. We also show that this relation disappears whenever trading by informed investors generates additional information asymmetries that managers cannot reduce through improved accounting information

WORK IN PROGRESS

[11] “The Information Content of Volatility Indices,” work in progress with *Nikolaus Hautsch* and *Michael Noé*, 2019

Abstract: The VDAX-NEW has two special characteristics compared to another model free implied volatility index. First, the usage of trading prices, if more recent than quotes. And second the applied cut-off rule applied by Deutsche Börse. We analyze these two characteristics and the corresponding impact on the information content. We find that trading prices can lead to artificial jumps in the VDAX-New if they are based on a mistrade. We further find that the used cut-off rule can lead to artificial index movements and an incoherent usage of the risk neutral distribution. By applying the concept of corridor indices we create a set of volatility indices with a coherent usage of the risk neutral distribution on various frequencies, and therefore without artificial movements. We further analyze the forecasting capabilities of different parts of the smile on future market returns. We find that out of the money put options have information content on future market returns.

[12] “The Role of Market Makers in the Quality of SPX Quotes,” work in progress, 2018 (to be submitted to *Journal of Financial Markets*)

Abstract: The S&P 500 index options (SPX) are the most actively traded index options in the U.S. and the market benchmark to estimate the most popular volatility index in financial markets: the VIX. However, despite the high relevance of SPX quotes dynamics, there is a lack of studies that estimate the sensitivity of SPX quotes quality to the microstructure of the Hybrid 3.0 quoting system that drives the SPX quotes at the CBOE. This article proposes the first option-based total spread measure and studies for

the first time the sensitivity of the SPX bid-ask spread to the microstructure of the effective SPX quoting system in place. It is important to stress that even though the SPX quotes under the Hybrid 3.0 system that allows for both electronic and on-floor trading the main SPX trading takes place in the pit, where only one Lead Market Maker (designated by the CBOE) quotes the SPX options at each maturity cycle. We find that the SPX spread dynamics is significantly sensitive to the Lead Market Maker quoting on the pit, and that this sensitivity increases in high-volatile times. This result will help to characterize the dynamics of the price discovery process at the US market (approached by the S&P500). Overall, our results suggest the need to make certain adjustments in the effective SPX quoting system that lead to narrowing the sensitivity of SPX quotes dynamics to the market maker. Moreover, when the identity of this institution is unknown outside the pit.

[13] “Periodic pattern in high-frequency data,” work in progress with *David E. Guerrero*, 2017
Abstract: Financial series usually show intraday periodic patterns. Filter the series from this pattern results crucial to model the own series dynamics, and to relate this with another series. This article proposes a general model to capture the intraday deterministic periodic pattern in a series and evaluate its long-term evolution. The model reported is (i) additive, although can be easily transformed into multiplicative, and (ii) represented by a trigonometric series related to the Fourier transformation traditionally reported. This article shows to recover the seasonal pattern at the time-domain from the specification at the frequency domain, making possible not only to get an estimation robust to outliers but also to interpret most of the seasonal patterns in the financial series in the time-domain. This methodology is used to characterize intraday patterns in the 15-min VIX series: there is a significant U-shape in the absolute log returns of the index, while the 15 log VIX shows a sort of smirked intraday pattern.

REFEREE

Review of Finance, Operations Research, Journal of Financial Markets, MATCOM (Mathematics and Computers in Simulation), Economic Modelling, Business Research Quarterly, Empirical Economics, Investigaciones Económicas (SERIEs), The Journal of Risk, Cuadernos de Economía y Dirección de la Empresa (CEDE), International Journal of Theoretical and Applied Finance.

GRANTS

2016-2019 *Financial Crisis effects on the SMEs capital structure and on the flow of volatility of the capital markets* [Efectos de la crisis Financiera sobre la estructura de capital de las SMES y sobre los Flujos de Volatilidad en los Mercados de Capitales]. Funded by “Ministerio de Economía, Industria y Competitividad” (Ministry of Economy, Industry and Competition, Spain). Ref.: ECO2016-79693-P. ([project director](#)).

2013-2016 *Corporate Governance, Capital Markets, and Financial Crises*. Funded by Ministerio de Economía y Competitividad (Ministry of Economy and Competition, Spain). Ref.: ECO2012-32554.

2006-2009 *Optimal Fiscal and Monetary Policies: 1) theoretical analysis, 2) impact on financial markets*. Funded by Ministerio de Ciencia e Innovación (Ministry of Science and Innovation, Spain). Ref.: SEJ2006-14354.

2005-2009 *Quantitative Analysis of Economic Policy and Financial Markets*. Funded by: Universidad Complutense de Madrid, Spain.

2000-2001 *Simplifying VMA and VARMA Models: Linear Estimation and Automatic Specification Methods of Space State Models*. Funded by: Ministerio de Educación (Ministry of Education, Spain) Principal Ref.: DGICYT PB98-0789

2000- 2001 *Econometric Modeling with Application to Financial Markets, Corporate Investment, and Infrastructures*. Funded by: Ministerio de Educación (Ministry of Education, Spain). Ref.: DGICYT PB95-0912.

EXTERNAL Ph.D./MASTER COMMITTEE MEMBER

2018 Proposal Defense DBA • Ivan Montoya, “A comprehensive analysis of Investment Funds in Colombia: An Empirical Investigation” (Master Thesis Advisor: Juan-Pedro Gomez), IE, Madrid, Spain, March 22, 2018

2017 Ph.D. Committee member • Julio A. Crego, “Essays on Political Economy and Migration” (Ph.D. Advisor: Dante Amengual), CEMFI, Madrid, Spain, June 1, 2017

INVITED PRESENTATIONS (recent)

2020: • Universidad Carlos III, Madrid, Spain. • Vienna Workshop on “Econometrics of Options Markets”, Vienna, Austria.

2018: • University of Vienna. Finance Department Seminars, Austria. • First International Workshop on New Frontiers in Financial Markets, CUNEF, Madrid, Spain.

2017: • XXV AEFIN Finance Forum, UPF, Barcelona, Spain. First Prize to the Best Paper in Derivatives (BME) • IE (Instituto de Empresa), Madrid, Spain • Lisbon Finance Seminars. CATOLICA-LISBON, NOVA SBE, ISCTE-IUL and ISEG (Lisbon, Portugal)

2016: • 3rd Empirical Finance Workshop. ESSEC Business School, Paris, France • XXIV AEFIN Finance Forum, CUNEF, Madrid, Spain.

HONORS AND AWARDS

2017: XXV Finance Forum best conference paper in derivatives award for “A Corridor FIX for High-Frequency VIX: Developing Coherent Implied Volatility Measures” (with Torben G Andersen and Oleg Bondarenko). Universitat Pompeu Fabra (UPF), Barcelona, Spain.

TEACHING

Colegio Universitario de Estudios Financieros (CUNEF) , Madrid, Spain

Assistant Professor / Tenured Associate Professor

Business Statistics I (Undergraduate)	2011-2012
Business Statistics II (Undergraduate)	2011-2018
Banking and Stock Market Operations (Undergrad.)	2013-2019
Technical Analysis (M.Sc. in International Markets and Institutions)	2015-2016
Technical Analysis (Summer Course)	2015-2017

Kellogg School of Management, Northwestern University, Finance Department, IL, USA

Invited Professor

Lecture: Construction and applications of volatility indexes (1st year Ph.D. course)

2011

Universidad Complutense de Madrid, Madrid, Spain

Teaching Assistant / Trainee

Introduction to Econometrics (Undergraduate)	2005-2007
Econometrics I (Undergraduate)	2004-2006
Econometrics II (Undergraduate)	2004-2007
Financial Economics (Undergraduate)	2002-2003
Introduction to Macroeconomics (Undergraduate)	2001-2004
Advanced Macroeconomics (Undergraduate)	2001-2002
Economic Analysis (M.Sc. in Economics)	2001-2005

Fundación de Estudios Financieros (Financial Studies Foundation), Madrid, Spain

Professor

Statistical Methods (M.Sc. in International Finance, 16 hours) 2005-2006

ORGANISATION OF SEMINARS AND WORKSHOPS

2018 • First International Workshop on New Frontiers in Financial Markets, CUNEF, Madrid, Spain. March 16-17, 2018, • Research Seminars at CUNEF, Madrid, Spain. September 2017 – June 2018.

ACADEMIC SERVICE (recent)

2017- present. • Member of the academic job promotion committee at CUNEF, Madrid, Spain.
• Member of the *Spanish Ministry of Economy, Industry and Competitiveness* Research Agency (Evaluator), Madrid, Spain.

2016 • Scientific Committee Member for XXIV AEFIN Finance Forum at CUNEF, Madrid, Spain

LANGUAGES

Spanish (native), English (fluent)

COMPUTATION SKILLS

Matlab, SAS, SPSS, Stata, Eviews, Office