Anna Bykhovskaya

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Employment

2019 – 2022 Juli Plant Grainger Postdoctoral Fellow,
UW Madison, Department of Economics

Education

PhD, Economics, Yale University, 2019
Dissertation: "Peer Effects: Theory and Measurement"
Advisors: Peter C.B. Phillips, Larry Samuelson

MA, MPhil, Economics, Yale University, 2016

MA, Economics, *Cum Laude*, New Economic School, 2013

BS, MS, Mathematics (with specialization in probability theory),
Summa Cum Laude, Moscow State University, 2012

Research Interests

Time Series Econometrics, Matching and Market Design, Networks

Publications

"Cointegration in Large VARs" (with Vadim Gorin), *Annals of Statistics*, forthcoming, 2021

"Time Series Approach to the Evolution of Networks: Prediction and Estimation", *Journal of Business and Economic Statistics*, forthcoming, 2021

"Stability in Matching Markets with Peer Effects", *Games and Economic Behavior*, Vol. 122, July 2020

"Point Optimal Testing with Roots that are Functionally Local to Unity" (with Peter C.B. Phillips), *Journal of Econometrics*, Vol. 219, No. 2, 2020

"Boundary Limit Theory for Functional Local to Unity Regression" (with Peter C.B. Phillips), *Journal of Time Series Analysis*, Vol. 39, No. 4, 2018

Working papers

"Asymptotics of Cointegration Tests for High-Dimensional VAR(k)" (with Vadim Gorin), 2021

Conference publications

"Limiting variance of (β, α)-transformations", *Proceedings of International Youth Scientific Forum "Lomonosov-2012"* (in Russian), 2012

"(β, α)-transformations and codings", *Proceedings of International Youth Scientific Forum "Lomonosov-2011"* (in Russian), 2011

Seminar and Conference Presentations

2021 *International Conference on Computational and Financial Econometrics*
NES Alumni seminar, online
European Summer Meeting of the Econometric Society, online
North American Summer Meeting of the Econometric Society, online
Ohio State, UW Madison, Cambridge, Hebrew University Jerusalem
2020 *Russian Integrable Probability Seminar*, online
2019 UC Berkeley, Cornell, UW Madison
2018 *International Conference on Game Theory*, Stony Brook University, USA
Tripartite Conference, Singapore
NYU Micro Theory Student Lunch, New York University, USA
2017 *NES* 25*th Anniversary Conference*, Moscow, Russia

Grants and scholarships

Petr Aven Fellowship (2017 – 2018)
Falk Foundation Fellowship (2016 – 2017)
Besen and Dublier Fellowship (2014 – 2016)
Yale University Fellowship (2013 – 2019)
Cowles Fellowship (2013 – 2017)
NES alumni scholarship (2011 – 2012)
Grant RFBR-11-01-00982 a (2011 – 2012)
Scholarship of the Moscow city administration (2011 – 2012)

Teaching

Desired Teaching: Econometrics, Game Theory, Microeconomics

UW Madison:

Economic Forecasting, Spring 2020, 2021, 2022 (undergraduate)

Mathematical Economics (Math Camp), Fall 2020, 2021 (graduate)

Yale University (teaching fellow):

General Economic Theory: Microeconomics, Fall 2015, 2016, Spring 2017, 2019 (graduate)

Intermediate Microeconomics, Spring 2016 (undergraduate)

New Economic School (teaching fellow):

Game Theory, Winter 2013 (graduate)

Moscow School #57 (teaching fellow):

Evening math study group, 2007 – 2008 (middle school)

Research and Work Experience

Research assistant to Larry Samuelson, Spring 2018
Research assistant to Florian Ederer, Spring 2015
Research assistant to Dirk Bergemann, Summer 2014
Member of the Russian translation group of the mathematical popularization website "Dimensions" `http://www.dimensions-math.org`

Referee Service: *Theoretical Economics, Econometric Theory, The Econometrics Journal, Oxford Bulletin of Economics and Statistics, Review of Economic Studies, Journal of Econometrics, Journal of Financial Econometrics*

Other

Citizenship: USA, Russia

Languages: Russian (native), English (fluent), French (intermediate)

Software: C/C++, Gauss, Matlab, Mathematica, Stata, LaTeX

References

Prof. Peter Phillips
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Prof. Donald Andrews
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Prof. Alexei Onatski
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Prof. Daniel Quint
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Research Abstracts

Cointegration in Large VARs with Vadim Gorin
Annals of Statistics, forthcoming, 2021

The paper analyses cointegration in vector autoregressive processes (VARs) for the cases when both the number of coordinates, N, and the number of time periods, T, are large and of the same order. We propose a way to examine a VAR for the presence of cointegration based on a modification of the Johansen likelihood ratio test. The advantage of our procedure over the original Johansen test and its finite sample corrections is that our test does not suffer from over-rejection. This is achieved through novel asymptotic theorems for eigenvalues of matrices in the test statistic in the regime of proportionally growing N and T. Our theoretical findings are supported by Monte Carlo simulations and an empirical illustration. Moreover, we find a surprising connection with multivariate analysis of variance (MANOVA) and explain why it emerges.

Asymptotics of Cointegration Tests for High-Dimensional VAR(k) with Vadim Gorin

The paper studies non-stationary high-dimensional vector autoregressions of order k, VAR(k). Additional deterministic terms such as trend or seasonality are allowed. The number of time periods, T, and number of coordinates, N, are assumed to be large and of the same order. Under such regime the first-order asymptotics of the Johansen likelihood ratio (LR), Pillai-Barlett, and Hotelling-Lawley tests for cointegration is derived: Test statistics converge to non-random

integrals. For more refined analysis, the paper proposes and analyzes a modification of the Johansen test. Application of our approach to the S&P100 weekly prices does not reject the null of no cointegration.

Time Series Approach to the Evolution of Networks: Prediction and Estimation
Journal of Business and Economic Statistics, forthcoming, 2021

The paper analyzes non-negative multivariate time series which we interpret as weighted networks. We introduce a model where each coordinate of the time series represents a given edge across time. The number of time periods is treated as large compared to the size of the network. The model specifies the temporal evolution of a weighted network that combines classical autoregression with non-negativity, a positive probability of vanishing, and peer effect interactions between weights assigned to edges in the process. The main results provide criteria for stationarity vs. explosiveness of the network evolution process and techniques for estimation of the parameters of the model and for prediction of its future values.
Natural applications arise in networks of fixed number of agents, such as countries, large corporations, or small social communities. The paper provides an empirical implementation of the approach to monthly trade data in European Union. Overall, the results confirm that incorporating non-negativity of dependent variables into the model matters and incorporating peer effects leads to the improved prediction power.

Stability in Matching Markets with Peer Effects
Games and Economic Behavior, Vol. 122, July 2020

The paper investigates conditions which guarantee the existence of a stable outcome in a school matching in the presence of peer effects. We consider an economy where students are characterized by their type (e.g. SAT score), and schools are characterized by their value (e.g. teaching quality) and capacity. Moreover, we divide students and schools into groups, so that going to a school outside of one's group may be associated with additional costs or even prohibited. A student receives utility from a school per se (its value minus costs of attending) and from one's peers, students who also go to that school.
We find that sufficient condition for a stable matching to exist is that a directed graph, which governs the possibility to go from one group to another, should not have (directed or undirected) cycles. We also construct a polynomial time algorithm, which produces a stable matching. Furthermore, we show that if the graph has a cycle, then there exist other economy parameters (types, costs and so on), so that no stable matching exists. In addition, in cases where a stable matching exists we investigate whether it is unique.

Point Optimal Testing with Roots that are Functionally Local to Unity
with Peter C.B. Phillips
Journal of Econometrics, Vol. 219, No. 2, 2020

Limit theory for regressions involving local to unit roots (LURs) is now used extensively in time series econometric work, establishing power properties for unit root and cointegration tests, assisting the construction of uniform confidence intervals for autoregressive coefficients, and

enabling the development of methods robust to departures from unit roots. The present paper shows how to generalize LUR asymptotics to cases where the localized departure from unity is a time varying function rather than a constant. Such a functional local unit root (FLUR) model has much greater generality and encompasses many cases of additional interest that appear in practical work, including structural break formulations that admit subperiods of unit root, local stationary and local explosive behavior within a given sample. Point optimal FLUR tests are constructed in the paper to accommodate such cases and demonstrate how the power envelope changes in situations of practical interest. Against FLUR alternatives, conventional constant point optimal tests can be asymptotically infinitely deficient in power, with poor finite sample power performance particularly when the departure from unity occurs early in the sample period. New analytic explanation for this phenomenon is provided. Simulation results are reported and some implications for empirical practice are examined.

Boundary Limit Theory for Functional Local to Unity Regressions
with Peter C.B. Phillips
Journal of Time Series Analysis, Vol. 39, No. 4, 2018

This paper studies functional local unit root models (FLURs) in which the autoregressive coefficient may vary with time in the vicinity of unity. We extend conventional local to unity (LUR) models by allowing the localizing coefficient to be a function which characterizes departures from unity that may occur within the sample in both stationary and explosive directions. Such models enhance the flexibility of the LUR framework by including break point, trending, and multi-directional departures from unit autoregressive coefficients. We study the behavior of this model as the localizing function diverges, thereby determining the impact on the time series and on inference from the time series as the limits of the domain of definition of the autoregressive coefficient are approached. This boundary limit theory enables us to characterize the asymptotic form of power functions for associated unit root tests against functional alternatives. Both sequential and simultaneous limits (as the sample size and localizing coefficient diverge) are developed. We find that asymptotics for the process, the autoregressive estimate, and its t statistic have boundary limit behavior that differs from standard limit theory in both explosive and stationary cases. Some novel features of the boundary limit theory are the presence of a segmented limit process for the time series in the stationary direction and a degenerate process in the explosive direction. These features have material implications for autoregressive estimation and inference which are examined in the paper.