Francesca Bastianello
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Recommendation Letter Writer: John Y. Campbell

December 4, 2019

Dear Sir/Madam,

I am a fourth year PhD student in the Business Economics program at Harvard, and I would be very interested in taking part in the Behavioral Macroeconomics Research Boot Camp, which was recommended to me by Andrei Shleifer, one of my advisors.

As further detailed in my essay, in my research I study the aggregate macro and finance implications of behavioral biases which lead agents to use misspecified models of the world to process information.

I am currently working on two papers which study the aggregate implications of agents failing to realize the general equilibrium consequences of their actions, a form of limited thinking that we refer to as "Partial Equilibrium Thinking" (PET). In "Partial Equilibrium Thinking in General Equilibrium" we study this concept in a static setup, and we show how it can give rise to over-reaction to information and to persistently incorrect beliefs. In "Partial Equilibrium Thinking in Motion" we build on our previous work to show that in a dynamic model PET can be used to develop a theory of bubbles.

In future work, I wish to study the aggregate and policy implications of PET and other forms of model misspecification in a variety of macro and finance setups, to study phenomena such as credit cycles, investment booms, and business cycles. I also wish to consider the role of model uncertainty in advising optimal policy.

Given my research interests, I believe the Behavioral Macroeconomics Research Boot Camp would be a very valuable and timely opportunity for me to broaden my knowledge in behavioral macroeconomics, as well as to interact with peers with similar research interests. I hope to have the opportunity to participate in and contribute to this workshop.

Thank you for taking the time to consider my application.

Best wishes,

Francesca Bastianello

**FRANCESCA BASTIANELLO**
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## Education

2016 – Present PhD Student in Business Economics, Harvard University
Advisors: Professors John Y. Campbell, and Andrei Shleifer
Fields – Finance and Econometrics (completed)
ECON2723: Asset Pricing
ECON2725: Corporate Finance and Banking
ECON3011: Finance Graduate Student Workshop
ECON2140: Econometric Methods
ECON2142: Time Series Analysis
ECON2150: Machine Learning in Econometrics
Generals (completed)
ECON2010a: Economic Theory (Microeconomics I)
ECON2010b: Economic Theory (Microeconomics II)
ECON2010c: Economic Theory (Macroeconomics I)
ECON2010d: Economic Theory (Macroeconomics II)
ECON2120: Intro to Applied Econometrics
Other (completed)
ECON2030: Psychology and Economics
ECON2099: Market Design
ECON3001: Graduate Student Workshop in Behavior in Games and Markets
ECON3013: Graduate Student Workshop in Contracts and Organizations
MBA Classes (completed)
HBSMBA1446: Investment Management
HBSMBA1490: Investment Strategies

2015 – 2016 MPhil in Economic Research, University of Cambridge, Trinity College, Distinction
Advisor: Professor Andrew C. Harvey

2012 – 2015 BA in Economics, University of Cambridge, Trinity College, First Class Honours
Advisor: Professor Oliver B. Linton

## Teaching Experience

Fall 2018 ECON2723: Asset Pricing, Harvard, teaching fellow for Professor John Y. Campbell

## Research Experience and Other Employment

Summer 2014 University of Cambridge, Trinity College: Summer Research Studentship, under the supervision of Professor Oliver B. Linton
August 2011 Lazard Asset Management, London: Internship

## Professional Activities

Referee: *Quarterly Journal of Economics*

## Honors, Scholarships, and Fellowships

2019 – present NBER Pre-Doctoral Fellowship in Behavioral Macroeconomics
2015 Internal Graduate Studentship, University of Cambridge, Trinity College
2015 Senior Academic Scholarship, University of Cambridge
2014 Summer Research Studentship, University of Cambridge, Trinity College
2013 Junior Academic Scholarship, University of Cambridge

## Research Papers in Progress

*"Partial Equilibrium Thinking in General Equilibrium"* (with Paul Fontanier)

We study the aggregate implications of information diffusion in a financial market where agents fail to understand the general equilibrium consequences of their actions, a form of limited thinking that we call "Partial Equilibrium Thinking" (PET). In our setup we model a financial market where agents think they are the only ones inferring information from prices, when actually everyone is behaving in the same way. Since PET agents use a misspecified model of the world, they extract and trade on the wrong information. Although agents adopt a thought process that is in between the rational expectations and the competitive equilibrium benchmarks, the resulting equilibrium does not lie in the convex set of these two standard equilibrium concepts, and results in over-reaction to news. Moreover, we extend our model to allow for more general forms of model misspecification and heterogeneous agents with different levels of sophistication, and we consider the conditions required for K-level Thinking to converge to the Rational Expectations Equilibrium.

*"Partial Equilibrium Thinking in Motion"* (with Paul Fontanier)

We build on our work on "Partial Equilibrium Thinking in General Equilibrium" to show that in a dynamic setup PET leads to an endogenous feedback effect between agents' beliefs and the general equilibrium outcome they observe: price changes lead uninformed agents to update their beliefs, which leads to further price changes and further belief updating, and so on. We then show how the endogenous feedback effect between prices and beliefs which arises naturally in our model may lead to two different types of equilibrium paths: if the information content in prices is high enough, be it because there are enough informed agents or because the information they receive is very precise, then the equilibrium is stable, so that prices and beliefs converge to a state-dependent equilibrium which exhibits over-reaction relative to the Rational Expectations Equilibrium. If instead the information content is too low, so that the feedback effect between prices and beliefs is too strong, the equilibrium is unstable, and prices and beliefs become extreme and decoupled from fundamentals. Moreover, we show how it is possible for the transition dynamics to endogenously switch from an unstable to a stable path. We leverage this insight to build a theory of bubbles driven by PET behavior, and we provide conditions for when a bubble endogenously arises, and when it may burst. Finally, we argue that the endogenous feedback effect between prices and agents' beliefs generated in our model can be applied more generally to setups where agents learn from a general equilibrium variable, thus lending itself to a variety of other macro and finance applications, such as credit cycles and investment booms.

*"Identification of Factor-Augmenting Technical Growth and the Decline of the Labor Share"* (with Robert Lawrence, Eben Lazarus, and James Stock)

This project ties together some time series theory on weak identification with macro-related questions on the drivers of the decline in the labor share. In a standard Neoclassical production framework, the decline in the labor share could be due to either capital augmenting technological progress if capital and labor are substitutes, or to labor-augmenting technological progress if capital and labor are complements. It is well known that when the elasticity of substitution between capital and labor is unity, the production function is

Cobb-Douglas and the growth rate of capital- and labor-augmenting technical progress are not separately identified. In this project, we develop asymptotic theory for the distribution of these estimators for the case when the elasticity of substitution between capital and labor is close to unity, so that identification is weak. We then develop methods for weak-identification-robust inference extended to the cointegration context relevant for this empirical setting. Although confidence sets for some industries and sectors are uninformative, overall our results come down on the side of labor and capital being complements and technical change on net being labor-augmenting.

*"Intraday Auctions in Equity Markets"*

This paper studies the introduction of the midday auction on the London Stock Exchange (LSE) on March 2016. The goal of this policy was to gather liquidity at a time of the day when volume is low, and to provide mid-day price formation for products and portfolio benchmarking. Using microsecond frequency data, I find that, contrary to LSE's expectations, the midday auction fails to attract volume, and leads to a deterioration in market quality in its aftermath, not only on the LSE, but also on competing exchanges. This result is surprising as theory would predict that traders who do not want to trade in LSE's midday auction would migrate to competing platforms, thus increasing trading volume on these venues. Instead, I find that LSE plays a key role in the price discovery process, without which competing platforms are unable to operate. The policy implications of these findings is that regulators should consider abolishing scheduled daily intraday auctions.

**References**

**John Y. Campbell**
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**Andrei Shleifer**
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**Matthew Rabin**
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**Jeremy Stein**
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# Rationale for Applying & Research Statement

*Francesca Bastianello*

Attending and participating in the Behavioral Macroeconomics Research Boot Camp hosted by the NBER would be a very valuable opportunity for me at this stage in my academic career: not only are my research interests very closely aligned with the scope of the workshop, but also this comes at a time where I am actively broadening my knowlegde in the field of behavioral macroeconomics.

In my research, I study the aggregate macro and finance implications of behavioral biases which lead agents to use misspecified models of the world to process information.

In this essay, I will discuss two papers I am currently working on, and which study the aggregate implications of agents failing to realize the general equilibrium consequences of their actions, a form of limited thinking that we refer to as "Partial Equilibrium Thinking" (PET). In "Partial Equilibrium Thinking in General Equilibrium" we study this concept in a static setup, and we show that it provides a micro-foundation for over-reaction to news, and that modeling agents' beliefs in this way allows for an endogenous feedback effect between agents' beliefs and the general equilibrium outcome they observe. In "Partial Equilibrium Thinking in Motion" we develop our notion of PET in a dynamic setup, and show that depending on the strength of the feedback effect which PET generates, prices and beliefs will either converge to a state-dependent equilibrium which exhibits over-reaction, or they become extreme and decoupled from fundamentals. We then exploit that the strength of this feedback effect is time-varying to develop a theory of bubbles and crashes.

In future work, I wish to study the aggregate and policy implications of PET and other forms of model misspecification in a variety of macro and finance setups. I also wish to consider the role of model uncertainty in advising optimal policy. In this respect, the opportunity to participate in the Behavioral Macroeconomics Research Boot Camp would be extremely timely and valuable in shaping my research going forward.

**Partial Equilibrium Thinking in General Equilibrium** (with Paul Fontanier)

Rational expectations in a general equilibrium setup requires the very strong, and empirically unsopported, assumption of common knowledge rationality. This project aims to study the effects of relaxing this assumption when agents infer information from a general equilibrium variable. Doing so in this context implies that agents use a misspecified model of the world to extract information, thus leading to misinference.

In particular, we define "Partial Equilibrium Thinking (PET)" as a behavioral bias where agents fail to realize the general equilibrium consequences of their actions, and we model this by assuming that agents are rational, but fail to realize that other agents are also rational and that they behave just like them. To make this more concrete, consider a trader who sees the price of Apple rise, but doesn't know why. They might think that some informed agents received positive news about Apple and decided to buy. Given this thought process, they infer positive news about Apple, and also buy. What they fail to realize when they think in this way is that all other uninformed agents may be thinking and behaving just like them. Therefore, in reality, the price rise they

observe reflects the buying pressure of both informed and uninformed agents. If instead they attribute the whole price rise to the buying pressure of informed agents alone (i.e. to new information alone, thus neglecting the general equilibrium consequences of their actions), they will infer news which is more positive than in reality, and over-react.

Interestingly, despite the fact that the assumptions which define PET are in between those which define the Cursed Equilibrium (CE, agents are not rational/do not extract information), and the Rational Expectations Equilibrium (REE, agents have common knowlegde rationality/correctly extract information), the equilibrium PET price does not lie in the convex set of the CE and REE prices: while CE leads to under-reaction relative to the REE, PET leads to over-reaction, just as we saw in the Apple example.

We also show that our model is tractable enough to consider more general forms of model misspecification to account for a wide range of behavioral and cognitive biases. We then extend our model to have heterogeneous agents with different levels of sophistication by allowing them to use different misspecified models of the world, and we show that this leads to endogenous heterogeneous beliefs even when all agents have homogeneous priors.

**Partial Equilibrium Thinking in Motion** (with Paul Fontanier)

When introduced in a dynamic setup, PET gives rise to an endogenous feedback effect between prices and agents' beliefs: when uninformed PET agents see a price change, they attribute it to news, they update their beliefs, and trade on it. Since all uninformed agents behave in the same way, this leads to a further price change, which they attribute to further news, and so on. We show that depending on the strength of this feedback effect, prices and beliefs will either become extreme and decoupled from fundamentals (when the feedback effect is too strong relative to the risk bearing capacity of informed agents), or they will converge to a stable state-dependent equilibrium which exhibits over-reaction relative to the REE (when the feedback effect is weak enough).

Moreover, we show that in our model the strength of this feedback effect is time-varying, and that we can endogenously shift between these two regions. Interestingly, when we shift from the first (unstable) region to the second (stable) region we described above, we are able to explain both how bubbles form, and how they burst. This also allows us to explain patterns such as short-term momentum and long-term reversal, two features which are generally very hard to reconcile within a single model.

Finally, we are investigating the role of speculative motives in this context, and preliminary results show that if omniscient agents face enough residual uncertainty, they will ride the bubble and will get out of it fast enough before it crashes. If instead residual uncertainty is low, they arbitrage the opportunity away immediately.

**Future Research Direction**

While prices are a natural general equilibrium variable agents may learn from, our model can be applied to any setup where agents learn from a general equilibrium variable which aggregates information, thus lending itself to a variety of macro and finance setups, such as credit cycles, investment booms and business cycles. We aim to investigate these applications further in future research.

Gmail by Google

**Elisa Pepe <epepe@nber.org>**

# joint letter for NBER Behavioral Boot Camp

**Shleifer, Andrei** <shleifer@fas.harvard.edu> Wed, Dec 4, 2019 at 7:00 AM
To: Elisa Pepe <epepe@nber.org>
Cc: Yuriy Gorodnichenko <ygorodni@econ.berkeley.edu>

Dear Elisa and Yuriy,

This is a brief joint letter for 6 Harvard Ph.D. students whom I work closely with applying for the Behavioral Macro bootcamp. They are all part of a group I am advising in this space, and they work together, come to same informal group meetings, and are generally part of a small community. They are also all amazingly good.

I would divide them into the "older" thesis writing category, and the "younger" starting out category, although even people in the younger category are actively doing research.

Older category includes Francesca Bastianello, Paul Fontanier, and Peter Maxted. All three are very talented and technically strong, all have completed first rate papers. I think all three are on the market next year, and all were in the very final few for the Sloan pre-doc last year (Francesca got it). (I think they may also all be getting letters from same people who are recommending them for pre-docs.) So I think at this point you are familiar with all of them.

Let me write two sentences about each of the other three -- all of whom I have known for some time because all three were Harvard undergraduates.

Spencer Kwon is a G2, and a very rare person I have seen as a Ph.D. student who has the intellectual ambition and potential to do transformative work. If there is a limit on how talented he is, I have not detected it. I can tell many stories, but this is not the place. Mike and Andrew can provide first hand testimony from the Sloan-Nomis camp.

Johnny Tang is a G2. He is specializing in finance, was at Nick Barberis camp last summer (Nick loved him), has fantastic empirical skills and is doing incredibly well in the program. He is working on a very exciting project with Spencer. He also happens to be just a great person, totally beloved by everyone in his class (it is a Canadian effect, I suppose).

Suproteem Sankar is a G1. He comes with a Computer Science background, went to Sloan Nomis like Spencer before starting grad school, seems to have placed out of most of G1 classes even though he did not major in economics as an undergraduate, and is figuring out what he wants to do. I recently saw his resume (he is applying for the Soros fellowship for first generation americans) and was quite stunned by his accomplishments, which he had not told me about. He is extremely bright and is looking for what he wants to do. I would love to draw him into this field -- his potential is enormous.

I hope this is helpful.

Warm regards,

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December 7, 2019

To the NBER Behavioral Macroeconomics Research Boot Camp selection committee:

I am writing to give **Francesca Bastianello** my strongest recommendation for participation in the NBER Behavioral Macroeconomics Research Boot Camp. Francesca is one of those students who make teaching at Harvard such a privilege. She is extremely strong technically, as demonstrated by her outstanding performance in my second-year PhD course Asset Pricing in the fall of 2017. She was also excellent as the teaching fellow for that course in the fall of 2018. She was able to help students both with technical issues and with economic intuition, across a broad range of topics.

More importantly, Francesca is a talented self-starter who is already well along in a fascinating research agenda. She has found a tractable way to model the behavioral phenomenon of over-confidence in a macro-finance context. Working with Paul Fontanier, a fellow Harvard PhD student, Francesca has built a model of "partial equilibrium thinking" – in which initially uninformed investors extract information from prices but fail to understand that other investors are also doing so. In other words, these investors are overconfident about their status in the information-processing hierarchy. They do understand that some investors may be endowed with private information, but they think that they are unique in understanding how to extract this information from prices and react to it intelligently, in other words they wrongly believe that there is a mass of investors more naïve than they are.

Francesca and Paul show that in a model of the classic Grossman and Stiglitz variety, partial equilibrium thinking leads prices to overreact to information. This is striking because if investors failed to learn from prices at all, prices would underreact to information. Thus Francesca and Paul's equilibrium is not intermediate between rational expectations equilibrium and old-fashioned competitive equilibrium with no learning from prices. Beyond this, Francesca and Paul show how to solve their model if investors have higher-order partial equilibrium thinking of any degree. They state conditions under which such higher-order thinking converges to rational expectations equilibrium.

Francesca and Paul's initial model is static, but they have also started work on a dynamic model in which agents imperfectly learn from past prices to formulate their current asset demands. This model looks as if it will generate bubbles and crashes endogenously. I think this is an extremely promising direction that will allow them to connect their research agenda to a rich empirical literature on beliefs and behavior in macroeconomics and asset pricing.

In summary, Francesca's research is perfectly matched to the purposes of the NBER Behavioral Macroeconomics Research Boot Camp. She has a clever theoretical framework that is already delivering insights, and she has both the ambition and all the tools she needs to relate this framework to macroeconomic data. Francesca will benefit enormously from broader exposure to current papers in behavioral macroeconomics. I give her my strongest recommendation.

Sincerely,



John Y. Campbell