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Admissions Committee
NBER Digitization Tutorial 2021

Subject: Application to NBER Digitization Tutorial 2021

Nov 12, 2020

Dear Sir/Madam,

I am writing to you to apply to the *NBER Digitization Tutorial 2021*. My research explores how classic questions of industrial organization are impacted by the digitization of the economy. I should note I was a participant in the *NBER Digitization Tutorial 2020* and found it to be a wonderful opportunity to exchange ideas and thoughts with other researchers interested in similar topics. Please find below the requested details.

Contact Information.

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Graduate Studies. I am a fifth year PhD student at Princeton (enrolled since 2016), and also have an MPhil in economics from Oxford (Nuffield College; 2014-2016) as well as a BA in Philosophy, Politics and Economics from Oxford (2011-2014). On top of classic first-year coursework (micro, macro, metrics), which I completed at both institutions, my graduate coursework focussed on:

- Industrial Organization
  - IO 1: Theory (Oxford; Mark Armstrong & Simon Cowan)
  - IO 2: Empirical (Oxford; Howard Smith)
  - IO 3: Network & Selection Markets (Oxford; Andre Veiga)
  - Industrial Organization I (Princeton; Jakub Kastl and Nick Buchholz)
  - Industrial Organization II (Princeton; Jakub Kastl and Adam Kapor)
- Microeconomic Theory
  - Advanced Microeconomics I (Oxford; Margaret Meyer, Yuval Heller & Peyton Young)
  - Advanced Microeconomics II (Oxford; Adrien Vigier)

  - Advanced Economic Theory I (Princeton; Leeat Yariv & Pietro Ortoleva)
  - Game Theory (Princeton; Juan Pablo Xandri Antuna)
  - Decision Theory (Princeton; David Dillenberger)
- Political Economy
  - Political Economy I (Princeton; Thomas Romer)
  - Political Economy II (Princeton; Matias Iaryczower)
- Advanced Macroeconomics I (Oxford; Chris Bowdler & Basile Grassi)
- Advanced Econometrics I (Oxford; Bond & Duffy)

I sat my field exams at Princeton in Industrial Organization and Microeconomic Theory.

Research Interests. My (primary) supervisor is Jakub Kastl, and my main research area is industrial organization. More concretely, I am interested in how digitization shapes economic incentives in classic industrial organization settings such as price competition, mediation of competition via platforms and efficient procurement.

My current working papers:

- **Algorithmic Pricing Facilitates Tacit Collusion: Evidence from E-Commerce.**
  As the advance of the digital age is lowering menu costs across all sectors of the economy, it is becoming increasingly important to study how firms' ability to update prices more and more frequently is affecting the nature of competition between them. While there is an extensive theoretical literature on dynamic games, the Folk Theorem warns us that the predictive power of equilibrium reasoning is extremely limited in dynamic environments with brief periods. Hence, empirical research into the issue of repricing is necessary.

  This paper employs extensive data on the pricing decisions made by third-party sellers on a well-known e-commerce platform to empirically assess and expand the theoretical predictions of the literature on dynamic pricing. We find that delegation of pricing to simple algorithms has the potential to facilitate tacit collusion by reducing the set of available strategies. Furthermore, the algorithms currently employed are significantly simpler than the Markov-perfect strategies of Maskin and Tirole (1988) and emerge naturally as the result of a best-response process once the ability to regularly reprice is introduced into the marketplace. We build a model that suggests that if this best-response process were allowed to play out without intervention, the market would fully transition from static to dynamic pricing. Along the transition path, prices initially fall, but eventually rise dramatically. However, the marketplace we examine has only just begun its way on this transition path.

  We argue that cycling patters we see in our data lack several of the classic features of Edgeworth cycles and are more consistent with our model of 'delegated strategies'. Inverting this model to marginal costs, we conclude that welfare under automated repricing is comparable to welfare under monopoly pricing.

  This paper won the third-year paper prize of the Princeton Economics Department.

- **Markets Shaped by Recommender Systems and Endogenous Entry.** *(with Kwok-Hao Lee)*
  As an increasing number of market transactions are intermediated by various technology companies using online platforms, we have seen an increasing interest in examining the extent to which these platforms can exploit their intermediation decisions to cement their market power and/or influence competition. This paper is concerned with one specific intermediation technology: the Amazon 'Buybox' algorithm which assigns sales to merchants on the third-party marketplace.

  In our reduced form analysis, we find that sellers' likelihood of reaching the Buybox depends on multiple criteria, the most important of which is perhaps unsuprisingly the price they charge. However, relative to variables observable to us, Amazon also seems to be giving its own offers an advantage equivalent to a 16.9% decrease in prices. Similarly, merchants that employ Amazons' in-house fulfillment service FBA are given an advantage equivalent to a 10.9% price discount. However, perhaps most interestingly, we find that Amazon seems to rotate the Buybox, i.e. even with fixed offer-characteristics, the Buybox seller identity changes over time.

Motivated by these rotations, we build a structural model in which merchants make entry decisions anticipating the strength of competition as induced by the extent of the randomization. We explore counterfactuals under which Amazon increases or decreases the extent of randomization and conclude that Amazon's main incentive in randomizing is to incentivize entry in the presence of fixed costs and high merchant turnover.

- **Data Transparency and Public Oversight in E-Procurement.** *(with B. Baranek and V. Titl)*
  Developing countries typically spent a large fraction of their GDP on procurement markets. While oversight of these markets is crucial to preventing collusion and corruption, oversight by professionals can be extremely costly. We argue that motivated members of the public constitute a currently untapped free resource for procurement oversight. To tap this resource, countries only need to allow the public free access to procurement data, which can be done very cost-efficiently digitally.

  We explore how public oversight can discipline procurement outcomes in data from the Ukraine. We begin by developing a novel structural test to detect collusive behavior, documenting that the bidding patterns in the data are incompatible with a competitive equilibrium, identifying pairs of colluding firms and validating the soundness of our collusion detection algorithm on a large sample of prosecuted companies. In Ukraine, a broad policy reform created an unprecedented scale of data transparency and an online monitoring system. Numerous NGOs and educated volunteers started to monitor the market for public procurement. We document that this new system of supervision effectively reduces collusion and prices on the market; in particular, prices decrease by 20.6%. Finally, we estimate the deadweight loss and find a possible sizeable overall welfare gain from the additional oversight due to e-procurement of between 2.68% and 3.11% of the total procurement spending.

  This project was awarded a Weiss Grant in the Spring 2020 funding cycle.

The following projects are in early-stage, exploratory phases:

- **Building a Reputation: Flight Compensation and Legal Tech** *(with Jonas Müller-Gastell)*
  The EU requires airlines to compensate passengers for flight delays, but passengers used to rarely sue due to high (hassle) costs. We plan to explore how a new breed of 'legal tech' companies exploited digital technology to dramatically lower the costs of enforcing a judgement by building a credible reputation that all meritorious cases that were not settled would be prosecuted. We are in late-stage talks about data acquisition with a large flight compensation company.

- **Asymmetric Information in Sponsored Advertising** *(with Sarah Moshary)*
  We plan to (i) evaluate the extent to which sellers on a large auction platform are asymmetrically informed when it comes to the effects of sponsored advertising and (ii) experimentally explore possible interventions to correct the asymmetry.

- **Intermediation's Influence on Equilibrium Product Characteristics** *(with Shumiao Ouyang)*
  We plan to explore the influence an intermediator's choice of recommendation algorithm can have on product characteristics chosen in equilibrium. We are currently in talks concerning data acquisition with a large online platform that intermediates between consumers searching for investment opportunities and investment funds and changed their recommendation algorithm multiple times over several years.

As you can see from these extended abstracts, the key focus of a vast majority of my ongoing research projects is to examine the impact that digitization has had on various marketplaces: how has the introduction of a re-pricing API on Amazon Marketplace influenced the quality of competition between merchants? To what extent can online platforms exploit their intermediation decisions to shape competition between themselves and third parties? Does the increased transparency and oversight functionality of e-procurement platforms translate into substantially lower procurement costs? The answers to these research questions speak to the more general influence that digitization has had and will have on our economy.

Best wishes,



Leon Musolff