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**EDUCATION**

*PhD*, Operations — Expected Graduation 2022
University of North Carolina at Chapel Hill - Kenan-Flagler Business School

*BS*, Mathematical Economics, Summa Cum Laude — Graduated 2013
University of Richmond - School of Arts and Sciences

**WORKING PAPERS**

***Intertemporal Pricing with Resellers: An Empirical Study of Product Drops***, with Saravanan Kesavan and Seyed Emadi

*Abstract:* Product drops occur when a firm releases a limited-edition product line on a specific date for a short period of time. The product drop generates hype from customers that results in large sales, and a resale market may emerge where products resell at higher prices once the firm stocks out. A firm may ask: "How do resellers impact my profit?" To answer this, we obtain a unique data set from a retailer of baby clothing with weekly product drops. We estimate a structural model that incorporates the strategic behavior of customers reselling as well as firm pricing decisions based on limited inventory.

**Presented at**: UNC Chapel Hill, INFORMS 2020, POMS 2021

***Enhancing Local Fulfillment in Online Retail: An Application of the Newsvendor Model at JD.com***, with Saravanan Kesavan

*Abstract*: JD.com leverages a regional network of distribution centers (DCs) to fulfill online orders, consisting of regional DCs and front DCs. Front DCs improve delivery times for their local customers due to closer proximity. However, front DCs only hold the required inventory to fulfill locally for 35% of orders, requiring them to leverage backup fulfillment from regional DCs. Backup fulfillment impacts the customer experience, with a 1.1 day increase in average promised delivery time. Thus, JD.com faces a central trade-off: stock the local DC to maximize sales but increase replenishment costs; or leverage the network to lower operating costs but sacrifice sales due to increased promise times. We build a structural model where the decision maker acts rationally according to the newsvendor model in balancing the trade-off of fulfilling demand locally or through backup fulfillment. We estimate relative costs for local fulfillment, supporting the empirical evidence that front DCs fulfill less orders locally than regional DCs. Using our model, we find that JD.com's current utilization of front DCs drives 16% in decreased median promised time for local demand, resulting in 1.8% increased revenue for local demand. If front DCs fulfilled all of their local demand, additional 4.3% increase in revenue. However, doing so would require substantial investment in front DCs to lower local fulfillment costs. We explore the sensitivity of revenue gains to short-term investments that reduce local fulfillment costs.

**PUBLISHED PAPERS**

***The Effect of Brexit on EU Voting Power***, with Kathy Hoke
*The UMAP Journal (February 2018)*
*Abstract*: The Treaty of Lisbon, the latest treaty governing law-making in the European Union (EU), went fully into effect in 2014. Since then, the United Kingdom (UK) has petitioned to leave the European Union, based on a 2016 referendum in the UK (that exit is colloquially referred to as "Brexit"). We use two power indices from game theory literature, the normalized Banzhaf index and the Shapley-Shubik index, to give insight into current voting power and then to understand redistribution of power when the UK exits. Analyzing voting power in the Council of Ministers, we leverage generating functions to help with computation. We assess how equitably power is distributed with and without the UK by tying our power indices to the Gini index, originally developed to measure how equitably income is distributed. We show that the system displays only slightly more equitable distribution of power despite the departure of such a critical member state.

***A comparison of Carlet's second order nonlinearity bounds*****,** with Sihem Mesnager, Gavin McGrew, James Davis, Katherine Marsten
*International Journal of Computer Mathematics (December 2015)*
*Abstract*: Carlet provides two bounds on the second-order nonlinearity of Boolean functions. We construct a family of Boolean functions where the first bound (the presumed weaker bound) is tight and the second bound is strictly worse than the first bound. We show that the difference between the two bounds can be made arbitrarily large.

**TEACHING**

**Instructor**, UNC Chapel Hill
*BUSI 410: Business Analytics* 2020
Instructor Evaluation 4.8/5.0 (Response Rate: 26/28)

**Teaching Assistant**, UNC Chapel Hill
*BUSI 403*: *Operations Management* 2018
*BUSI 410: Business Analytics* 2020
*MBA 703*: *Operations Management* 2017-2020
*MBA 705: Business Modeling: Prescriptive Analytics* 2020-2021
*MBA 706: Data Analytics: Tools and Opportunities* 2020

**PROFESSIONAL EXPERIENCE**

**Research Assistant** 2017-Present
UNC Chapel Hill - Operations Department

**Director of Data Analytics** 2012-2017
Monument Consulting, Richmond, VA

**REFERENCES**

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