The Interplay of Information from Friends Versus Crowds in the Consumer Shopping Journey

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In this project, we plan to empirically examine, quantify and compare network effects from crowds of users and from direct peers in a large video-on-demand platform and in a mock-up website we developed.

We study how consumers combine social signals from different information channels at different stages of their search-to-purchase process and we focus on two types of social information signals: popularity of movies determined by a crowd of users, and information from friends obtained directly through social connections.

We will answer the following research questions: (a) Do consumers combine product quality information from friends and from the crowd in their search to purchase process? (b) How much weight do they assign to each type of signal during the different stages of the choice process (search for information and purchase decision)? (c) How do different product characteristics affect the role of friend-based quality signals and crowd-based quality signals on the search and purchase stages of consumer choice?

To answer these questions, we model the search-to-purchase process using a dynamic structural model that combines a discrete choice model with the classical optimal stopping framework (Weitzman, 1979). Our model takes into account the sequential arrival of information that is revealed during the search process as well as the search cost.

We instantiate the model with data from a video-on-demand (VoD) platform of a large multinational provider of telecommunication services. We will also instantiate

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the model with data from a lab experiment we are deploying via Amazon Mechanical Turk. The lab experiment will provide external validity to our model and to the results that we have so far obtained in the secondary data that we describe below.

The dataset we collected so far includes household-level clickstream data and transaction data for approximately 261,000 search-to-purchase sessions from more than 117,000 households during a six-month period (from June to December of 2015). We also have information on the social graph linking these households that we construct using call detail records (CDRs) from mobile communications among clients of our industry partner.

Our preliminary results show that quality signals provided by the crowd (measured by number of likes a certain movie displayed in the system) and those provided by friends (proxied by the number of social ties that purchased each title) influence consumers' evaluation of movies in their choice process. Specifically, friends' signals have higher explanatory power than crowd signals in the search stage of the decision process while crowd information is more relevant in the purchase stage of the decision process.

Going forward, we will expand the literature on how social signals and network effects affect consumer decision making and we will contribute to practice, by identifying and quantifying the impact of specific information items that firms can leverage upon to help guide and steer consumers' attention in their search journeys in online product market places.

The data required to pursue this project is already in hand. Over the next 12 months, we plan to i) continue developing our review of the literature and expand upon our theoretical contributions; ii) conduct additional analyses to test the robustness of our results with particular focus on replicating our results in the experimental dataset; iii) expand upon our preliminary results, including and exploring additional sources of heterogeneity in product and user characteristics in our data; and iv) present these results at conferences and workshops to obtain feedback that will inform i), ii) and iii).

Budget Allocation

Description	Cost	Justification
Flight to CMU / Lisbon	3000	2 trips to and from Lisbon towards Pittsburgh or other location to allow the co-authors of the proposal to meet and work together in this project and with company executives
Hotel Lodging	3000	Hotel lodging for ~2 weeks (14 days)
Research Assistant	6624	Research assistant for a period of 6 months. Costs in Portugal for a research assistant with MSc degree in computer science to support data cleaning and processing tasks
Amazon Mechanical Turk	2000	Contribution toward lab experiment costs associated we will use in the project

CURRICULUM VITAE

Name	Miguel Maria Castro Melo Godinho de Matos
Nationality	Portuguese
Date of Birth	29/03/1984
Address (PT)	Largo Carlos Selvagem nº2 5ºDto 1500-140, Lisbon – Portugal
Address (US)	5000 Forbes Av. Baker Hall 129, 15123 PA, Pittsburgh – United States of America
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RESEARCH INTERESTS

Primary	Economics of Digitization; Consumer Behavior; Social Network Analysis and Peer influence
Secondary	Telecommunications and Media; Applied Econometrics; Big Data

TEACHING INTERESTS

Big Data Analytics, Data Mining, Business Forecasting, Business Statistics, Econometrics, Social Network Analysis

EDUCATION

2009- 2013	**CARNEGIE MELLON UNIVERSITY, *Pittsburgh (USA)*** Doctoral Degree in Engineering & Public Policy	
2009- 2011	**CARNEGIE MELLON UNIVERSITY, *Pittsburgh (USA)*** MSc in Engineering & Public Policy	3.9 (of 4.0)
2008	**EUROMONEY TRAINNING, *Prague (Czech Republic)*** Valuation & Financial Analysis Training	
2005-2007	**INSTITUTO SUPERIOR TÉCNICO, *Lisbon (Portugal)*** MSc Degree in Computer Engineering	19 (of 20)
2006-2007	**T.U.DELFT, *Delft (The Netherlands)*** Erasmus	
2002-2005	**INSTITUTO SUPERIOR TÉCNICO, *Lisbon (Portugal)*** Bachelor's Degree in computer engineering	18 (of 20)

ACADEMIC POSITIONS

From Sep 2014 *Lisbon* *Portugal*	**UNIVERSIDADE CATÓLICA PORTUGUESA (CLSBE) – *Assistant Professor*** Assistant Professor of Information Systems and Management at Católica Lisbon School of Business and Economics
From Sep 2014	**CARNEGIE MELLON UNIVERSITY (CMU) – *Visiting Research Scientist***

Pittsburgh *U.S.A.*	Visiting Research Scientist at the Heinz College of Carnegie Mellon University (CMU), Pedro Ferreira is the resident faculty sponsoring the affiliation.

2013-2014 **UNIVERSIDADE CATÓLICA PORTUGUESA (CLSBE) – *Post-Doctoral Researcher***

Lisbon *Portugal*	Post-Doctoral Researcher Católica Lisbon School of Business and Economics working with Francisco Veloso studying the impact of content recommendation systems on consumer choice.

2013-2014 **CARNEGIE MELLON UNIVERSITY (CMU) – *Post-Doctoral Researcher***

Pittsburgh *U.S.A*	Post-Doctoral Researcher at the Heinz College of Carnegie Mellon University (CMU) working with Pedro Ferreira and Rahul Telang on the analysis of social networks and peer influence on consumer behavior.

2011-2011 **CARNEGIE MELLON UNIVERSITY (CMU) – *Teaching Assistant***

Pittsburgh *U.S.A*	Teaching Assistant for the Engineering and Public Policy Department at Carnegie Mellon University. I lectured the graduate level course "*Telecommunications, Technology Policy and Management"* chaired by Marvin Sirbu

JOURNAL PAPERS PEER REVIEWED

Godinho de Matos, Miguel, P.A. Ferreira and Rodrigo Belo (Mar 2018). Target the ego or target the group: Evidence from a randomized experiment in proactive churn management, Marketing Science, *(Accepted in March 2018 - Forthcoming)*

Belo, Rodrigo, P.A. Ferreira, **Miguel Godinho de Matos** and Filipa Reis (Feb 2018). The Impact of Time-Shift TV on TV Viewership and on Ad Consumption: Results a Randomized Experiment, Management Science *(Accepted in February 2018 - Forthcoming)*

Godinho de Matos, Miguel, P.A. Ferreira and Michael D. Smith (Nov 2017). The Effect of Subscription Video-on-Demand on Piracy: Evidence from a Household Level Randomized Experiment, Management Science, Articles in Advance

Godinho de Matos, Miguel, P.A. Ferreira, Michael D. Smith and Rahul Telang (Sep 2015). Culling the herd: Using real world randomized experiments to measure social bias with known costly goods, Management Science Vol. 62 No. 9, pp. 2563 - 2580, September 2016, DOI:10.1287/mnsc.2015.2258

Godinho de Matos, Miguel, Pedro A. Ferreira and David Krackhardt. (Dec 2014). Peer Influence in The Diffusion Of The IPhone 3G Over a Large Social Network, Management Information Systems Quarterly (MISQ) 38, 4: 1103 - A15.

Wilhelm, Stefan, and **Miguel Godinho de Matos** (Jun 2013). Estimating Spatial Probit Models in R, The R Journal, Volume 5, p130-143

JOURNAL PAPERS UNDER REVIEW

Ferreira,P.A. , Xiaochen Zhang, Rodrigo Belo and **Miguel Godinho de Matos** (Mar 2018). Recommender Systems and Consumer Welfare: Results from a Randomized Experiment in Video-on-Demand *(MISQ - 2nd round outcome – Minor Revision)*

Yang, Baojiang, **Miguel Godinho de Matos** and P. A. Ferreira (Mar 2018). Quantifying the welfare impact of lock in period in the telecommunications industry *(MISQ - 2st round – under review)*

Reis, Filipa, **Miguel Godinho de Matos** and P. A. Ferreira (Fev 2018). The Impact of DNS Blocking on Digital Piracy Activity *(ISR – 1st round outcome – Major Revision)*

Ferreira, Pedro, Rahul Telang and **Miguel Godinho de Matos** (Oct 2017). Identifying Contagious Churn in Cell Phone Networks *(JMIS - 1st round outcome - Major Revision)*

WORKING PAPERS

Godinho de Matos, Miguel, P.A. Ferreira (Mar 2018). Binge Yourself Out: The Impact of Binge Watching on TV Viewership and on the Subscription of Video on Demand

Rodrigo Belo, **Miguel Godinho de Matos**, P.A. Ferreira and (Jan 2018). Word of mouth in video-on-demand: Evidence from a randomized experiment

EARLY STAGE WORKING PAPERS

Godinho de Matos, Miguel and Christian Peukert. Mobile Internet and Consumer Welfare, Evidence from a Natural experiment from EU-Roaming Like at Home Regulation

Godinho de Matos, Miguel, Filipa Reis and Pedro Ferreira. Free Trials and Information Goods: Evidence from a randomized experiment

Belo, Rodrigo, P.A. Ferreira, **Godinho de Matos, Miguel**, Xiaochen Zhang. Recommender Systems Price Discrimination and Consumer Surplus

RESEARCH GRANTS

2016, 2017 **Principal Investigator** for an unrestricted $100,000 gift for research from and industry partner to conduct research on digital media ($40,000 in 2016 and $60,000 in 2017)

2016, 2017 **Principal Investigator** for an unrestricted $80,000 gift for research from Carnegie Mellon University to conduct research on digital media to complement the 2015 grant received from IDEA

2015 **Principal Investigator** for an unrestricted $20,000 gift for research from the Initiative for Digital Entertainment Analytics (IDEA) at Carnegie Mellon University to conduct research on consumer behavior in digital media channels and digital piracy

2013 Post-Doctoral Research Grant SFRH/BPD/94212/2013 awarded from the Portuguese Foundation for Science and Technology (36,000€)

2009 - 2013 Doctoral Grant SFRH/BD/33772/2009 awarded from the Portuguese Foundation for Science and Technology the Carnegie Mellon Portugal Program. (Full Tuition + Stipend)

AWARDS

2017 **Best Paper Award** in the track of Economics and Value of IS (ICIS 2017)

2017 **Best Paper Award** in the track of Data Science (ICIS 2017)

2016 **Best Reviewer** for the track of Data Science and Business Analytics

2006 Scholarship SINFO XII 2006 for extracurricular activities awarded by the Information Systems Department of Instituto Superior Técnico for academic merit

2005 Best Student Award 2005/2006 conceded for excellent academic performance by Instituto Superior Técnico

PHD STUDENT ADVISING

Xiaochen (Jamea) Zhang, Department of Engineering and Public Policy, Carnegie Mellon University, working on the effects recommender systems on firm profits and consumer surplus (member of the thesis committee that is chaired by Professor Pedro Ferreira), Graduated 2017, Data Scientist at UBER

Filipa Reis, Heinz College, Carnegie Mellon University, working on peer effect of telecommunication networks and media consumption (co-chair with Pedro Ferreira), Graduated 2018, Post-Doctoral Researcher at Católica Lisbon School of Business and Economics

Baojiang (Chris) Yang, Department of Engineering and Public Policy, Carnegie Mellon University, working on the effects of product bundling and consumer choices in telecommunications (co-chair with Pedro Ferreira)

CONFERENCE PROCEEDINGS PEER REVIEWED

Godinho de Matos, Miguel, P.A. Ferreira (Dec 2017). Binge Yourself Out The Impact of Binge Watching on TV Viewership and on the Subscription of Video on Demand, International Conference on Information Systems (ICIS 2017), Seul, South Korea, December 2017

Belo, Rodrigo, P.A. Ferreira, Miguel Godinho de Matos, Filipa Reis (Dec 2017). The Impact of Time-Shift TV on TV Viewership and on Ad Consumption: Results from a Randomized Experiment, , International Conference on Information Systems (ICIS 2017), Seul, South Korea, December 2017

Best Track Paper Award: Best Paper Award in the track of Data Science

Reis, Filipa, Miguel Godinho de Matos and P. A. Ferreira (Dec 2017). The Impact of DNS Blocking on Digital Piracy Activity, International Conference on Information Systems (ICIS 2017), Seul, South Korea, December 2017

Best Track Paper Award: Best Paper Award in the track of Economics and Value of IS

Godinho de Matos, Miguel, P.A. Ferreira (Oct 2017). Binge Yourself Out The Impact of Binge Watching on TV Viewership and on the Subscription of Video on Demand, Conference on Information Systems and Technology (CIST 2017), Houston, Texas, October 2017

Godinho de Matos, Miguel, P.A. Ferreira (Dec 2016). Binge Yourself Out The Impact of Binge Watching on TV Viewership and on the Subscription of TV Products, Workshop on Information Systems and Economics 2016, December 14-16, 2016

Yang, Baojiang, Miguel Godinho de Matos, Pedro A. Ferreira (Dec 2016) Consumer Digital Shopping Journey in Social Environment: The Interplay of Information from Friends and Crowds, Workshop on Information Systems and Economics 2016, December 14-16, 2016

Reis, Filipa, Miguel Godinho de Matos and P. A. Ferreira (Dec 2016). The Impact of Website Blocking on Digital Piracy Activity, Workshop on Information Systems and Economics 2016, December 14-16, 2016

Godinho de Matos, Miguel, P.A. Ferreira (Oct 2016). Binge Yourself Out The Impact of Binge Watching on TV Viewership and on the Subscription of TV Products, The Conference on Digital Experimentation (CODE), MIT, 14-15 October 2016

Godinho de Matos, Miguel, P.A. Ferreira and Michael D. Smith (Oct 2016). The Effect of Television Content on Pirate's Online Activity: Evidence from a Randomized Experiment, The Conference on Digital Experimentation (CODE), MIT, 14-15 October 2016

Belo, Rodrigo, P.A. Ferreira, Miguel Godinho de Matos, Filipa Reis (Jul 2016). The Impact of Time-Shift TV on TV Viewership and on Ad Consumption: Results from Both Natural and Randomized Experiments, The National Bureau of Economic Research Summer Institute (NBER), Cambridge, Massachusetts 21-22nd July 2016

Belo, Rodrigo, P.A. Ferreira, Miguel Godinho de Matos, Filipa Reis (Jul 2016). The Impact of Time-Shift TV on TV Viewership and on Ad Consumption: Results from Both Natural and Randomized Experiments, 14th ZEW Conference on The Economics of Information and Communication Technologies, Mannheim, 23-24 June 2016

Belo, Rodrigo, P.A. Ferreira, Godinho de Matos, Miguel, Xiaochen Zhang (2015), Recommender Systems and Consumer Welfare: Results from a Randomized Experiment in Video-on-Demand, Workshop on Information Systems and Economics 2015, December 12-13, 2015

Baojiang Yang, Miguel Godinho de Matos and Pedro Ferreira (2015), Quantifying Switching Costs and the Role of Service Contracts in Triple Play Markets, The Workshop on Information Technologies and Systems (WITS), December 12-13, 2015

Reis, Filipa, Miguel Godinho de Matos and Pedro Ferreira (2015). Television and Internet Technologies of Convergence: Evidence from a randomized trial, Conference on Information Systems and Technology (CiST), 30-31 October 2015

Reis, Filipa, Miguel Godinho de Matos and P. A. Ferreira (Oct 2015). Patterns of substitution in consumption for Internet and TV in the era of media streaming, evidence from a

randomized experiment, The Conference on Digital Experimentation (CODE), MIT, 16-17 October 2015

Belo, Rodrigo, P.A. Ferreira, Godinho de Matos, Miguel, Xiaochen Zhang (Oct 2015). Recommender Systems and Consumer Welfare: Results from a Randomized Experiment in Video-on-Demand, The Conference on Digital Experimentation (CODE), MIT, 16-17 October 2015

Godinho de Matos, Miguel, P.A. Ferreira and Rodrigo Belo (July 2015). The ego or the group? The value of friends in consumer retention efforts, evidence from a randomized experiment, The Conference on Digital Experimentation (CODE), MIT, 16-17 October 201

Godinho de Matos, Miguel, P.A. Ferreira and Michael D. Smith (July 2015). The Effect of Television Content on Pirate's Online Activity: Evidence From a Randomized Experiment, Economics of Digitization, The National Bureau of Economic Research Summer Institute (NBER), Cambridge, Massachusetts 16-17th July 2015

Godinho de Matos, Miguel, P.A. Ferreira and Rodrigo Belo (May 2015). Target the ego or target the group? The value of friends in consumer retention efforts, evidence from a randomized experiment, 13th ZEW Conference on The Economics of Information and Communication Technologies

Godinho de Matos, Miguel, Pedro A. Ferreira, Rodrigo Belo (2014). Price Discounts and Peer Effects in Information Goods: A Randomized Experiment, Conference on Information Systems and Technology (CiST), November 8-9 2014

Godinho de Matos, Miguel, Pedro A. Ferreira, Rodrigo Belo (2014). Price Discounts and Peer Effects in Information Goods: Results from a Large Scale Organic in-Vivo Randomized Experiment, The Conference on Digital Experimentation (CODE), MIT, 10 October 2014

Belo, Rodrigo, Miguel Godinho de Matos and P.A. Ferreira (2013). Prime Time Any Time: The Effect of Time-Shifted TV on Media Consumption, 23rd Workshop on Information Technology and Systems, Milan, 15-18 December 2013

Godinho de Matos, Miguel, P.A. Ferreira, Michael D. Smith, Rahul Telang (2013). The Impact of Likes on the Sales of Movies in Video-on-Demand: a Randomized Experiment, 23rd Workshop on Information Technology and Systems, Milan, 15-18 December 2013

Belo, Rodrigo, Miguel Godinho de Matos and P.A. Ferreira (2013). Prime-Time Any Time: The Effect of Time-Shifted TV on Media Consumption, 41st TPRC, George Mason University, Washington DC, 28-29th September 2013

Godinho de Matos, Miguel, P.A. Ferreira, Michael D. Smith and Rahul Telang (2013). The Impact of Likes on Sales of Movies in a VoD System: A Randomized Experiment, Economics of Digitization, The National Bureau of Economic Research Summer Institute (NBER), Cambridge, Massachusetts 18-19th July 2013

Godinho de Matos, Miguel, P.A. Ferreira, Rahul Telang and Michael D. Smith (2013). The Impact of Popularity on Sales of Movies in a VoD System: A Randomized Experiment Economics of Digitization, The National Bureau of Economic Research (NBER), Stanford, California, 8th March

Godinho de Matos, Miguel, P.A. Ferreira and David Krackhardt (2012). Peer Influence in Product Diffusion Over a Very Large Social Network, International Conference on Information Systems (ICIS2012), Orlando, Florida, 16-19 December 2012

Godinho de Matos, Miguel, P.A. Ferreira and David Krackhardt (2012). Peer Influence and Homophily in Product Diffusion Over a Very Large Social Network, International Conference on Social Computing (SocialCom2012), Amsterdam, The Netherlands, 3-5 September 2012

Godinho de Matos, Miguel, P. A. Ferreira (2011). Entry in Telecommunication Markets: Determining the Industry's Market Structure, Carnegie Mellon University, 39th TPRC, George Mason University, Washingto

CONFERENCE PRESENTATIONS PEER REVIEWED

Godinho de Matos, Miguel, P.A. Ferreira and Rodrigo Belo (June 2016). The ego or the group? The value of friends in consumer retention efforts, evidence from a randomized experiment, Statistical Challenges in eCommerce Research Symposium, Naxos, Greece, 23-24 June, 2016

Price Discounts and Peer Effects in Information Goods: Results from A In-vivo Organic Randomized Experiment (June 2016), Statistical Challenges in eCommerce Research Symposium, Naxos, Greece, 24-26 June, 2016

Belo, Rodrigo, P.A. Ferreira and Miguel Godinho de Matos (2014). The Effect of Streaming Time-shifted TV on TV Consumption, Statistical Challenges in eCommerce Research Symposium, Tel-a-viv, Israel, June 11-13, 2014

Godinho de Matos, Miguel, P.A. Ferreira, Rahul Telang and Michael D. Smith (2013). The Impact of Likes on Sales of Movies in a VoD System: A Randomized Experiment, Statistical Challenges in eCommerce Research Symposium, Lisbon, Portugal, June 27-28, 2013.

Godinho de Matos, Miguel, P.A. Ferreira and David Krackhardt (2012). Peer effects on iPhone 3g adoptions, Statistical Challenges in eCommerce Research Symposium, Montreal, Quebec, June 28-29, 2012

SERVICE & OTHER ACTIVITIES

2019 Co-Chair for the Workshop of Information Systems and Economics to take place in Munich in the winter of 2019

2017 Associate Editor for the track of Data Science, Decision Analytics and Visualizations for the 2017 International Conference on Information Systems

2016-Today Ad-hoc Reviewer for Management Science and Information Systems Research, Strategic Management Journal

2014-Today Ad-hoc Reviewer for the Management Information Systems Quarterly Journal

2013 Treasurer and Member of the local organizing committee of the Statistical Challenges in eCommerce Research Symposium that took place at Católica Lisbon School of Business and Economics in Lisbon, Portugal

INDUSTRY POSITIONS

2011-Present **Telecommunications Firms – *External Advisor in Business Analytics***

Europe & Singapore

Have been leading several business analytics projects including the development of models for predicting consumer churn, forecasting video-on-demand sales, the design and implementation of field experiments for the analysis of user ratings and popularity information on movie sales and for determining the price elasticity of demand for movie titles in video-on-demand. Have also developed several algorithms for inferring television audiences from set-top-box clickstream data and for obtaining consumer insights from the analysis of call detail records.

2008-2009 **BANCO FINANTIA – *Senior Analytis of Corporate Finance***

Lisbon

Portugal

Supported clients throughout their entire investment process. My work involved firm valuation, business plan design, due diligence coordination and sectorial research. I worked mainly with clients from Brazil, Spain and Portugal. My industry focus was on telecommunications, but I also worked in energy and in the healthcare sector.

2007-2008 **MCKINSEY&COMPANY - *Business Analyst of the Business and Technology Office***

Lisbon

Portugal

I was a member of the Business Technology Office and served one of the most important banking players in Portugal. Among other engagements, I helped redesign the bank's entire credit workout division.