

Thesis Proposal

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1 Research Question

To what extend does the diversity of recommended products influence the diversity of products sold.

It has been hypothesized that the internet has influenced the expansion of the long-tail of products sold (Anderson, 2006). Main drivers of the internet's influence were conjectured to be a decrease of the consumer's search costs and the retailer's decreased shelf space and inventory costs. Online retailers are able to carry a much larger inventory and can display this larger inventory better to consumers than traditional brick-and-mortar stores. The negligible costs of an extra product-page in the e-retailers online catalogue permits consumers access to a virtual warehouse with endless shelves. A welfare analysis indicated that consumer welfare has increased by \$ 731 million to \$ 1.03 billion in the year 2000 by the added benefit of the increased product variety of online book retailers (Brynjolfsson et al., 2003).

Recommender systems step in the online world as a navigational tool for consumers, that points consumers to interesting products in the inventory of a retailer (Häubl & Trifts, 2000). This can be done on an personalized user-to-item basis, or a general item-to-item basis. In the item-to-item case, a products detail page is linked to several other similar product detail pages. These other product detail pages are similar in the sense that customers who visited the focal product detail page, also visited the recommended product detail pages, or customers who bought the focal products, also bought the recommended product.

In essence these recommendations create a product network, where products similar to each other are explicitly linked to one another (Oestreicher-Singer & Sundararajan, 2012). Oestreicher-Singer & Sundararajan (2012) posit that products more visibly in this network have a better "shelf position", wherefore demand for these products increases. But this effect can have two consequences. On the one hand, hard to reach, niche product might see an uplift in demand, since consumers are better able to find these products due to recommender systems (Oestreicher-Singer & Sundararajan, 2010, 2012). On the other hand, popular products might benefit from a positive feedback loop, originating from recommender systems. Fleder & Hosanagar (2009) postulate that recommender systems can be influenced more by popular products, which increases the position of these popular products in the recommendation, and therefore the popular products are bought more, and thereafter recommended more, and then bought more, and so forth.

These arguments seem to contradict one another, since a recommender system cannot increasingly promote popular and niche products at the same time. Oestreicher-Singer & Sundararajan (2010) set out to investigate this conflict, and assess whether recommender system are biased to

popular products, or to niche products. What they find is that recommender systems that have a larger product network (i.e. more diverse recommendations) are associated with more diverse product sales. Thus, recommenders focused on bestsellers create a 'superstar' market, and recommenders focused on niche products enhance the long-tail.

This contradiction was also noted by Brynjolfsson et al. (2010), but the authors indicated that two recommender systems can also coexist. In other words, there can be a recommender that links best-sellers, and a separate one that links niche products. The authors also highlight, that new research should study the effect of each technology on consumers' shopping behaviours in terms of how they search for information, evaluate alternatives and make purchase decisions. Also, this effect can be in isolation and in tandem, which might increase or decrease a recommenders influence on the concentration pattern of consumers' purchases. Finally, this effect can differ across categories, consumers and over time.

This evaluation of the literature led me to propose the following research question:

To what extent does the diversity of recommended products influence the diversity of products sold?

This seems to be a research topic that is suitable to the data generated by the OTTO recommender system, since it allows me to dive deeper into the search, evaluation and purchase decisions of OTTO customers. Furthermore, I will be able to tweak this algorithm, in the sense that I can present OTTO customers a best-seller or a niche recommender at the product detail page, or both, at multiple categories. Furthermore, the categories that span the assortment of OTTO are not the typical information goods like music, book and film categories touched upon by previous recommender system literature.

2 Research Design

An option to assess the research question is presented in Oestreicher-Singer & Sundararajan (2010), where the authors compute a Gini coefficient for products sold as the dependent variable in a regression model, and use a computed measure essentially similar to Google's PageRank algorithm as the independent variable. The authors posit that the PageRank measure can provide a ranking of the importance of the focal product in the recommendation network of products being linked to one another. Product with a higher PageRank in this context are more likely to receive traffic from the recommendation network. The average PageRank of products in a category then assesses the influence of the recommendation network on the demand of the products in the category. So the authors test whether the distribution of sales in categories that are more influenced by the recommendation network is different from categories less influenced by recommendation, and they find that a doubling of the recommendation network's influence on a category is associated with flatter distribution of product sold.

So to sum up, the dependent variable will be a measure that assesses the diversity of goods sold in a category. The main independent variable of interest will be a measure that assesses the influence of the recommendation network on products within a category. Furthermore, I am able to experiment with the distribution of recommendations, and their focus on either niche or superstar products. I can present these different types of recommendations jointly or separately to customers. I can change the recommendations on a day by day basis, and compute measures of each daily recommendation batch and the daily distribution of sales within each category.

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