The Value of a Day: Optimizing Delivery Time

PROBLEM STATEMENT

When should this chair arrive by?

Relevance: Shipping speed is a crucial source of competitive advantage.

Problem Definition: February – March
Data Acquisition & Feature Engineering: April - May
Instrumental Variable Regression: June - July
Optimization Framework: July – August

DATASET

Product
Customer
Data Lake
Web
Shipping
Logistics

Data Scope
Limited data to large parcels in the US over 2018-2019
Conversion data captured at checkout page
Data from more than one million customers

i n s t r u m e n t a l  v a r i a b l e  r e g r e s s i o n

PROBLEM
Conversion Rate
Delivery Speed
Controls

Unobservable

SOLUTION
Conversion Rate
Delivery Speed
Controls

Instrument

RESULTS

Product type / customer segments see significantly different effects of delivery promise on conversion rate (see right)
Faster delivery speed significantly increases conversion by 0.1% baseline per day
Lengthening delivery promise by one day increases truck utilization by 0.23%

MODEL

We determine the optimal delivery promise for all customer segment / product pairs using integer programming

Maximize Profit

By selecting first delivery promise bucket & then specific delivery promise

Example Decision: 4 day delivery promise

SIMULATION

We simulated instances of online shopping to account for customer variability and determine a range of expected increase in conversion rate (see right)
The minimum lift Wayfair can expect to see is 10%, which aligns with the optimization output, and the maximum lift is 16%
The distribution of checkout conversion rate increase is approximately normal, with the expected lift in conversion rate being 13%

CONCLUSIONS & NEXT STEPS

By using our framework, Wayfair will realize an increase in checkout conversion rate of approximately 13%, which translates to an overall conversion rate lift of 0.5%
Wayfair will be able to quickly make data-driven decisions about shipping speed using the methodologies we have developed this summer
The framework we have developed (IV regression & optimization) can be expanded upon in a few ways: more in-depth transportation costs incorporated, adding long-term loyalty benefits, etc.