

Can Technology Enabled Supply Chain Interventions Reduce Market Imperfections? A Case of Mom and Pop Shops in Pakistan

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June 1, 2024

Presentation at SANEM-World Bank North American Discussion Forum
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Preview

- ▶ **Effects of technology-enabled supply chain intervention on market imperfections?**
- ▶ **Main findings:**
 - ▶ Positive significant impact on reducing price dispersions.
 - ▶ Negative significant impact on meeting demand needs of the retailers.
 - ▶ Mechanisms:
 - ◉ Frequency of placing orders shifts transaction costs to the supplier.
 - ◉ Road infrastructure → efficient utilization of the intervention.
 - ▶ Increase in HH subsistence consumption and profits → richer neighborhoods with dense network of roads

Outline

- ▶ Motivation and research question
- ▶ Methodology
- ▶ Results
- ▶ Policy and conclusion

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Motivation and Research Question

Methodology

Results

Conclusion

Background



Motivation

- ▶ Nanostores fall at the very end of the retail value chain
- ▶ 95 percent of the stores in Pakistan are nanostores, contributing to 70 percent of all grocery purchases.
- ▶ In emerging markets, nano stores face **distinct challenges**.
 - ▶ Infrequent and inaccurate demand estimates
 - ▶ Credit and cash-constrained
 - ▶ Subject to frequent price changes
 - ▶ Access to limited suppliers- high transaction costs

Contribution to literature

- ▶ Characteristics that lead to supply chain imperfections.
 - ▶ Sources of imperfections (Lee et al., 1997)
 - ▶ Asymmetric information in the supply chain of retail stores (Fransoo et al., 2021; Escamilla et al., 2021).
 - ▶ Theoretical studies on supplier-retailer collaboration (Boulaksil & van Wijk, 2018)
- ▶ Gap: **Role of technology in solving the supply chain inefficiencies.**
 - ▶ **Unorganized retail** sector in a **developing economy**
 - ▶ **Negative effects** - offset direct positive effects.
 - ▶ Role of **infrastructure** in the utilization of technology.
 - ▶ First Micro-level data collected on nano retailers in Pakistan.

→ **Contribution of this paper**

This study in particular:

- ▶ Estimates impact of an app-based marketplace connecting suppliers to mom-and-pop retailers in Pakistan on reducing fragmented **supply chain inefficiencies**.
 1. Demand and Price Dispersions
 2. Transaction Costs

- ▶ Estimate the impact of the intervention on **welfare of the store-owners**.
 1. Average monthly profits
 2. HH subsistence consumption

App-based marketplace that connects micro retailers directly to their suppliers.



Figure: App allows retailers and suppliers to register through an account. Retailers fulfill their demand by searching for relevant suppliers, and products and comparing prices.

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This study collects the first ever primary data set of nanostores in Pakistan.

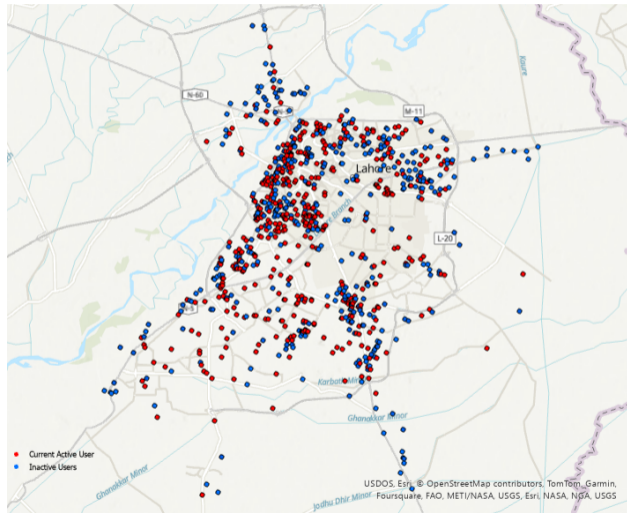
▶ Primary Data Source

1. Field survey data of N= 850 observations, collected in the district of Lahore, Punjab.
2. Latitude and Longitude of all the suppliers in the district of Lahore.

▶ Other Characteristics

1. Multi-dimensional poverty index for each sub-area in Lahore, calculated by Intelligent Machines Labs at Information Technology University Lahore.
2. Road density for each sub-area, defined as high road density and low road density.

Retailers are uniformly distributed as active and inactive users of the app.



Methodology: 2SLS

$$P(\text{user type}_i = 1 \mid Z_i, X_i, A_i, T_i) = \Phi(\alpha + \gamma Z_i + \psi X_i + \theta A_i + \phi T_i + \varepsilon_i) \quad (1)$$

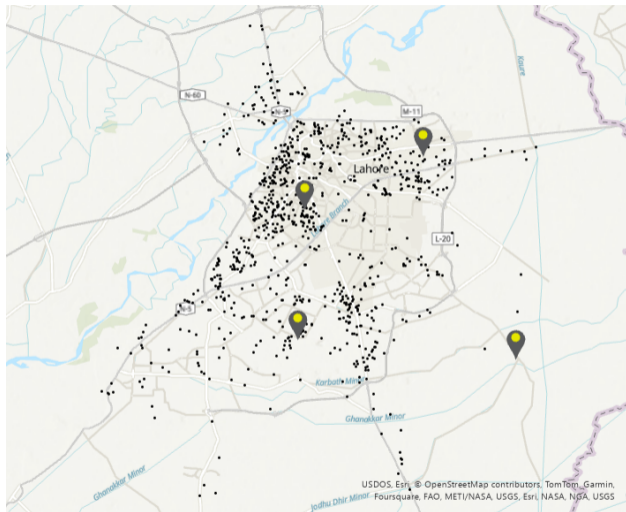
$$Y_i = \beta_0 + \beta_1 \text{user type}_i + \beta_2 X_i + \beta_3 A_i + \beta_4 T_i + \eta_N + e_i \quad (2)$$

- ▶ usertype_i is a binary variable defining user type. (Active users Vs inactive users)
- ▶ Z_i is the IV defined as the **geodesic distance of retailers to their nearest supplier**.
- ▶ X_i are individual and household level controls.
 - ▶ age, income, HH members, marital status, education, no of dependents
- ▶ A_i are store-level controls
 - ▶ operational years, size, no of stores, partners, daily foot traffic, price range of products, foot traffic.
- ▶ T_i are the controls for the current level of technology used (before the adoption of app).
- ▶ η_N are neighborhood fixed effects.

Distance meets exogeneity criteria because:

- ▶ Stores are part of, or attached to, **personal houses, instead of a function of access to potential suppliers.**
 - ▶ More than 100,000 nano stores whereas the total no of suppliers is less than 200.
 - ▶ Stores care more about where their customers are, these suppliers especially the bigger ones are located slightly off the city center.

Biggest suppliers located in the district's outskirts.



What about the market concentration of suppliers dependent on regional characteristics?

- ▶ Control for road density.
- ▶ Control for MPI for different zones as defined by my analysis.
- ▶ Interacted with store-level controls such as the size of the store, the average price range of products sold, and the daily foot traffic of the store.

Assumption

- ▶ The IV estimates in this paper capture the '**local average treatment effect**' of app users or the average effect for the sub-population of nano store owners for whom the distance to their existing suppliers is relevant in determining their usage frequency of the technological intervention

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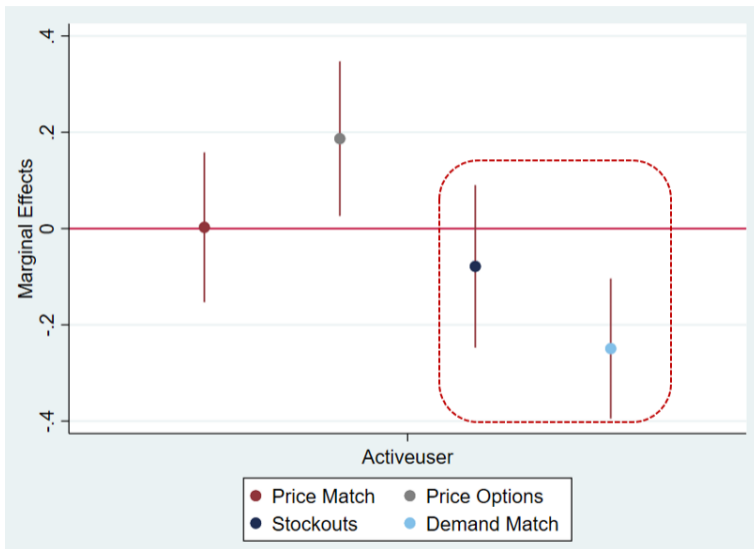
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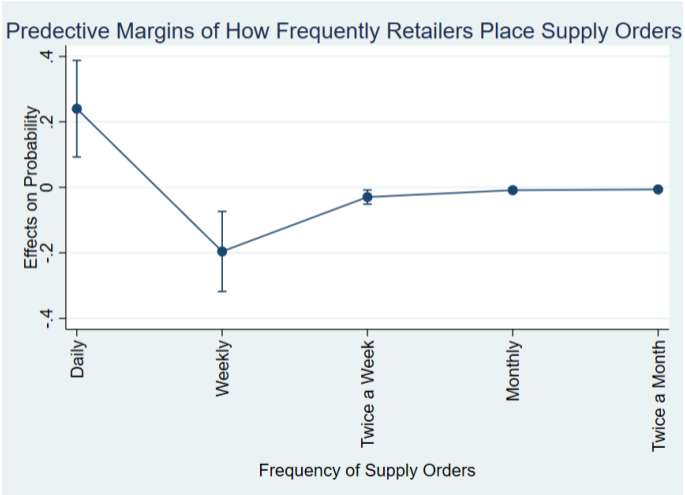
Price competitiveness and price information see a significant positive impact.



But demand problems persist in the retailer-supplier relation



Frequency of placing orders explains the inability of suppliers to meet demand orders.



Shifts transaction costs from retailers to the suppliers.

VARIABLES	(1) On Time Deliveries (Marginal Effects)	(2) Cancel Deliveries (Marginal Effects)	(3) Accurate Supply Orders (Marginal Effects)
active_user	-0.303*** (0.0845)	0.0179 (0.0366)	-0.0565 (0.03657)
Observations	745	745	745
Individual control	Yes	Yes	Yes
HH controls	Yes	Yes	Yes
Current Technology Controls	Yes	Yes	Yes

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

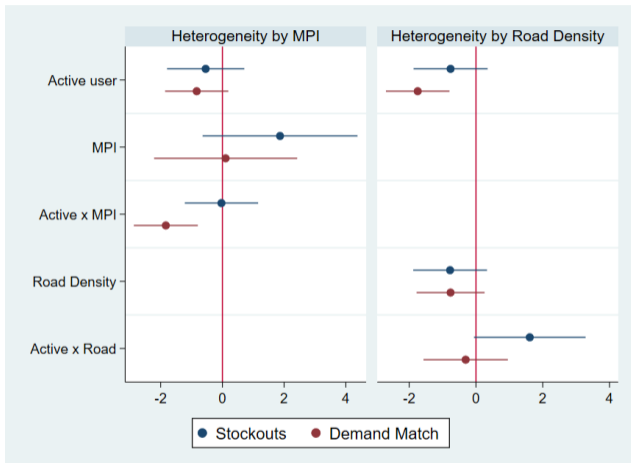
NOTE: All predictors at their mean value

Gains through profits are not directly impacted.

VARIABLES	(1) Avg Monthly Profits	(2) HH Subsistence Consumption	MEs
active_user	30,707 (22,606)	Don't Agree	-0.028 (0.018)
		Somewhat Agree	-0.176* (0.108)
		Moderately Agree	0.173* (0.107)
		Highly Agree	0.031* (0.019)
Constant	95,910 (66,425)		
Observations	745	745	
Individual control	Yes	Yes	
HH controls	Yes	Yes	
Current Technology Controls	Yes	Yes	
Neighborhood FEs	Yes	Yes	

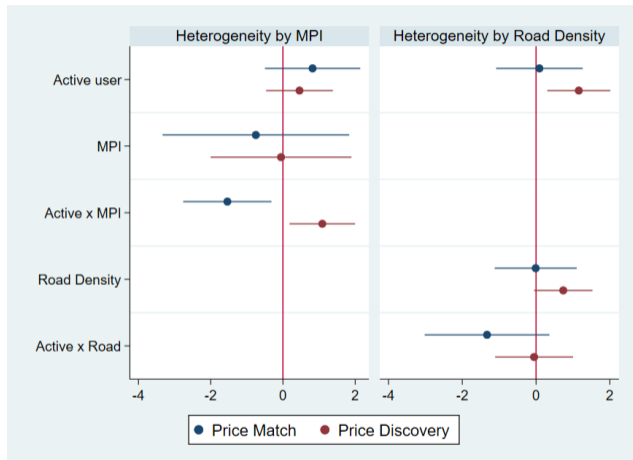
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Treatment Effects on Demand: By Poverty (MPI) and Road Density



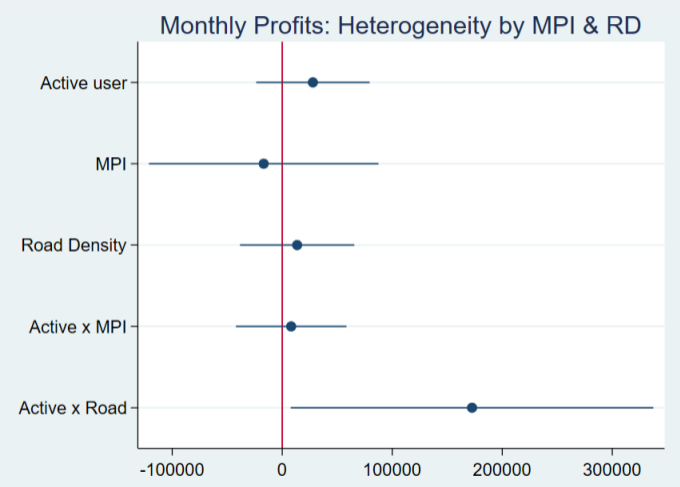
- ▶ Synergistic linkages between technological adoption and road infrastructure.
- ▶ As poverty scores of the neighborhood increase, the demand matching ability for the suppliers of active users of the app decreases.

Treatment Effects on Prices: By Poverty (MPI) and Road Density



- ▶ Limited bargaining power of retailers in poor neighborhoods.
- ▶ Ability to observe comparable prices remains positive and significant.

Treatment Effects on Profits: By Poverty and Road Density



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- ▶ Price competitiveness and price information seem to be more important.
- ▶ Shift in transaction costs from retailers to the suppliers - negative spillovers on suppliers through ease of placing multiple smaller orders.
- ▶ Increase in profits is sensitive to poverty levels and road density controls.