USING FINANCIAL TRANSACTION DATA TO MEASURE ECONOMIC RESILIENCE TO NATURAL DISASTERS

PARTNERS: BBVA DATA & ANALYTICS

PROGRAMME AREA: HUMANITARIAN ACTION

SUMMARY

This project explored how financial transaction data can be analysed to better understand the economic resilience of people affected by natural disasters. The project used the Mexican state of Baja California Sur as a case study to assess the impact of Hurricane Odile on livelihoods and economic activities over a period of six months in 2014. The project measured daily Point of Sale transactions and ATM withdrawals at high geospatial resolution to gain insight into the way people prepare for and recover from disaster. The study revealed that people spent 50% more than usual on items such as food and gasoline in preparation for the hurricane and that recovery time ranged from 2 to 40 days depending on characteristics such as gender or income. Findings suggest that insights from transaction data could be used to target emergency response and to estimate economic loss at local level in the wake of a disaster.

BACKGROUND

Resilience is the capacity of individuals, communities and systems to adapt and survive in the face of stress and disruption. It ensures that external pressures do not have long-lasting adverse consequences for development. With an abundance of new sources of real-time data, quantitative frameworks for measuring resilience could be enhanced by the ongoing data revolution. This project used data analytics to derive quantitative proxy indicators of the economic impact and market resilience of populations affected by natural disaster.

The first major, and most destructive, hurricane to hit the Mexican state of Baja California Sur (BCS) in 25 years, tropical cyclone Odile made landfall near Cabo San Lucas in September 2014. This project used transactional data from Point of Sale (POS) card payments and ATM cash withdrawals to understand how people in BCS behaved prior to, during and in the wake of hurricane Odile. Analysis of the transactional data provided an opportunity to understand behavioural patterns displayed when people are subject to external shocks such as natural disasters.

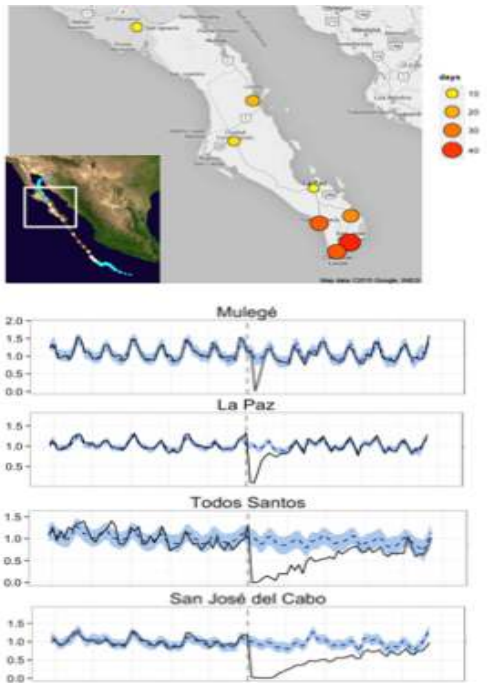
MAPPING DISASTER RESPONSE WITH TRANSACTIONS

The project analysed POS payment and ATM cash withdrawal data produced by more than 100,000 clients (out of an estimated population of 637,000), which totalled a number of 25,000 transactions per day.

Data was aggregated into three categories with a similar number of transactions distributed throughout BCS according to income: low (bottom 50% of population), medium (next 30%) and high (top 20%). The income level was calculated taking into account the median Mexican income. In addition, each of the subsets was disaggregated by gender. The total number of card transactions was divided into ATM and POS transactions and POS expenditures were further split into categories such as food, gasoline or entertainment (bars and restaurants).

The study created a 'normality model' to estimate what the economic activity in BCS would be under normal conditions. The model was created based on the activity of other Mexican regions not impacted by the hurricane. This 'normality model' was compared to the number of recorded transactions to measure both the 'recovery time' and the 'relative impact' on affected populations. A disaster-affected community's 'economic recovery time' is defined as the time needed to return to baseline activity levels in terms of number of transactions. The recovery time was also compared with maximum hurricane wind speed, the intensity of which was associated with slower return to baseline activities.

The methodology used aggregated transactions, which did not contain personal identifiers so that re-identification of users does not occur.

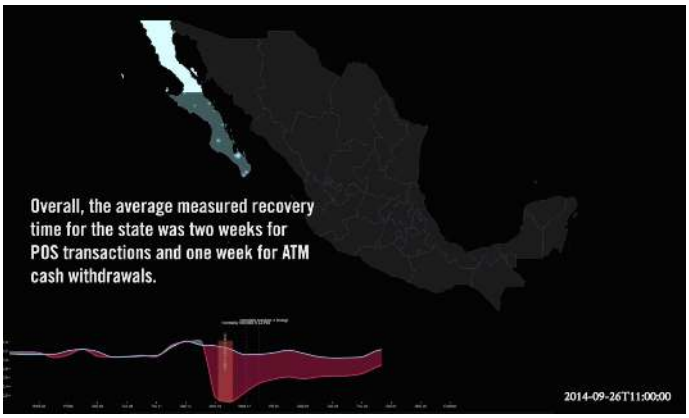


The figure above shows the recovery time in different locations. The black lines are the measured time series while the dashed lines correspond to the normality model.

INSIGHTS & OUTCOMES

This study revealed that financial transaction data mapped at high frequency and high resolution can be useful to gain real-time insights on the economic resilience of crisis-affected populations.

- The analysis showed the level of investment in disaster preparedness at household level for categories such as food or gasoline increased by 50%. In addition, the higher the income level, the more people spent in preparation of the hurricane compared to their normal expenses.
- In the aftermath of the hurricane, economic activity decreased, the average measured recovery time for the region being two weeks for POS transactions and one week for ATM cash withdrawals. However, when data was analysed with higher spatial resolution, by location, recovery times varied from two days to more than one month depending on the severity of Odile's impact in each town or village.
- Analysis of transaction by cardholder income revealed that the lower the income, the shorter the time it took to return to baseline activity levels, especially for ATM withdrawals (2-3days) compared to medium and high income populations (>10 days).
- Women increased expenditures in preparation of the hurricane twice as much as men. However, recovery times for women were measured as consistently longer than for men.
- In BCS, during the first 30 days after the hurricane, 30% fewer POS transactions and 12% less cash withdrawals were registered compared to the number of transactions expected in normal conditions.



This figure shows the transactions recovery time for card payments and cash withdrawals

The quantitative information obtained on disaster preparedness measures undertaken by a population suggests a potential role for proactive, targeted distribution of supplies or cash transfers to the most vulnerable, at-risk populations. Insights from transaction data could also be incorporated into current mechanisms for estimating the economic losses caused by disasters.

Further investigation is required to deploy the potential of continuous transactions monitoring to (1) manage inventory in stores as people prepare and avoid depletion of essential items; (2) to assess the effectiveness of recovery efforts; (3) to improve targeting of reconstruction aid after a disaster; (4) to proactively target social protection measures – insurance for the poor; and (5) to develop models that could be used to simulate the economic impact of imminent or potential disasters.

IMPLICATIONS & RECOMMENDATIONS

- This study allowed the measurement of very different impacts and recovery scenarios across close geographies, suggesting the potential of using such information to inform highly targeted responses to the most affected communities and to estimate economic loss at the local level in the wake of a natural disaster.
- Access to a stream of objective, real-time information on economic recovery could be used to design feedback loops into reconstruction programmes and policies.
- Further research is needed to understand the similarities and differences of different disasters through the lens of transaction data. Potential next steps could also involve developing the tools and approaches needed to transition from case studies to operational use on-site during disasters, and exploring the potential of such tools and insights to inform humanitarian aid or relief efforts.

REFERENCES

Brodersen K. et al (2015) Inferring causal impact using Bayesian structural time-series models. The Annals of Applied Statistics, 9(1), 247-274.

Food Security Information Network Resilience Measurement Technical Working Group. (2014, January). Resilience measurement principles: Toward an agenda for measurement design.

Cangialosi, J.P., and Kimberlain, T.B. (2015, March 4). National Hurricane Center tropical cyclone report: Hurricane Odile (EP152014).

Sobolevsky, et al (2015, June). Scaling of city attractiveness for foreign visitors through big data of human economical and social media activity. 2015 IEEE International Congress on Big Data, 600-607

HOW TO CITE THIS DOCUMENT:

UN Global Pulse, 'Using Financial Transaction Data To Measure Economic Resilience To Natural Disasters', Project Series, no. 24, 2016.