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Collecting Robust Real-Time High Frequency Price Data in Fragile Settings

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To embark on a sustainable pathway toward development, effective policy responses must be implemented quickly and based on evidence. This requires reliable, timely data, which is often unavailable especially in fragile settings. An innovative High Frequency Survey (HFS) infrastructure offers a modern data collection system to fill critical data gaps. It can provide quantitative data to inform programs and policies, often linked to resilience in fragile settings. Using the cases of Somalia and South Sudan, this note describes the design and setup of such a HFS infrastructure and illustrates how high frequency price data can effectively support decision-making even in the event of an economic or humanitarian crisis.

Designing effective interventions requires reliable and timely data especially in shocks prone, fragile countries like Somalia and South Sudan. Fragile and conflict-affected countries are particularly vulnerable to shocks disrupting and reversing development outcomes. For example, Somalia has suffered from several humanitarian crises linked to conflict and drought. In South Sudan, civil war broke out two years after independence in a challenging macro-economic environment. In such settings, timely humanitarian and development interventions are key to avoid humanitarian crises and support the self-reliance of the most vulnerable populations. High frequency price data are essential to monitor markets and detect economic shocks to allow evidence-based programming in such contexts.¹

The High Frequency Survey (HFS) allowed for a prompt diffusion of the data to online users, minimized costs and facilitated adjustments on

the fly. A crucial challenge was developing an automated system that can make cleaned and processed data available instantaneously to online users. Therefore, the HFS included a near real-time dashboard that tracked market prices and currency exchange rates across several locations. Setting up the survey implied a moderate fixed up-front cost for the development of the software and purchase of the hardware. Once the survey infrastructure was in place, frequent collection of data was low-cost and required minimum supervision. In addition, the flexibility of the system permitted introducing changes without disruptions. The questionnaire was easily adjusted as needed to include new products and locations.

Infrastructure of the High Frequency Survey

Computer assisted personal interviewing (CAPI) allowed real-time processing of data. The Survey

¹ World Bank. "Challenges and Opportunities of High Frequency Data Collection in Fragile States: Lessons from South Sudan". World Bank, 2014.

Solutions software was used to collect data. Computer Assisted Personal Interview (CAPI) makes collected data instantaneously available in the cloud –a necessary feature for a real-time monitoring system. Data quality was improved by preventing enumerators from skipping questions and introducing dynamic checks and constraints. For example, dynamic validation algorithms were used to flag suspiciously high or low data entries requiring confirmation from the enumerators before proceeding. Downloading and processing of the data was automated with a scheduled API script to download the latest data from the cloud server, and then execute a pipeline of Stata code to anonymize, clean and process the data. Finally, the script updated the data repository access by the Tableau server to visualize the data online. Once the system was in place, enumerators collected data regularly with the information becoming automatically available online within minutes of data collection.

The data analysis system of the HFS automatically downloaded the data from the cloud server to an analysis server and prepared the data before submitting to the online dashboard. The data downloaded from the project’s Survey Solutions cloud server was processed using Stata to remove outliers, calculate aggregate statistics and prepare the data for visualization in Tableau (Figure 1). The processing began with anonymization and checks for security threats like malicious code injections. Outliers were identified with a moving average standard deviation that does not affect data older than three weeks.² This allowed outlier detection to remain accurate despite high volatility in prices. Outliers were replaced by imputations based on a linear interpolation of the unit price for the item.

² A given unit price is considered an outlier if it is higher or lower than the moving average by more than 50 percent.

In addition, the architecture of the HFS allowed submission of corrections for wrongly entered data without disrupting the automated process.

Data entry errors from enumerators are usually corrected when data is cleaned. However, manual corrections are not possible in an automated system like the HFS. Therefore, a correction questionnaire and submission system were designed as part of the automated infrastructure to facilitate overwriting wrong data entries. Corrections were submitted by analysts to the cloud using tablets with the same data collection software. The processing system automatically read and applied the corrections each time it produced an update for the dashboard.

Flexibility of the HFS infrastructure

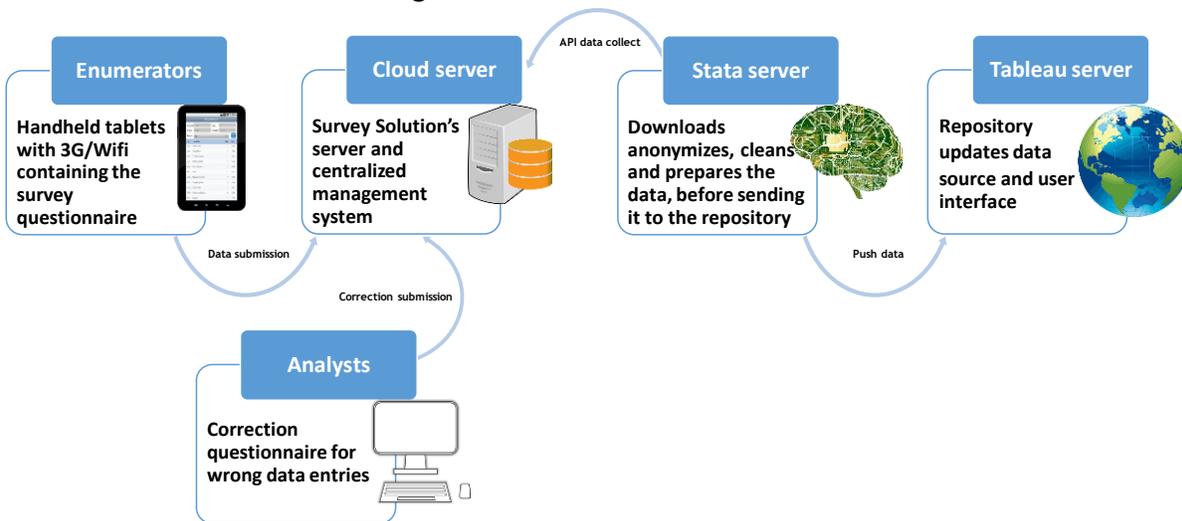
In Somalia, the Market Price Survey (MPS) and Currency Exchange Rate Survey (CERS) were easily adjusted to increase the coverage of products and markets. The HFS infrastructure provides flexibility which facilitates adapting to changing circumstance. Using the results from the first wave of the Somali HFS, the list of products in the MPS were modified while coverage was extended to additional markets. Similarly, the ERS questionnaire was modified to capture exchange rates from three different money traders in each market: open street hawkers, diverse service providers and registered banks or forex traders. Using the ability to push questionnaire revisions remotely to enumerators, these changes did not disrupt the data collection process.

In South Sudan, the questionnaire was modified to track exchange rates offered by commercial banks within 48 hours after the government abandoned the peg of the exchange rate. Between

2015 and 2017 the value of the South Sudanese pound (SSP) declined rapidly. The government responded by moving from a pegged exchange rate

to a managed float on the 15th of December 2015. The questionnaire was modified on-the-fly to track the new commercial exchange rates within 48 hours.

Figure 1. Infrastructure of the HFS

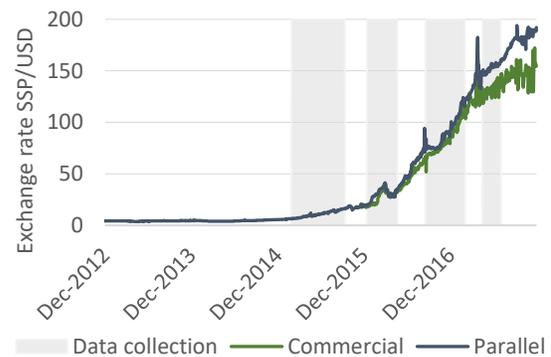


Guiding policy with evidence

The online dashboard provided useful insights into the dynamics of the severe drought that affected the Somali population in 2017. In Somalia, the dashboard identified trends in specific products and locations during the drought of 2017, supporting food assistance programs in deciding whether to import aid products or source them locally, as unnecessary imports could have depressed prices and disrupted livelihoods of local producers.³ Meat prices steadily declined in markets of Mogadishu from an average of around US\$ 4.65 in March 2016, to just over US\$3.00 in May 2017, providing evidence of the poor conditions of livestock and the desperate situation of many households selling their livestock as a coping mechanism to the drought. Aid imports of substitutes could have further depressed prices, rendering this coping mechanism less effective.

³ Available at: www.thesomalipulse.com.

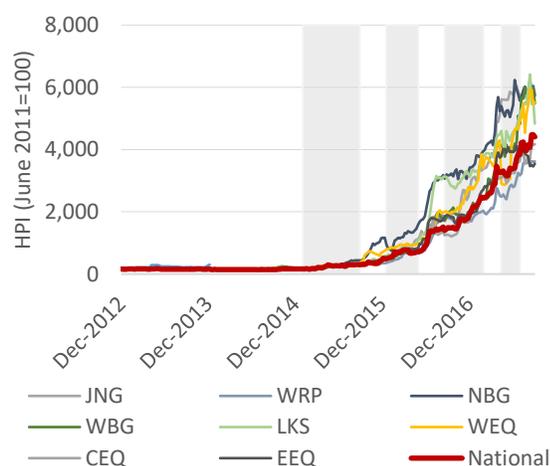
Figure 2. Exchange rate SSP/USD (national average)



In South Sudan, the dashboard reported a long period of accelerating devaluation and CPI inflation, providing valuable real-time information to the government and the international community. Only six months after the government abandoned the peg, prices doubled with the official exchange rate skyrocketing from 2.95 to 38 SSP/USD (Figure 2). The gap between the official and parallel market exchange rates indicated the

scarcity of foreign currency at the official rate.⁴ CPI inflation spiraled further pushed by an insufficient domestic production capacity and conflict related disruptions, peaking at an annual inflation of 549 percent in September 2016. Rising prices, as seen in Figure 3, forced households to rely on their own food production, even though its level remained insufficient to prevent growing food insecurity, while especially urban households fell deeper into poverty. The real-time dashboard provided this critical information in a timely and high-quality manner to inform programs.⁵

Figure 3. High Frequency Price Index for South Sudan



Conclusion

Overcoming data collection challenges in fragile contexts is a stepping-stone for achieving greater development impacts. To embark on a sustainable pathway toward development effective policy, responses must be implemented quickly and based on evidence. High frequency price data can be one

important piece in the puzzle helping to monitor markets, detect and track economic shocks. In turn, this information allows to design and implement interventions, based on reliable and timely data.

The HFS provided information in a timely and ready-to-use manner, which supported evidence-based interventions in Somalia and South Sudan.

The HFS infrastructure included a near real-time dashboard that tracked market prices and currency exchange rates across several locations. The fieldwork strategy involved several innovations to ensure real-time updates of high-quality data. In addition, the flexibility of the infrastructure allowed for adjustments on the fly. Although it was limited to real-time information on exchange rates and market prices, the innovations are applicable in a much wider context of electronic data collection. Furthermore, the innovations can be robustly implemented in most challenging field environments including fragility and low-capacity, given that they were already successfully implemented in Somalia and South Sudan. In Somalia, the dashboard provided useful insights into the dynamics of the drought that affected the country in 2017. In South Sudan, the dashboard reported a long period of accelerating devaluation, providing real-time information on the dynamic of exchange rates and prices.

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⁴ World Bank. "South Sudan Economic Update, 2017: Taming the Tides of High Inflation". World Bank, 2017.

⁵ Available at: www.thepulseofsouthsudan.com.