

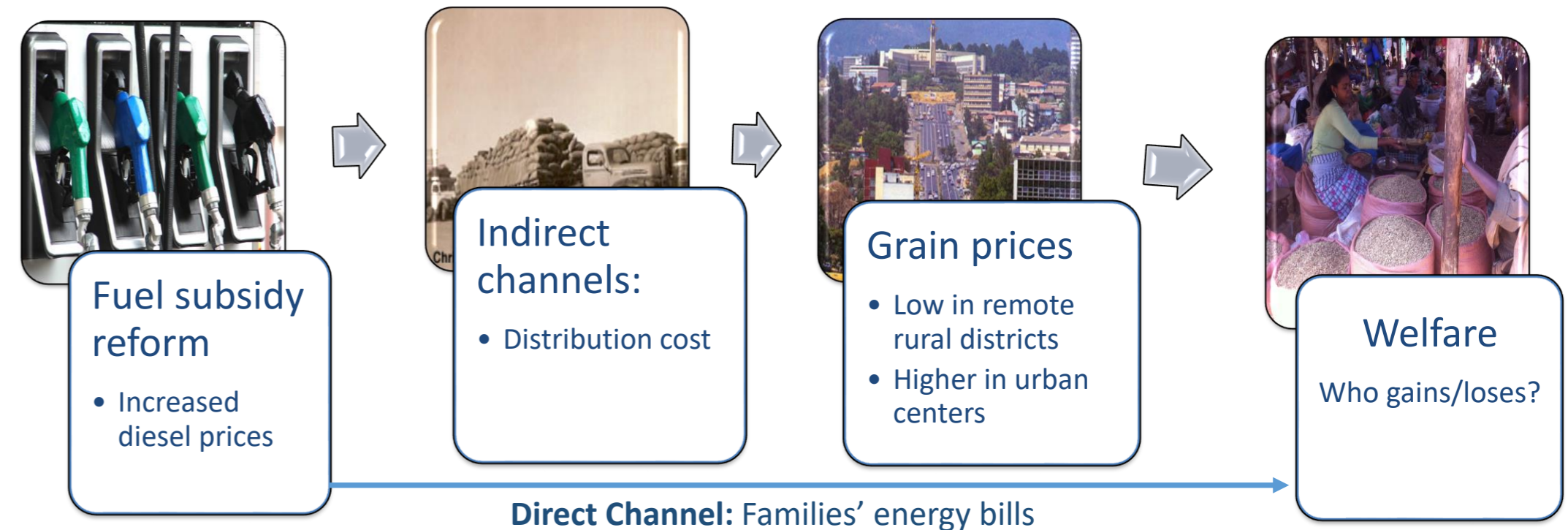
Fossil Fuel Subsidy Reforms, Spatial Market Integration, and Welfare

Evidence from a Natural Experiment in Ethiopia

By Habtamu Fuje

- The G20 leaders declared that they are “committed to rationalize and phase out inefficient fuel subsidies” to discourage wasteful energy consumption (Washington Post, 09/25/2009).
- Many countries in sub-Saharan Africa have undertaken fuel subsidy reforms. Ethiopia also removed its fuel subsidy in October 2008.
- What are the implications of removing fuel subsidies on welfare? What are the transmission channels?
 - Direct impact (through increased energy bills)
 - Indirect channels—increases in food prices due to high production cost, transportation cost or substitution between oil and biofuel.
 - *This study focuses on the transportation cost channel.*

Transmission Channels: Fuels Subsidy Reforms to Welfare



Transport Cost and Grain Price Dispersion:

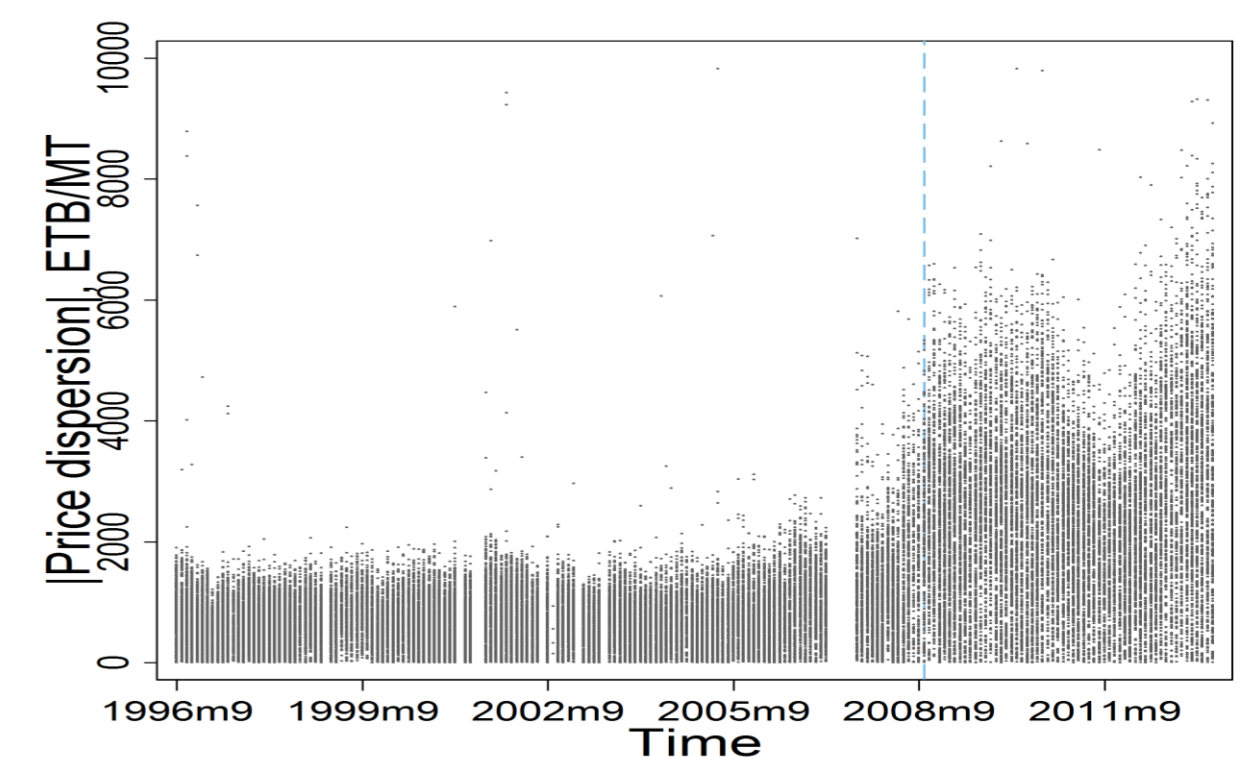
The Law of One Price:

$$|P_{jt} - P_{it}| = F_{ijt} + C_{ijt}$$

Data

- Monthly price of 5 major grains from 300 rural markets (1996-2013).
- Household survey (HICES), 21,000 households.

Price Dispersion (Between Addis Ababa & rural markets)



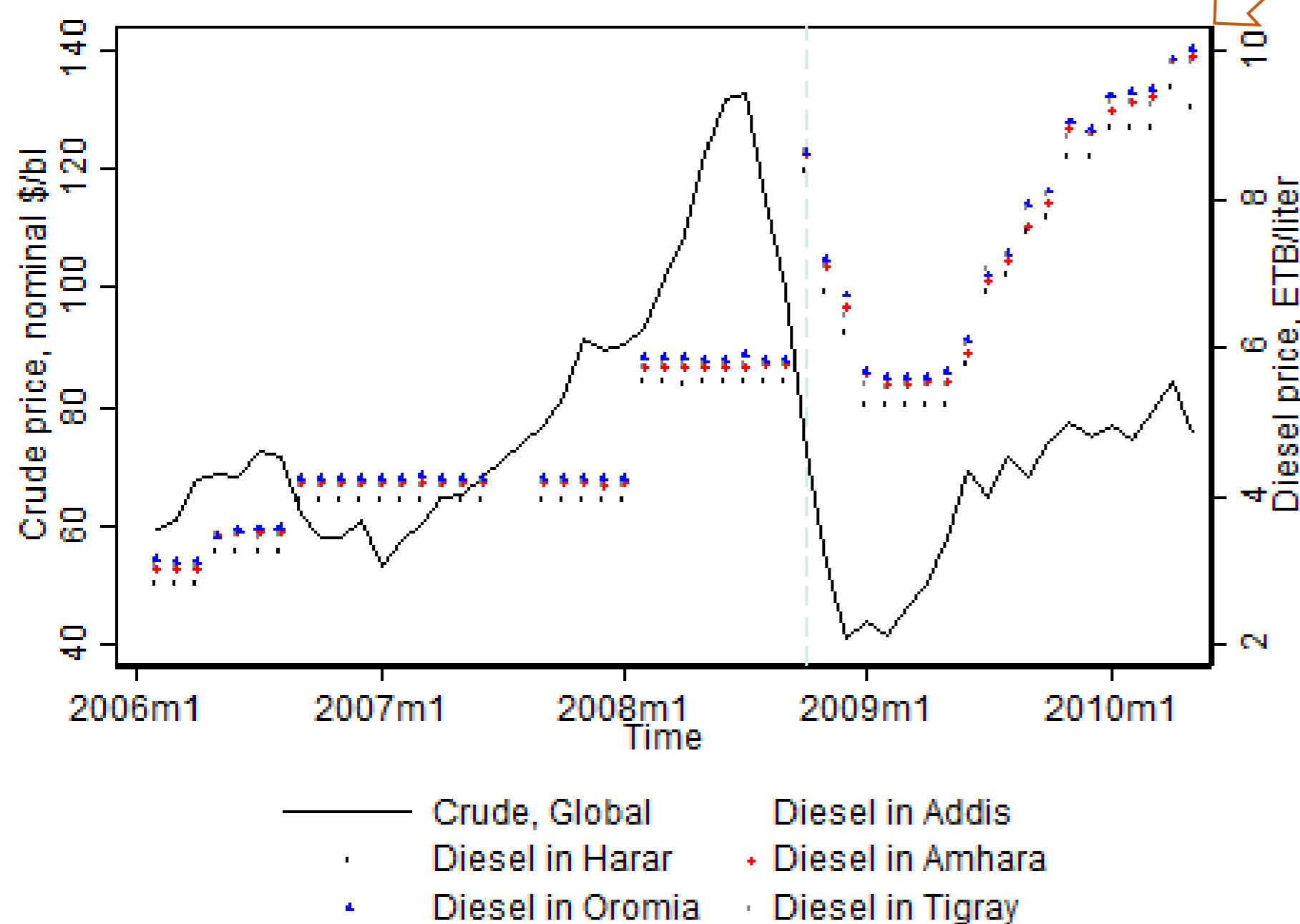
Empirical Approach: Time Regression Discontinuity (RD) Designed and spatial Difference-in-Difference (sDID).

Time RD:

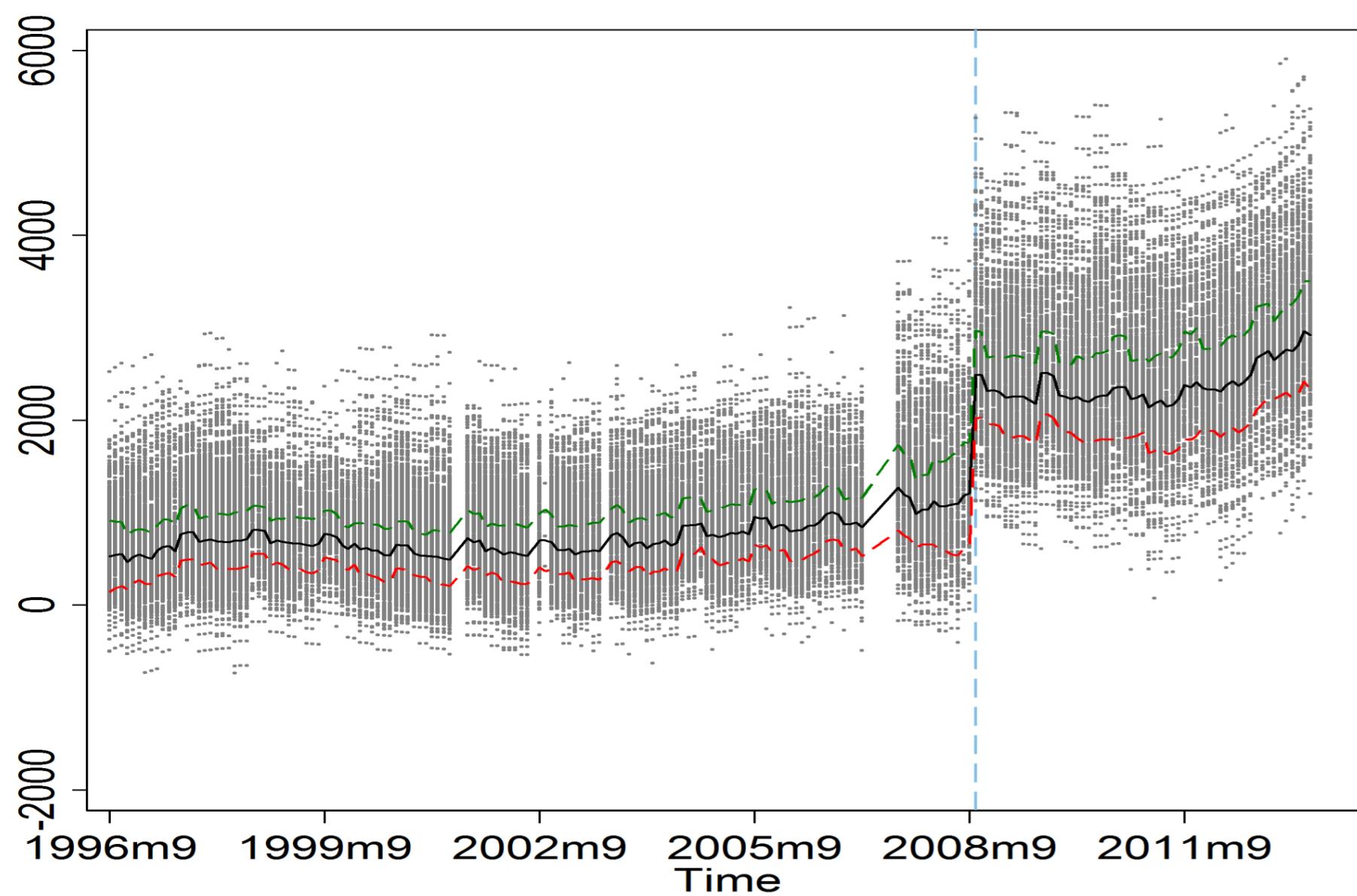
$$Y_{it} = \alpha_0 + \alpha_1 Treatment_t + X'\beta + f(time) + \epsilon_{it}$$

The dependent variable is the absolute price dispersion between Addis and rural markets, *Treatment* is a dummy indicating post-reform period, X is a vector control variables and *f(time)* is Chebyshev polynomial of time.

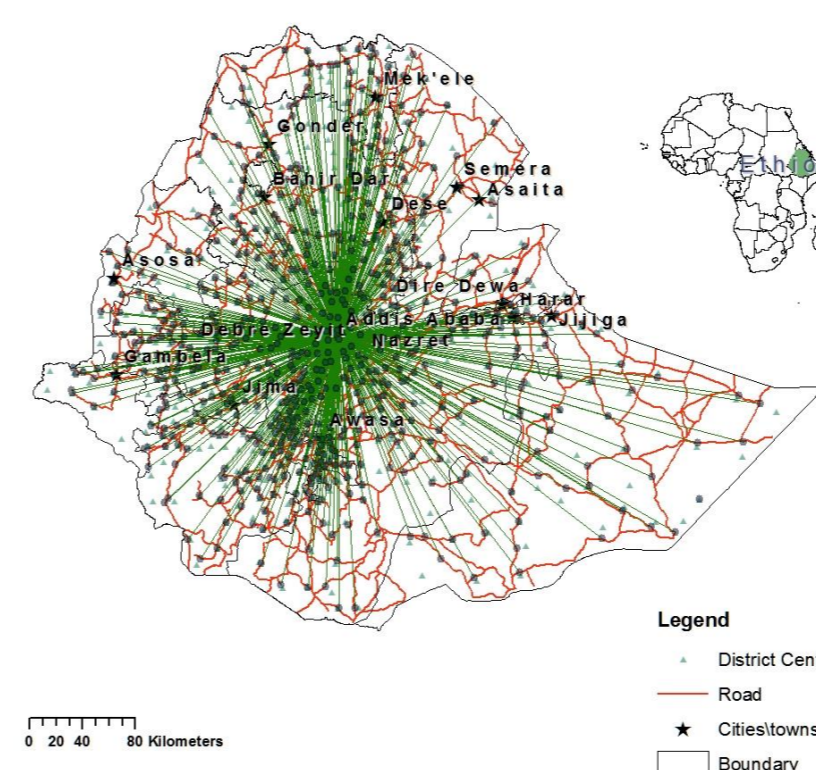
Global Crude Oil Price and Local Diesel Price in Ethiopia



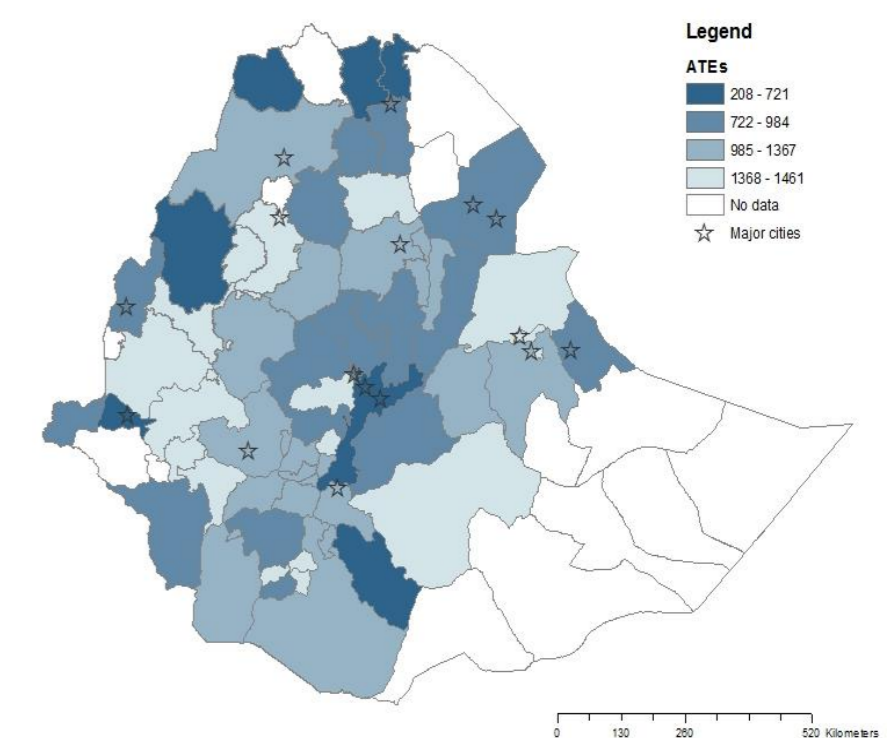
Impact of Fuel Subsidy Reform on Price Dispersion, RD Result



Distance from Addis Ababa



Heterogeneity in the Impact of Fuel Subsidy Reform, by Distance



- GIS network analysis is used to impute distance (on existing road network) from each market to Addis.
- The markets are divided into 100 km distance intervals, which are then interacted with *Treatment* variable to estimate heterogeneity in impacts of the reform.

How does this price gap translate into welfare?

We use the classic compensating variation (CV) technique to study the instantaneous/first order welfare effects of the price change (Deaton, 1989 1997):

$$CV_i = [(1 - \mathbb{I}[Y_i < \bar{Y}])t_{ij} \frac{q_{ij}^d P_{ij}}{Y_i} - \frac{q_{ij}^s P_{ij}}{Y_i}] \frac{\Delta P_{ij}}{P_{ij}}$$

Note: The government has used some of the money saved by removing fuel subsidy to provide targeted food subsidy in urban areas. We need to take this into account. Only poor households (i.e. $[Y_i < \bar{Y}]$) were eligible for the food subsidy.

- The CV represents the amount of transfer needed to maintain the households at their pre-reform welfare level.
- The change in price ($\frac{\Delta P_{ij}}{P_{ij}}$) is based on estimates using time RD with price level as dependent variable (with additional interaction term with distance intervals).
- The income ($\frac{q_{ij}^s P_{ij}}{Y_i}$) and expenditure ($\frac{q_{ij}^d P_{ij}}{Y_i}$) shares are from the households survey.
- t_{ij} is the amount of food subsidy given to eligible households.

Changes in Incomes of Rural and Urban Households due to the Reform

Household Type	Variables	Consumption Quartile				
		1	2	3	4	National
Rural	Income loss (ETB)	-249 (7.2)	-386 (10.1)	-433 (11.1)	-460 (14.6)	-380 (5.5)
	% HHs who lost income	73 (0.9)	78 (0.8)	79 (0.8)	73 (0.9)	76 (0.4)
Urban	Income loss (ETB)	28 (4.2)	15 (8.2)	16 (7.7)	-2 (5.9)	11 (3.3)
	% HHs who lost income	26 (0.8)	26 (1.0)	26 (1.0)	29 (0.6)	27 (0.4)