# Online Appendix

## "The High and Falling Price of Cement in Africa"
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## A   Derivations of the Entry Model

**Equilibrium Pricing.**   Omitting the arguments in parenthesis, the first-order conditions associated with equation (1) are:

$$P_i + \frac{\partial P_i}{\partial Q_i}\frac{\partial Q_i}{\partial q_{ji}}q_{ji} = MC_{ji}. \tag{A.1}$$

$MC_{ji} \equiv \partial C_j/\partial q_{ji}$ denote the marginal cost of firm $j$ in market $i$. Define $\lambda_i \equiv \partial Q_i/\partial q_{ji}$ as firm $j$'s beliefs about the post entry game. Define market share $s_{ji} \equiv q_{ji}/Q_i$ and the elasticity of demand $\eta_i \equiv -\left(\partial P_i/\partial Q_i \times Q_i/P_i\right)^{-1}$. Substituting these identities into equation (A.1) yields:

$$P_i + \frac{\lambda_i}{\eta_i}P_i s_{ji} = MC_{ji}. \tag{A.2}$$

Let $MC_{ji} = MC_i + \nu_{ji}$. In words, firm $j$'s marginal cost in market $i$ depends on a common component across firms $MC_i$ and a private shock $\nu_{ji}$. Let $\mathbf{E}[\nu_{ji}] = \delta > 0$. Taking the average of equation (A.2) across all firms in a market delivers:

$$P_i + \frac{\lambda_i}{\eta_i}\frac{P_i}{N_i} = \overline{MC}_i, \tag{A.3}$$

where $\overline{MC}_i \equiv MC_i + \delta$. Using $N_i = 1/H_i$, equation (A.3) can be rearranged to deliver the left-hand side of equation (2).

**Entry Choices.**   Marginal cost shocks $\nu_{ji}$ are only known to firms upon entry. Firms use expected marginal costs $\overline{MC}_i$ to compute first-stage expected profits, which implies firm symmetry at this stage. A firm decides to enter if it will at least break even given all other firms' entry decisions. The right-hand side of equation (2) can be written as:

$$\frac{Q_i}{N_i}\left(M_i(N_i) - 1\right)\overline{MC}_i \geq F_i > \frac{Q_i}{N_i + 1}\left(M_i(N_i + 1) - 1\right)\overline{MC}_i. \tag{A.4}$$

The first term denotes expected revenues with the observed number of firms. The last denotes (counterfactual) expected revenues with an additional entrant. A firm's expected revenues are decreasing in the number of competitors because of lower quantity sold and

lower markup. Fixed costs are such that $N_i$ firms make non-negative profits but $N_i + 1$ would not.

# B GMM Moment Conditions

The GMM estimator chooses $\theta = (\alpha, \beta, \lambda, \gamma, \sigma)$ to minimize the objective function

$$g(\theta) = \sum_{i,t} \begin{pmatrix} Z_{it}\xi_{it}(\alpha) \\ W_{it}\omega_{it}(\alpha, \beta, \lambda) \\ \partial \ln(L_{it}(\alpha, \beta, \lambda, \gamma, \sigma))/\partial \gamma \\ \partial \ln(L_{it}(\alpha, \beta, \lambda, \gamma, \sigma))/\partial \sigma \end{pmatrix},$$

where the vector $Z_{it}$ contains all variables in the demand Equation (3), but replacing $\ln(P_{it})$ with $EXPORTNEAREST_{it})$ to identify the demand elasticity. In the Cournot model, $W_{it}$ contains all variables in the marginal cost function in Equation (4). In the Conduct model, $W_{it}$ also includes columns $URBCON_{it}$, $MMC_{it}$, and $\ln(POP_{it})^n$ where $n \in \{1,2\}$. We employ a continuously-updating GMM estimator, which has better small sample properties than the canonical two-step procedure (Hansen et al., 1996). Each equation of the model is estimated separately and these parameters are used as starting values when minimizing the objective function.

# C   Additional Tables

**Table C.1: Regressions of Price and Number of Firms.** All regressions include a year fixed effect. "'# Firms (HHI)" refers to the HHI-adjusted number of incumbent firms. "Scale" controls are population, GDP per capita and land area. "Governance" controls are $z$-scored measures of rule of law, political stability and control of corruption from the World Bank's World Governance Indicators. Road density is sourced from the World Bank's Global Roads Inventory Project. Diesel price is sourced from the World Bank's International Comparison Program. All variables in logs except governance controls. * indicates $p < .05$, ** indicates $p < .01$, and *** indicates $p < .001$. Reported at the foot of the table are median and mean price change in African countries as predicted by each regression.

| VARIABLES | (1) Price | (2) Price | (3) Price | (4) Price | (5) Price | (6) Price |
|---|---|---|---|---|---|---|
| # Firms | −0.266*** | | −0.215*** | | −0.175*** | |
| | (0.052) | | (0.050) | | (0.048) | |
| # Firms (HHI) | | −0.301*** | | −0.291*** | | −0.218*** |
| | | (0.059) | | (0.059) | | (0.057) |
| | | | | | | |
| Observations | 150 | 168 | 150 | 168 | 150 | 168 |
| R-squared | 0.317 | 0.305 | 0.392 | 0.372 | 0.474 | 0.458 |
| Scale | Yes | Yes | Yes | Yes | Yes | Yes |
| Governance | No | No | Yes | Yes | Yes | Yes |
| Road Density | No | No | Yes | Yes | Yes | Yes |
| Diesel Price | No | No | No | No | Yes | Yes |
| | | | | | | |
| Median AFR Change | -10.3% | -17.3% | -12.9% | -17.7% | -19% | -19.1% |
| Mean AFR Change | -16.5% | -17.9% | -14.9% | -16.2% | -17.4% | -18.1% |

**Table C.2: OLS Alternative Specifications of Demand for Cement.** This table replicates Table 7, except using OLS instead of 2SLS. Robust standard errors in parenthesis. * for $p < .05$, ** for $p < .01$, and *** for $p < .001$

| VARIABLES | (1) Quantity | (2) Quantity | (3) Quantity | (4) Quantity | (5) Quantity | (6) Quantity | (7) Quantity | (8) Quantity |
|---|---|---|---|---|---|---|---|---|
| Price of cement (USD) | -2.410*** | -1.060*** | -0.781*** | -1.044*** | -1.079*** | -1.022*** | -0.827*** | -1.061*** |
| | (0.248) | (0.102) | (0.111) | (0.104) | (0.100) | (0.135) | (0.120) | (0.102) |
| Price × (Year=2017) | | | | | | -0.109 | | |
| | | | | | | (0.202) | | |
| Exchange rate (USD/LCU) | | 0.016 | 0.009 | 0.004 | 0.013 | 0.016 | 0.012 | 0.015 |
| | | (0.017) | (0.017) | (0.017) | (0.017) | (0.017) | (0.016) | (0.017) |
| Population | | 0.895*** | 0.917*** | 0.862*** | 0.892*** | 0.894*** | 0.899*** | 0.900*** |
| | | (0.030) | (0.030) | (0.028) | (0.031) | (0.031) | (0.032) | (0.031) |
| GDP per capita (USD) | | 0.369*** | 0.369*** | 0.330*** | 0.367*** | 0.369*** | 0.356*** | 0.385*** |
| | | (0.035) | (0.033) | (0.045) | (0.036) | (0.036) | (0.034) | (0.036) |
| Construction share of GDP | | 0.395*** | 0.413*** | 0.314*** | 0.397*** | 0.391*** | 0.356*** | 0.386*** |
| | | (0.093) | (0.098) | (0.084) | (0.093) | (0.093) | (0.094) | (0.095) |
| Price of diesel (USD) | | | -0.292*** | | | | -0.336*** | |
| | | | (0.070) | | | | (0.081) | |
| Price of aggregate (USD) | | | -0.128 | | | | | |
| | | | (0.084) | | | | | |
| Population growth (YoY, %) | | | | | | | | 0.036 |
| | | | | | | | | (0.025) |
| Neighbor's cement exports (level) | -0.020 | 0.015 | 0.022* | 0.015 | | 0.017 | 0.026** | 0.014 |
| | (0.038) | (0.012) | (0.012) | (0.012) | | (0.017) | (0.012) | (0.012) |
| Neighbor's exports × (Year=2017) | | | | | | -0.005 | | |
| | | | | | | (0.023) | | |
| Neighbor's GDP per capita | | | | 0.050 | | | | |
| | | | | (0.036) | | | | |
| Others' exports (distance-weighted) | | | | | 0.907 | | | |
| | | | | | (2.049) | | | |
| % terrain carbonate (e.g. limestone, dolomite) | | | | | | | 0.291 | |
| | | | | | | | (0.277) | |
| Road density (km per km$^2$, Z-scored) | | | | | | | 0.041 | |
| | | | | | | | (0.045) | |
| Year (=2017) | -0.412 | -0.083 | -0.081 | -0.087 | -0.084 | 0.463 | -0.070 | -0.069 |
| | (0.256) | (0.081) | (0.077) | (0.080) | (0.082) | (1.009) | (0.079) | (0.084) |
| Constant | 27.189*** | 3.436*** | 2.055** | 3.555*** | 3.556*** | 3.244*** | 2.128** | 3.120*** |
| | (1.334) | (0.898) | (0.874) | (0.896) | (0.893) | (0.988) | (0.923) | (0.927) |
| | | | | | | | | |
| Observations | 168 | 168 | 160 | 157 | 168 | 168 | 168 | 166 |
| R-squared | 0.310 | 0.931 | 0.941 | 0.928 | 0.930 | 0.931 | 0.937 | 0.931 |
| Elasticity | 2.41 | 1.06 | .781 | 1.044 | 1.079 | | .827 | 1.061 |
| Elasticity, 2011 | | | | | | 1.022 | | |
| Elasticity, 2017 | | | | | | 1.131 | | |

**Table C.3: Cement Prices and PPP GDP per Capita.** We regress the USD price of cement on market attributes, including GDP per capita adjusted for purchasing power parity. Robust standard errors in parenthesis. * for $p < .05$, ** for $p < .01$, and *** for $p < .001$. All variables are in natural logs except the constant, the nearest neighbor's cement exports, $z$-scored number of procedures to start a business, $z$-scored concentration of urban centers, and $z$-scored multi-market contact.

| VARIABLES | (1) Price | (2) Price | (3) Price | (4) Price | (5) Price | (6) Price | (7) Price |
|---|---|---|---|---|---|---|---|
| GDP per capita (PPP) | -0.139*** | -0.058** | -0.206*** | -0.069** | -0.071** | -0.067** | -0.064** |
| | (0.029) | (0.028) | (0.038) | (0.028) | (0.028) | (0.028) | (0.030) |
| Neighbor's cement exports (level) | | -0.045*** | | -0.044*** | -0.044*** | -0.044*** | -0.041*** |
| | | (0.008) | | (0.007) | (0.007) | (0.007) | (0.007) |
| Price of diesel (USD) | | 0.402*** | | 0.387*** | 0.392*** | 0.407*** | 0.397*** |
| | | (0.051) | | (0.052) | (0.053) | (0.055) | (0.054) |
| Road density (km per km$^2$) | | -0.047* | | -0.043* | -0.044* | -0.040 | -0.025 |
| | | (0.026) | | (0.024) | (0.024) | (0.025) | (0.024) |
| Cement tariff (simple average) | | | -1.011* | | | | |
| | | | (0.583) | | | | |
| Population | | | | -0.069*** | -0.070*** | -0.073*** | -0.132*** |
| | | | | (0.015) | (0.016) | (0.016) | (0.026) |
| Construction share of GDP | | | | | 0.057 | 0.063 | 0.063 |
| | | | | | (0.056) | (0.057) | (0.056) |
| Procedures to start business (Z-score) | | | | | | 0.028 | 0.038 |
| | | | | | | (0.029) | (0.028) |
| Concentration of urban centers (Z-score) | | | | | | | -0.116** |
| | | | | | | | (0.046) |
| Multimarket contact (Z-score) | | | | | | | 0.023 |
| | | | | | | | (0.026) |
| Constant | 6.260*** | 5.544*** | 6.952*** | 6.775*** | 6.944*** | 6.973*** | 7.937*** |
| | (0.258) | (0.266) | (0.374) | (0.406) | (0.467) | (0.475) | (0.567) |
| | | | | | | | |
| Observations | 163 | 163 | 134 | 163 | 163 | 163 | 163 |
| R-squared | 0.139 | 0.389 | 0.218 | 0.453 | 0.457 | 0.460 | 0.486 |