# IV regression

Think of this as essentially a prediction problem. We essentially are trying to predict the price in these markets without the FRA – i.e. based on only market fundamentals like local production and time since harvest, and anything that affects local demand. Then we want to understand if the deviations from that non-FRA price prediction are being driven by FRA interventions

1. First Stage

fra\_buy ~ district\_share + deviation\_prod + monthly\_share + district\_share\* monthly\_share\*deviation\_prod

fra\_sales ~ monthly share + predict FRA stock + distance\_weight + expected monthly share \* the predicted FRA stocks from last year \* distance-weights

1. List of IVs (need something that affects the FRA sales but not the quantity produced)

FRA purchase:

* 1. Monthly share \* deviation from average production in year t \* average share purchased in each district

（Monthly share = split 2/9 in July, 3/9 in Aug, 3/9 and Sept and 1/9 in Oct etc.）

FRA sales:

1. distance-weighted predicted monthly sales to millers: expected monthly share \* the predicted FRA stocks for that year \* distance-weights
2. expected monthly share \* expected total harvest from the CFS for that year \* distance-weights
3. Total national stock:
   * 1. stock end from last year
     2. stock end + cfs prediction
4. Second Stage

Price/DEV ~ instrumented FRA sales + weather + safex/malawi price + stock end

Price/DEV ~ instrumented FRA purchase + weather + safex/malawi price + stock end

Price/DEV ~ instrumented FRA sales + instrumented FRA purchase + weather + safex/malawi price + stock end + actual harvest

Three panel results: Two stage/ First stage / OLS

Columns (whole sample/ limit to 3 month)

1. Full sample, two endogenous variables

Table 1 : IV REGRESSIONS OF Price and Deviation squared

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | OLS | | 2 IV (2nd stage) | | 3IV (2nd stage) | |
|  | Price | Deviation\_Squared | Price | Deviation\_Squared | Price | Deviation\_Squared |
| logpurchase | -2.866\* | -3033.2\*\*\* | 31.28 | -4818.7 | 18.48 | -19632.5\*\* |
|  | (-2.04) | (-5.42) | (-1.28) | (-0.55) | (-1.13) | (-2.67) |
| weighted\_fra\_sales | -0.00625\* | 0.473 | 0.00282 | -1.704 | -0.000973 | -6.096 |
|  | (-2.42) | (-0.46) | (-0.26) | (-0.45) | (-0.11) | (-1.54) |
| maxdays | 2.413\*\*\* | 1033.5\*\*\* | 5.538\* | 867.4 | 4.366\*\* | -488.9 |
|  | (-4.67) | (-5.01) | (-2.4) | -1.06 | (-2.76) | (-0.69) |
| raincytot | 0.165\*\*\* | 52.75\*\*\* | 0.277\*\*\* | 46.75 | 0.235\*\*\* | -1.583 |
|  | (-7.06) | (-5.64) | (-3.3) | -1.57 | (-4.03) | (-0.06) |
| tmean | -44.63\*\* | 12213.2 | -52.94\*\* | 12646.4 | -49.82\*\* | 16250.7\* |
|  | (-2.68) | (-1.83) | (-2.72) | -1.82 | (-2.80) | (-2.03) |
| mchinji | 0.288\*\*\* | 75.47\*\*\* | 0.295\*\*\* | 74.33\*\*\* | 0.293\*\*\* | 71.08\*\*\* |
|  | (-23.16) | (-15.18) | (-19.38) | -13.71 | (-21.22) | (-11.44) |
| safex | -0.112\*\*\* | 19.34\* | -0.0738\* | 17.09 | -0.0884\*\* | 0.272 |
|  | (-5.14) | (-2.22) | (-2.00) | -1.3 | (-3.02) | (-0.02) |
| stock\_end | -1.002\*\*\* | -414.5\*\*\* | -0.691\* | -419.2\*\*\* | -0.805\*\* | -550.8\*\*\* |
|  | (-4.51) | (-4.67) | (-2.09) | (-3.56) | (-2.93) | (-4.45) |
| heatday | -1.333 | 15.84 | -3.103 | 112.4 | -2.439 | 881.5 |
|  | (-1.27) | (-0.04) | (-1.80) | -0.18 | (-1.77) | （-1.42） |
| year | -8.816 | 6180.4\* | -55.33 | 8371.4 | -37.95 | 28484.2\*\* |
|  | (-1.22) | (-2.15) | (-1.62) | -0.69 | (-1.63) | （-2.72） |
| N | 2304 | 2304 | 2304 | 2304 | 2304 | 2304 |

3 IV identification

Under identification test (Anderson canon. corr. LM statistic): 17.850

Chi-sq(2) P-val = 0.0001

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Weak identification test (Cragg-Donald Wald F statistic): 5.856

Stock-Yogo weak ID test critical values: 10% maximal IV size 13.43

15% maximal IV size 8.18

20% maximal IV size 6.40

25% maximal IV size 5.45

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Sargan statistic (overidentification test of all instruments): 4.240

Chi-sq(1) P-val = 0.0395

2 IV identification

Under identification test (Anderson canon. corr. LM statistic): 9.134

Chi-sq(1) P-val = 0.0025

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Weak identification test (Cragg-Donald Wald F statistic): 4.480

Stock-Yogo weak ID test critical values: 10% maximal IV size 7.03

15% maximal IV size 4.58

20% maximal IV size 3.95

25% maximal IV size 3.63

Source: Stock-Yogo (2005). Reproduced by permission.

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Sargan statistic (overidentification test of all instruments): 0.000

(equation exactly identified)

Table 2: First Stage for FRA buy and sale against weighted buy sale prediction

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | logpurchase | weighted\_fra\_sales | logpurchase | weighted\_fra\_sales |
| weighed\_buy\_dev | 0.0000238\* | 0.000102 | 0.0000309\*\* | -0.000513 |
|  | -2.31 | -0.02 | -3.06 | (-0.10) |
| weighted\_sale\_dev | -0.000000810\*\* | 0.00265\*\*\* | -0.000000806\*\* | 0.00265\*\*\* |
|  | (-2.98) | -19.26 | (-2.96) | -19.26 |
| weighted\_buy\_dev2 | -0.00000696\*\* | 0.000609 |  |  |
|  | (-3.07) | -0.53 |  |  |
| maxdays | -0.0849\*\*\* | -5.012 | -0.0875\*\*\* | -4.782 |
|  | (-11.19) | (-1.31) | (-11.59) | (-1.25) |
| raincytot | -0.00297\*\*\* | -0.129 | -0.00314\*\*\* | -0.114 |
|  | (-8.52) | (-0.73) | (-9.09) | (-0.65) |
| tmean | 0.406 | -57.25 | 0.266 | -45.02 |
|  | -1.6 | (-0.45) | -1.07 | (-0.36) |
| mchinji | -0.000132 | -0.459\*\*\* | -0.0000895 | -0.463\*\*\* |
|  | (-0.71) | (-4.88) | (-0.48) | (-4.93) |
| safex | -0.00108\*\*\* | -0.0641 | -0.00114\*\*\* | -0.0583 |
|  | (-3.30) | (-0.39) | (-3.50) | (-0.35) |
| stock\_end | -0.00993\*\* | 7.182\*\*\* | -0.0112\*\*\* | 7.290\*\*\* |
|  | (-2.98) | -4.26 | (-3.37) | -4.36 |
| heatday | 0.0550\*\*\* | 0.894 | 0.0533\*\*\* | 1.039 |
|  | (-3.5) | (-0.11) | -3.39 | -0.13 |
| year | 1.395\*\*\* | -173.8\*\*\* | 1.419\*\*\* | -175.9\*\*\* |
|  | (-13.44) | (-3.31) | -13.69 | (-3.36) |
| R2 | 0.8089 | 0.3056 | 0.8082 | 0.3058 |

Summary results for first-stage regressions

(Under identification) (Weak identification)

Variable | F( 3, 2250) P-val | SW Chi-sq( 2) P-val | SW F( 2, 2250)

logpurchase | 9.19 0.0000 | 18.02 0.0001 | 8.80

weighted\_fra | 123.67 0.0000 | 44.05 0.0000 | 21.51

Under identification test

Ho: matrix of reduced form coefficients has rank=K1-1 (underidentified)

Ha: matrix has rank=K1 (identified)

Anderson canon. corr. LM statistic Chi-sq(2)=17.85 P-val=0.0001

Weak identification test

Ho: equation is weakly identified

Cragg-Donald Wald F statistic 5.86

1. Full sample, one endogenous variable

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | OLS | | 2 IV | | 3IV | |
|  | Price | Deviation\_Squared | Price | Deviation\_Squared | Price | Deviation\_Squared |
| logpurchase | -2.875\* | -3032.4\*\*\* | 26.77 | -2094.9 | 19.54 | -13033.2\* |
|  | (-2.05) | (-5.42) | -1.57 | (-0.34) | -1.47 | (-2.43) |
| weighted\_fra\_sales |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| maxdays | 2.422\*\*\* | 1032.8\*\*\* | 5.123\*\* | 1118.2 | 4.463\*\*\* | 121.9 |
|  | -4.69 | -5.01 | -3.12 | -1.87 | -3.38 | -0.23 |
| raincytot | 0.166\*\*\* | 52.70\*\*\* | 0.262\*\*\* | 55.73\* | 0.238\*\*\* | 20.37 |
|  | -7.07 | -5.64 | -4.34 | -2.53 | -4.84 | -1.02 |
| tmean | -44.62\*\* | 12212.6 | -51.84\*\* | 11984.3 | -50.08\*\* | 14648.2\* |
|  | (-2.67) | -1.83 | (-2.80) | -1.77 | (-2.83) | -2.05 |
| mchinji | 0.291\*\*\* | 75.26\*\*\* | 0.294\*\*\* | 75.34\*\*\* | 0.293\*\*\* | 74.41\*\*\* |
|  | -23.47 | -15.21 | -21.75 | -15.3 | -22.56 | -14.18 |
| safex | -0.112\*\*\* | 19.27\* | -0.0791\*\* | 20.3 | -0.0871\*\* | 8.318 |
|  | (-5.10) | -2.21 | (-2.63) | -1.85 | (-3.22) | -0.76 |
| stock\_end | -1.044\*\*\* | -411.3\*\*\* | -0.721\* | -401.1\*\*\* | -0.800\*\* | -520.2\*\*\* |
|  | (-4.71) | (-4.65) | (-2.38) | (-3.63) | (-2.93) | (-4.73) |
| heatday | -1.347 | 16.92 | -2.865\* | -31.1 | -2.495 | 529.1 |
|  | (-1.28) | -0.04 | (-2.00) | (-0.06) | (-1.93) | -1.02 |
| year | -7.918 | 6112.5\* | -49.41\* | 4800.2 | -39.29\* | 20110.5\* |
|  | (-1.10) | -2.13 | (-1.98) | -0.53 | (-1.97) | -2.49 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | OLS | | 2 IV | | 3IV | |
|  | Price | Deviation\_Squared | Price | Deviation\_Squared | Price | Deviation\_Squared |
| logpurchase |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| weighted\_fra\_sales | -0.00627\* | 0.457 | -0.00673 | -0.233 | -0.00677 | 0.0634 |
|  | (-2.43) | -0.44 | (-0.99) | (-0.09) | (-1.00) | -0.02 |
| maxdays | 2.674\*\*\* | 1309.8\*\*\* | 2.673\*\*\* | 1308.7\*\*\* | 2.673\*\*\* | 1309.2\*\*\* |
|  | -5.34 | -6.52 | -5.4 | -6.58 | -5.4 | -6.59 |
| raincytot | 0.174\*\*\* | 62.55\*\*\* | 0.174\*\*\* | 62.48\*\*\* | 0.174\*\*\* | 62.51\*\*\* |
|  | -7.59 | -6.78 | -7.67 | -6.84 | -7.67 | -6.85 |
| tmean | -45.32\*\* | 11474.5 | -45.32\*\* | 11474 | -45.33\*\* | 11474.2 |
|  | (-2.72) | -1.71 | (-2.75) | -1.73 | (-2.75) | -1.73 |
| mchinji | 0.289\*\*\* | 75.72\*\*\* | 0.288\*\*\* | 75.41\*\*\* | 0.288\*\*\* | 75.55\*\*\* |
|  | -23.17 | -15.14 | -22.81 | -14.85 | -22.81 | -14.88 |
| safex | -0.109\*\*\* | 22.66\*\* | -0.109\*\*\* | 22.56\*\* | -0.109\*\*\* | 22.60\*\* |
|  | (-5.01) | -2.59 | (-5.07) | -2.6 | (-5.07) | -2.61 |
| stock\_end | -0.970\*\*\* | -381.3\*\*\* | -0.967\*\*\* | -376.7\*\*\* | -0.967\*\*\* | -378.7\*\*\* |
|  | (-4.37) | (-4.28) | (-4.33) | (-4.20) | (-4.33) | (-4.22) |
| heatday | -1.479 | -139.5 | -1.478 | -137.9 | -1.478 | -138.6 |
|  | (-1.41) | (-0.33) | (-1.42) | (-0.33) | (-1.42) | (-0.33) |
| year | -12.83 | 1932.7 | -12.89 | 1835.1 | -12.9 | 1877 |
|  | (-1.85) | -0.69 | (-1.87) | -0.66 | (-1.87) | -0.68 |
| N |  |  |  |  |  |  |