

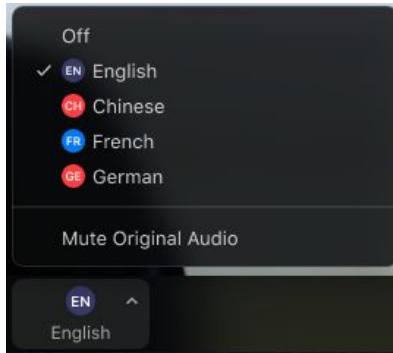
# Webinar Series in Applied Quantitative Analysis - Updated

| Date        | Topic                                                                       |   |
|-------------|-----------------------------------------------------------------------------|---|
|             | <u>Session One</u>                                                          |   |
| February 29 | Potential Outcomes and Omitted Variable Bias I (Theory)                     | ✓ |
| March 7     | Potential Outcomes and Omitted Variable Bias II (Application)               |   |
|             | <u>Session Two</u>                                                          |   |
| March 21    | Difference-in-differences I (Theory)                                        | ✓ |
| March 28    | Difference-in-differences II (Application)                                  |   |
|             | <u>Session Three</u>                                                        |   |
| April 25    | Power analysis, clustering and sample size calculations I (Theory)          | ✓ |
| May 2       | Power analysis, clustering and sample size calculations II (Application)    |   |
|             | <u>Session Four</u>                                                         |   |
| May 23      | Propensity score matching (Theory)                                          | ✓ |
| May 30      | Propensity score matching (Application)                                     |   |
|             | <u>Session Five</u>                                                         |   |
| June 20     | Fixed-effects I (Theory)                                                    | ✓ |
| June 27     | Fixed-effects II (Application)                                              |   |
|             | <u>Session Six</u>                                                          |   |
| July 25     | Instrumental variables I (Theory)                                           | ✓ |
| August 1    | Instrumental Variables II (Application)                                     |   |
|             | <u>Session Seven</u>                                                        |   |
| August 22   | Lagged dependent variables and the Arellano-Bond Estimator I (Theory)       |   |
| August 29   | Lagged dependent variables and the Arellano-Bond Estimator II (Application) |   |

# Écoute de l'interprétation d'une langue

## Windows | macOS

1. Dans les contrôles de votre réunion/webinaire, cliquez sur Interprétation .
2. Cliquez sur la langue que vous souhaitez entendre. (Nous aurons le français) Pas besoin de choisir l'anglais, c'est la langue de la salle Zoom principale



3. (Facultatif) Pour entendre uniquement la langue interprétée, cliquez sur Couper le son original.

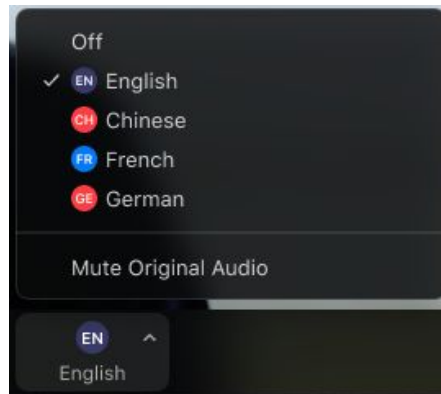
### Remarques:

- Vous devez rejoindre l'audio de la réunion via l'audio/VoIP de votre ordinateur. Vous ne pouvez pas écouter l'interprétation linguistique si vous utilisez les fonctions audio de connexion ou d'appel téléphonique.
- En tant que participant rejoignant une chaîne linguistique, vous pouvez retransmettre sur le canal audio principal canal si vous réactivez votre audio et parlez.

# Listening to language interpretation

## Windows | macOS

1. In your meeting/webinar controls, click Interpretation .
2. Click the language that you would like to hear. (We will have French) No need to choose English, that is the language in the main Zoom room



3. (Optional) To hear the interpreted language only, click Mute Original Audio.

### Notes:

- You must join the meeting audio through your computer audio/VoIP. You cannot listen to language interpretation if you use the dial-in or call me phone audio features.
- As a participant joining a language channel, you can broadcast back into the main audio channel if you unmute your audio and speak.

# Dynamic Panel Data Estimation II - Application

Ashu Handa

Institute Fellow – AIR

Kenan Eminent Professor of Public Policy – UNC-CH

August 29, 2024

# Recap of the main problem and the Blundell-Bond (1998) solution

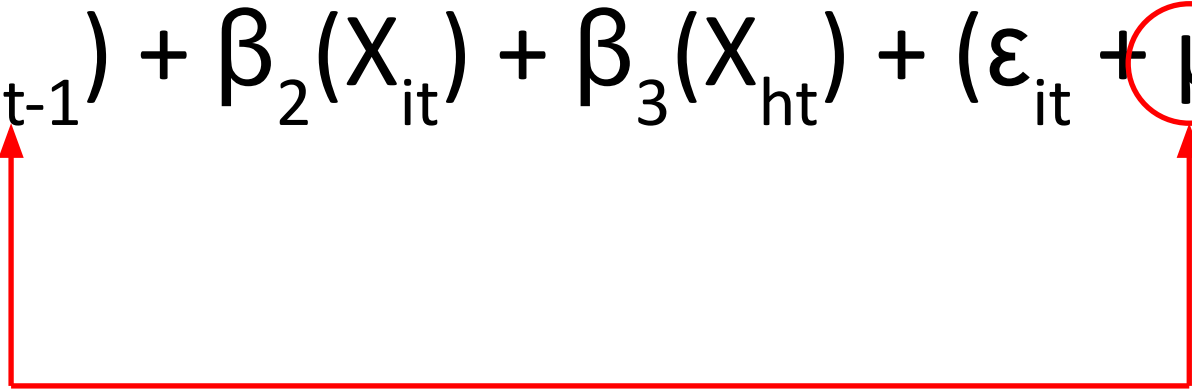
$$H_{it} = \beta_0 + \beta_1(H_{it-1}) + \beta_2(X_{it}) + \beta_3(X_{ht}) + (\epsilon_{it} + \mu_i)$$

Current period (t) height depends on lagged height (t-1)

Truly random error: not correlated with Xs nor  $H_{it-1}$

Health endowment of child: fixed over time and correlated with  $H_i$  in each period

We have an endogeneity problem:  $H_{it-1}$  is correlated with the error term!

$$H_{it} = \beta_0 + \beta_1(H_{it-1}) + \beta_2(X_{it}) + \beta_3(X_{ht}) + (\varepsilon_{it} + \mu_i)$$


We can solve this using IV. Instruments must satisfy two criteria

1. Must be highly correlated with  $H_{it-1}$ ;
2. Must not directly affect  $H_{it}$ ;

# The Blundell-Bond (1998) system estimator

$$H_{it} = \beta_0 + \beta_1(H_{it-1}) + \beta_2(X_{it}) + \beta_3(X_{ht}) + (\varepsilon_{it} + \mu_i) \quad (1)$$

Use  $(H_{it-1} - H_{it-2})$  as an instrument for  $H_{it-1}$

Levels equation with a lagged  
differenced instrument

$$\Delta H_{it} = \beta_1(\Delta H_{it-1}) + \beta_2(\Delta X_{it}) + \beta_3(\Delta X_{ht}) + (\Delta \varepsilon_{it})$$

(3)  
Use  $H_{it-2}$  as the instrument for  $(H_{it-1} - H_{it-2})$

Differenced equation with a lagged  
levels instrument

## Is There Catch-Up Growth? Evidence from Three Continents\*

SUDHANSHU HANDA<sup>†,‡</sup> and AMBER PETERMAN<sup>‡</sup>

<sup>†</sup>*Department of Public Policy, University of North Carolina, CB #3435 Abernathy Hall  
Chapel Hill, NC 27599-3435, USA (e-mail: shanda@email.unc.edu)*

<sup>‡</sup>*UNICEF Office of Research - Innocenti, Piazza SS Annunziata 12 Florence, 50122, Italy  
(email: apeterman@unicef.org)*

$$H_{it} = \beta_0 + \beta_1(H_{it-1}) + \beta_2(X_{it}) + \beta_3(X_{ht}) + (\varepsilon_{it} + \mu_i)$$



TABLE 4

*Summary coefficients of lagged height-for-age z-scores on current z-score, China 1991–93*

| <i>Estimator</i>                               | <i>OLS</i>    | <i>Arellano–Bond</i>    | <i>Blundell–Bond System</i> |         | <i>2SLS</i>   |               |               |
|------------------------------------------------|---------------|-------------------------|-----------------------------|---------|---------------|---------------|---------------|
|                                                | <i>Levels</i> | <i>First difference</i> | <i>First difference</i>     |         | <i>Levels</i> | <i>Levels</i> | <i>Levels</i> |
|                                                | (1)           | (2)                     | (3)                         | (4)     | (5)           | (6)           | (7)           |
| Coefficient                                    | 0.683         | 0.091                   | 0.566                       | 0.510   | 0.530         | 0.642         | 0.391         |
| (SE)                                           | (0.023)       | (0.110)                 | (0.064)                     | (0.085) | (0.070)       | (0.083)       | (0.084)       |
| t-statistic                                    | 29.70         | 0.83                    | 8.84                        | 6.00    | 7.57          | 7.73          | 4.65          |
| Instrument set                                 |               |                         |                             |         |               |               |               |
| 2 period lagged height-for-age                 | N/A           | Yes                     | Yes                         | Yes     | Yes           | No            | Yes           |
| Prices, interactions and wealth                | N/A           | Yes                     | Yes                         | No      | Yes           | Yes           | No            |
| F(instruments)                                 |               | 1.90                    |                             |         | 11.35         | 2.1           | 108.08        |
| Partial R-squared for<br>stage one instruments |               | 0.065                   |                             |         | 0.296         | 0.04          | 0.130         |

*Notes:* Observations are 1,121. The first difference estimator uses two period lagged height-for-age as instrument as well as lagged differences in prices and wealth. The levels equation uses the two period lagged difference in height-for-age as the instrument and lagged prices and wealth. See text for details.

Weak instrument problem identified by Blundell-Bond

## System estimator

TABLE 4

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|---------------------------------------------|---------------|-------------------------|-----------------------------|---------|---------------|---------------|---------------|
|                                             | <i>Levels</i> | <i>First difference</i> | <i>First difference</i>     |         | <i>Levels</i> | <i>Levels</i> | <i>Levels</i> |
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| Instrument set                              |               |                         |                             |         |               |               |               |
| 2 period lagged height-for-age              | N/A           | Yes                     | Yes                         | Yes     | Yes           | No            | Yes           |
| Prices, interactions and wealth             | N/A           | Yes                     | Yes                         | No      | Yes           | Yes           | No            |
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Differenced equation with  
two period lagged instrument in levels



## System estimator

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|------------------------------------------------|---------------|-------------------------|-----------------------------|------------|---------------|---------------|---------------|
|                                                | <i>Levels</i> | <i>First difference</i> | <i>First difference</i>     |            | <i>Levels</i> | <i>Levels</i> | <i>Levels</i> |
|                                                | <i>(1)</i>    | <i>(2)</i>              | <i>(3)</i>                  | <i>(4)</i> | <i>(5)</i>    | <i>(6)</i>    | <i>(7)</i>    |
| Coefficient                                    | 0.683         | 0.091                   | 0.566                       | 0.510      | 0.530         | 0.642         | 0.391         |
| (SE)                                           | (0.023)       | (0.110)                 | (0.064)                     | (0.085)    | (0.070)       | (0.083)       | (0.084)       |
| t-statistic                                    | 29.70         | 0.83                    | 8.84                        | 6.00       | 7.57          | 7.73          | 4.65          |
| Instrument set                                 |               |                         |                             |            |               |               |               |
| 2 period lagged height-for-age                 | N/A           | Yes                     | Yes                         | Yes        | Yes           | No            | Yes           |
| Prices, interactions and wealth                | N/A           | Yes                     | Yes                         | No         | Yes           | Yes           | No            |
| F(instruments)                                 |               | 1.90                    |                             |            | 11.35         | 2.1           | 108.08        |
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*Notes:* Observations are 1,121. The first difference estimator uses two period lagged height-for-age as instrument as well as lagged differences in prices and wealth. The levels equation uses the two period lagged difference in height-for-age as the instrument and lagged prices and wealth. See text for details.

Other exogenous variables can serve as instruments. In this case we have used prices and long-run wealth.

xtdpd htz l.htz X1 Prices, dgmiv(htz) lgmmiv(htz) div(Prices) liv(Lprices) artests(1) two vce(robust)

STATA command  
'dynamic panel data' estimation

Dependent variable: htz  
Lagged dependent variable as predictor: l.htz  
(lag operator in STATA, must tsset the data)

Other exogenous variables  
in the model

xtdpd htz l.htz X1 Prices, dgmmiv(htz) lgmmiv(htz) div(Prices) liv(Lprices) artests(1) two vce(robust)

STATA command  
'dynamic panel data' estimation

'GMM style' IV for the levels equation  
[This is the lagged dependent variable]  
[STATA knows this must be differenced]

'GMM-style' IV for the differenced equation  
[This is the lagged dependent variable]  
[STATA knows that this must be lagged two periods]

xtdpd

htz l.htz X1 Prices, dgmiv(htz) lgmiv(htz) div(Prices) liv(Lprices) artests(1) two vce(robust)

STATA command  
'dynamic panel data' estimation

Other potential instruments for the levels equation  
They will be in lags or lag differences, you must  
create these by hand

Other potential instruments for the differenced equation  
They will be in levels or lagged levels, you must create these by hand

xtdpd

htz l.htz X1 Prices, dgmiv(htz) lgmmiv(htz) div(Prices) liv(Lprices)

artests(1) two vce(robust)

STATA command  
'dynamic panel data' estimation

Other options, read about them by typing 'help xtdpd'  
I won't spend much time on them