Motivation

• Debate over why businesses are not investing more.
  o Is low investment mainly symptom of weak economic environment? (E.g., Chinn, 2011; Krugman, 2011.)
  o Are special impediments to blame, such as policy uncertainty or financial sector weaknesses? (E.g., European Investment Bank, 2013; Buti and Mohl 2014.)

• Diagnosing the cause is critical for devising policies to remedy the fall in investment.
Central questions of the chapter

1. Is there a global slump in private investment?
2. Is the slump in private investment due to housing or is it broader?
3. How much of this slump reflects the weakness of demand?
4. Which businesses have cut back more on investment and why?

1. Is there a global slump in private investment? AEs.
2. AEs: Just housing or broader? Broader.

**Categories of Real Fixed Investment**
(Log index; 1990 = 0)

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<tbody>
<tr>
<td>Residential</td>
<td>1.0</td>
<td>1.2</td>
<td>1.4</td>
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<tr>
<td>Business</td>
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<td>1.2</td>
<td>1.4</td>
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<tr>
<td>Business Structures</td>
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<td>1.2</td>
<td>1.4</td>
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<tr>
<td>Business Equipment</td>
<td></td>
<td></td>
<td></td>
<td>1.2</td>
<td>1.4</td>
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</tbody>
</table>

Housing: A small share of total investment.

**Shares and Relative Prices of Investment Categories**
(Percent of total fixed investment, unless noted otherwise)

1. Residential vs. Business
2. Private vs. Public
3. Business Investment: Equipment vs. Structures
4. Relative Prices: Equipment vs. Structures
Decomposing the slump: Not mainly housing.

Decomposition of the Investment Slump, 2008–14
(Average percent deviation from spring 2007 forecasts)

1. Residential vs. Business

2. Public vs. Private

3. How much reflects output?

- As mentioned, important to diagnose correctly → implications for policy.

A. Has the comovement of investment and output been unusual?
   - Is this time different from historical recessions?

B. How much has weak economic activity driven the weakness in investment
   - Address reverse causality issues using instrumental variables.
A. Unusual comovement of investment and output?

Responses of Business I and Y to Various Shocks

Ratio of Responses (Average I to Average Y)

Historical recessions
GFC AEs
GFC crisis AEs
GFC noncrisis AEs

B. How much reflects weak output? The bulk.

- First pass: Is this time different relative to historical recessions?
- Next: Identify effect of output on business investment. (Challenge: Reverse causality.)
- Approach: Focus on shocks not triggered by business investment. (Fiscal, housing.)
B. How much reflects weak economic activity?

**Investment-Output Relation: Instrumental Variables Estimation**

Business Investment Growth ($\Delta \ln I_t$) = $\alpha_t + \lambda_t + \beta \{\text{Instrumented } \Delta \ln Y_t\} + \rho \Delta \ln I_{t-1} + \varepsilon_t$

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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>2.445***</td>
<td>2.633***</td>
<td>1.719***</td>
<td>2.243***</td>
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<tr>
<td></td>
<td>(0.726)</td>
<td>(0.863)</td>
<td>(0.371)</td>
<td>(0.983)</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.128*</td>
<td>0.179***</td>
<td>0.108*</td>
<td>0.138**</td>
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<tr>
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<td>(0.066)</td>
<td>(0.062)</td>
<td>(0.064)</td>
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<tr>
<td>$R^2$</td>
<td>0.652</td>
<td>0.465</td>
<td>0.511</td>
<td>0.669</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>356</td>
<td>356</td>
<td>604</td>
<td>356</td>
</tr>
<tr>
<td>First-Stage $F$-Statistic</td>
<td>15.916</td>
<td>18.461</td>
<td>6.843</td>
<td>11.899</td>
</tr>
<tr>
<td>$p$-Value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>0.009</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Overidentification Restrictions $p$-Value</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>0.516</td>
</tr>
<tr>
<td>Definition of $Y_t$</td>
<td>GDP</td>
<td>C + X</td>
<td>GDP</td>
<td>GDP</td>
</tr>
<tr>
<td>Instruments for $\Delta \ln Y_t$</td>
<td>Fiscal shocks</td>
<td>Fiscal shocks</td>
<td>Housing shocks</td>
<td>Fiscal and housing shocks</td>
</tr>
</tbody>
</table>

Sources: Haver Analytics; national authorities; and IMF staff calculations.

*p < .1, ** p < .05, *** p < .01.

Country level: Actual investment close to prediction.

**Accelerator Model: Real Business Investment (Log index)**

1. United States
2. Japan
3. Germany
4. France

- Actual
- Accelerator model prediction
- Spring 2007 forecasts
Secondary in some: Financial constraints, policy uncertainty.

- Country-specific Accelerator Model.
  \[
  \frac{I_t}{K_{t-1}} = \frac{\alpha}{K_{t-1}} + \sum_{i=1}^{12} \beta_i \frac{\Delta Y_{t-i}}{K_{t-1}} + \sum_{i=1}^{12} \gamma_i X_{t-i} + \delta + \epsilon_i
  \]
- Exceptions in some euro area economies after 2011.
  - Financial constraints. (Survey-based measure.)

---

1/ Euro area economies (Greece, Ireland, Italy, Portugal, Spain) with high borrowing spreads during the 2010-11 sovereign debt crisis.
Secondary in some: Financial constraints, policy uncertainty.

- Country-specific Accelerator Model.
  \[ \frac{I_t}{K_{t-1}} = \alpha + \sum_{i=1}^{12} \beta_i \Delta Y_{t-i} \frac{K_{t-1}}{K_{t-1}} + \sum_{i=1}^{12} \gamma_i X_{t-i} + \delta + \epsilon_i \]

- Exceptions in some euro area economies after 2011.
  - Financial constraints. (Survey-based measure.)
  - Policy uncertainty. (News-based measure.)

4. Which businesses have cut back more and why?

- From macro ... to micro (firm-level). Why?
- Focus on role of financial constraints and uncertainty.
- Use a “difference-in-difference” approach.
Firm-level surveys cite weak demand as dominant factor.

Insufficient Demand

1. Europe

2. Stressed Euro Area

3. United States

Financial Constraints

1. Europe

2. Stressed Euro Area

3. United States

Estimating the role of financial constraints.

• Estimate effect on $I/K$ ratio for firm $i$ in sector $j$ in country $k$ in year $t$.

• “Diff-in-diff” approach of Dell’Ariccia, Detragiache, and Rajan (2008), applied to investment as in Claessens, Tong and Wei (2012).

\[
\frac{I_{ijk,t}}{K_{ijk,t-1}} = \beta \text{ Financial Dependence}_j \times \text{Crisis}_{k,t} + \sum_l \gamma_l x_{ijk,t} + \alpha_i + \sum_k \lambda_{k,t} d_{k,t} + \sum_j \phi_{j,t} d_{j,t} + \varepsilon_{ijk,t}
\]

• Intuition: If financial constraints play a significant role, then firms in sectors that are more dependent on external finance should cut $I$ more during a credit crunch.

• Data: Thomson Reuters Worldscope; Sample: 28 AEs, 27,661 firms, 2000-13.
How do we measure financial dependence?

- Financial dependence at sector level (Rajan and Zingales, 1998). Fixed over time.
  
  \[
  \text{Financial Dependence} = \frac{\text{Capital Expenditures} - \text{Cash Flow}}{\text{Capital Expenditures}}
  \]

- Based on US firms. Apply to 3-digit sector level for all AEs. (Assumption.)

- Interact with country-level credit crunch:
  Banking crisis (Laeven-Valencia); real credit growth.

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## Financial constraints

**Firm-Level Evidence: Financial Constraint Channel**

<table>
<thead>
<tr>
<th>Ratio of firm investment to lagged capital</th>
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<tr>
<td>Bank Crisis × Financial Dependence</td>
<td>−0.024***</td>
<td>−0.023***</td>
<td>−0.026***</td>
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<tr>
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<td>(0.007)</td>
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<td>(0.008)</td>
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<tr>
<td>Recession × Financial Dependence</td>
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<tr>
<td>Sales to Lagged Capital Ratio</td>
<td>0.008***</td>
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<td>(0.000)</td>
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<tr>
<td>Lagged Tobin’s Q</td>
<td>0.042***</td>
<td>0.042***</td>
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<td>(0.002)</td>
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**Fixed Effects**

- Firm: Y
- Sector × Year: Y
- Country × Year: Y

- Number of Observations: 161,073
- \( R^2 \): 0.03, 0.13, 0.13

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.

***p < 0.01.
Financial constraints

**Firm-Level Evidence: Financial Constraint Channel**

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<td></td>
<td>(0.002)</td>
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**Fixed Effects**

- Firm: Y Y Y
- Sector × Year: Y Y Y
- Country × Year: Y Y Y

**Number of Observations**

| 161,073 | 160,239 | 160,239 |

**R²**

| 0.03     | 0.13    | 0.13    |

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.
***p < 0.01.

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**Estimating the role of uncertainty.**

- Analogous “diff-in-diff” approach:

\[
\frac{I_{ijk,t}}{K_{ijk,t-1}} = \beta \text{Uncertainty Sensitivity}_j \times \text{Volatility}_{k,t} + \sum_t \gamma_t x_{ijk,t} + \alpha_i + \sum_{k,t} \lambda_{k,t} d_{k,t} + \sum_{j,t} \phi_{j,t} d_{j,t} + \epsilon_{ijk,t}
\]

- Intuition: If uncertainty has played a significant role, then firms whose stock prices usually respond more with aggregate measure of uncertainty (“sensitivity”) should cut I more during periods of high aggregate uncertainty.

- Aggregate uncertainty: country-specific (SD of country stock index return).
Firm level: Measuring “sensitivity” to uncertainty.

Two measures of sensitivity (fixed over time):


### Policy Uncertainty

**Firm-Level Evidence: Policy Uncertainty Channel**

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<tr>
<td>Market Volatility × Policy Uncertainty Sensitivity</td>
<td>-0.010* (0.006)</td>
<td>-0.028*** (0.008)</td>
<td>-0.017** (0.008)</td>
</tr>
<tr>
<td>Bank Crisis × Financial Dependence</td>
<td>-0.024*** (0.007)</td>
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**Fixed Effects**

- Firm: Y
- Sector × Year: Y
- Country × Year: Y

**Number of Observations**

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<tbody>
<tr>
<td>202,211</td>
<td>160,476</td>
<td>159,645</td>
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**R²**

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<tbody>
<tr>
<td>0.03</td>
<td>0.03</td>
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<td></td>
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</table>

Sources: Haver Analytics; national authorities; Thomson Reuters Worldscope; and IMF staff calculations.

*p < 0.1; **p < 0.05; ***p < 0.01.
Firm level: Financial constraints: Some more intuition.

- In banking crises, more financially dependent sectors (top quartile) cut $I/K$ by 1.5pp more than less dependent sectors (lowest quartile).
- Caution: Diff-in-diff speaks to relative $I$ performance of different firms.
- Illustration: Relative $I$ performance of different firms since the crisis.

Firm level: Financial constraints and uncertainty play a role.

**Response of Firm Investment to GFC, By Firm Type**

(percent; based on local projection model)

**By Degree of Sensitivity to Policy Uncertainty**

(percent; based on local projection model)
Conclusions

1. Slump in private investment: Mostly in AEs, broad-based. (Not just housing.)

2. Firms acting “normally” given weak economic environment. Little unexplained weakness.


4. Comprehensive set of policies required.
   - Support overall demand.
   - Faster recovery would lift investment.
Japan

Categories of Real Fixed Investment
(Log index; 1990 = 0)

1. Residential
2. Business
3. Business Structures
4. Business Equipment

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Private Investment and Components-to-GDP Ratio

Source: IMF, World Economic Outlook.
Notes: Relative Price of Investment = Private Investment Value/Private Investment Volume; Base year is 2005
Housing even smaller in Japan. Price of equipment flat.

Shares and Relative Prices of Investment Categories

(Percent of total fixed investment, unless noted otherwise)

1. Residential vs. Business

2. Private vs. Public

3. Business Investment: Equipment vs. Structures

4. Relative Prices: Equipment vs. Structures

OTHER
Investment ratios to GDP: Little sign of global slump.

**Private Investment-to-GDP Ratio**

**1. World**

**2. Advanced Economies**

**3. EMDEs**

**4. EMDEs excl. China**

Source: IMF, World Economic Outlook.

Notes: Relative Price of Investment = Private Investment Value/ Private Investment Volume; Base year is 2005; AEIs included are: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom and United States.

Brisk investment growth in the 2000s across EMDEs, but slowdown in recent years even relative to pre-boom forecasts

**Real Private Fixed Investment**

(Log index; 1990 = 0)

**1. EMDEs excl. China**

**2. Latin America and the Caribbean**

**3. Commonwealth of Independent States**

**4. Emerging and Developing Europe**

Source: IMF, World Economic Outlook.

Notes: Relative Price of Investment = Private Investment Value/ Private Investment Volume; Base year is 2005; AEIs included are: Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom and United States.
A. Has the comovement of investment and output been unusual?

**Emerging and Developing Economies**

**Responses of Business I and Y to Various Shocks**

- **Emerging and Developing Economies (EMDEs)**
- **Emerging and Developing (ED) Asia**
- **ED Asia excl. China**
- **Latin America and Caribbean (LAC)**

**Ratio of Responses (Average I to Average Y)**

- **Historical EMDEs**
- **EMDEs**
- **ED Asia**
- **ED Asia excl. CHN**
- **LAC**

**Real Business Investment: Accelerator Model Residuals and Investment Losses Relative to Precrisis Forecasts, 2008-14**

- 90 percent confidence interval
- Residual
- Total Investment Loss
Financial markets unusual given firms’ investment decisions?

Tobin’s Q and Real Business Investment-to-Capital Ratios

- Percentage change in investment-to-capital ratio
- Percentage change in Tobin’s Q

1. United States
2. Japan
3. Germany
4. United Kingdom

Sources: Haver Analytics; national authorities; and IMF staff calculations.

Tobin’s Q not in lock step, but can predict future investment.

- What we can say: I/K and Tobin’s Q not in lock step.
- Some evidence: Q has lagged relation with I.