The Rate of Return on Everything, 1870–2015

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Moritz Schularick¶  Alan M. Taylor★

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‡Deutsche Bundesbank
§University of Bonn
¶University of Bonn; CEPR
★University of California, Davis; NBER; CEPR
Real estate is the largest asset class

Source: Savills Research

[Bar chart showing the comparison of residential, commercial, agricultural, debt, equities, and global GDP 2015 assets in trillions of dollars.]

Source: Savills Research
Betting the house

Housing is the most important household asset.

Source: ECB Household Portfolio Survey, Flow of Funds.
The great mortgaging

Housing loans are the main asset of the financial system.

Source: Jorda, Schularick, Taylor, JME 2015
Residential real estate

Housing is the asset that matters most, but it is the asset we know least about.
Residential real estate

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A prominent example:

- The long-run equity risk premium is 6% (Mehra and Prescott 1985)
Residential real estate

Housing is the asset that matters most, but it is the asset we know least about.

A prominent example:

- The long-run equity risk premium is 6% (Mehra and Prescott 1985)
- What is the housing risk premium?
Residential real estate

Housing is the asset that matters most, but it is the asset we know least about.

A prominent example:

- The long-run equity risk premium is 6% (Mehra and Prescott 1985)
- What is the housing risk premium?
- How do housing returns vary over time and across space?
Residential real estate

Housing is the asset that matters most, but it is the asset we know least about.

A prominent example:

- The long-run equity risk premium is 6% (Mehra and Prescott 1985)
- What is the housing risk premium?
- How do housing returns vary over time and across space?
- Except for a few studies (Giglio et al. 2015, Favilukis et al. 2017), we know very little.
Core contribution

This paper presents:

1. Long-run returns on the main household asset: residential real estate.


3. Constructs economy-wide returns on wealth.
What we find

1. $r_{housing} \approx r_{equities}$ but $r_{housing}$ less volatile, less correlated internationally

2. $r_{safe}$ relatively volatile (ex post): today no lower than in other eras, 1980s high

3. $r_{wealth} \gg g$ across countries and over time...
NEW DATA ON GLOBAL RETURNS
Largest ever dataset on total returns in 16 economies over 145 years

|------------|------------|------------|----------|---------|

Statement of the obvious: It took years, lots of work... ...but it gets <1 minute here today
What’s new?

- **New: Housing total returns, prices and rental yields**
  Before: scattered rents/returns for short periods, house prices from Knoll, Schularick, Steger (AER 2017)

- **New: Equity total returns, prices and dividend yields**
  Before: commercial providers, dividends and documentation scarce, new prices and dividends here

- **New: Govt. bond total returns and yields, bill yields**
  Before: yields existed, returns from commercial providers
What’s new?

- New: Housing total returns, prices and rental yields
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- New: Govt. bond total returns and yields, bill yields
  Before: yields existed, returns from commercial providers

- Thanks to everyone who helped!
  It will all be here as a public good:
The *Jordà-Schularick-Taylor Macrohistory Database* is the result of an extensive data collection effort over several years. In one place it brings together macroeconomic data that previously had been dispersed across a variety of sources. On this website we provide convenient no-cost open access under a license to the most extensive long-run macro-financial dataset to date. Commercial data providers are strictly forbidden to integrate all or parts of the dataset into their services or sell the data (see Terms of Use and Licence Terms below).

The database covers 17 advanced economies since 1870 on an annual basis. It comprises 25 real and nominal variables. Among these, there are time series that had been hitherto unavailable to researchers, among them financial variables such as bank credit to the non-financial private sector, mortgage lending and long-term house prices. The database captures the near-universe of advanced-country macroeconomic and asset price dynamics, covering on average over 90 percent of advanced-economy output and over 50 percent of world output.

Assembling the database, we relied on the input from colleagues, coauthors and doctoral students in many countries, and consulted a broad range of historical sources and various publications of statistical offices and central banks. For some countries we extended existing data series, for others we relied on recent data collection efforts by others. Yet in a non-negligible number of cases we had to go back to archival sources including documents from governments, central banks, and private banks. Typically, we combined information from various sources and spliced series to create long-run datasets spanning the entire 1870–2014 period for the first time. The table below lists the available series.
LONG-RUN RETURNS
Return calculation

- Total real return: \[ r = \left( 1 + \{ \frac{\Delta P}{P + Y} \} \right) / (1 + \pi) - 1 \]

- Extensive sensitivity checks:
  Taxes, transaction costs, weighting, survivorship bias, rental yield benchmarks, stock market closures, leverage, location effects, compare to REITS, etc.
The rent-price approach

Rental yields ($RI$ is rent index, $HPI$ is house price index):

$$\frac{RI_{t+1}}{HPI_{t+1}} = \left[ \frac{(RI_{t+1}/RI_t)}{(HPI_{t+1}/HPI_t)} \right] \frac{RI_t}{HPI_t}$$

Total returns:

$$R_{h,t+1} = \frac{RI_{t+1}}{HPI_t} + \frac{HPI_{t+1} - HPI_t}{HPI_t}$$

- Basic intuition: start with diversified net rent-price ratio (excludes maintenance, management, etc.)
- Iterate forward/backward using rent growth and constant-quality house prices
- Corroborate using balance sheet approach and historical rental yield data
Reconciling multiple sources

Example: Sweden
Reconciling multiple sources
Example: USA

- Constructed rent-price ratio, final series
- Numbeo (city centers)
- Numbeo (rest of the country)
- Grebler et al (1956)
- Balance sheet approach
- Statistical abstract of the U.S.
- Census of housing
Market yield vs. balance-sheet approach

France

Sweden

USA

Yield co-movement

- - - - Rent-price approach

- - - - Balance sheet approach
AGGREGATE TRENDS
Global returns

equal weights

Excess Return vs Bills
Mean Annual Return

Full sample

Post-1950
Global returns

GDP weights

Excess Return vs Bills

Mean Annual Return

Full sample

Post-1950

Housing

Equity

Bonds

Bills

Mean annual return, per cent

Excess Return vs Bills

Mean Annual Return

Excess Return vs Bills

Mean Annual Return

0 2 4 6 8

Mean annual return, per cent

0 2 4 6 8

Mean annual return, per cent
## Total returns since 1870

<table>
<thead>
<tr>
<th></th>
<th>Bills</th>
<th>Bonds</th>
<th>Equity</th>
<th>Housing</th>
<th>Bills</th>
<th>Bonds</th>
<th>Equity</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean return p.a.</strong></td>
<td>0.98</td>
<td>2.50</td>
<td>6.89</td>
<td>7.05</td>
<td>4.60</td>
<td>6.10</td>
<td>10.75</td>
<td>11.06</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>6.01</td>
<td>10.74</td>
<td>21.94</td>
<td>9.98</td>
<td>3.33</td>
<td>8.91</td>
<td>22.78</td>
<td>10.70</td>
</tr>
<tr>
<td>Geometric mean</td>
<td>0.78</td>
<td>1.94</td>
<td>4.64</td>
<td>6.61</td>
<td>4.55</td>
<td>5.74</td>
<td>8.55</td>
<td>10.59</td>
</tr>
<tr>
<td><strong>Mean excess return p.a.</strong></td>
<td>.</td>
<td>1.53</td>
<td>5.91</td>
<td>6.07</td>
<td>.</td>
<td>1.93</td>
<td>5.91</td>
<td>6.07</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>.</td>
<td>8.38</td>
<td>21.43</td>
<td>9.86</td>
<td>.</td>
<td>1.93</td>
<td>5.91</td>
<td>6.07</td>
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<tr>
<td>Geometric mean</td>
<td>.</td>
<td>1.19</td>
<td>3.81</td>
<td>5.64</td>
<td>.</td>
<td>1.93</td>
<td>5.91</td>
<td>6.07</td>
</tr>
<tr>
<td>Observations</td>
<td>1739</td>
<td>1739</td>
<td>1739</td>
<td>1739</td>
<td>1739</td>
<td>1739</td>
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</table>

**Post-1950:**

<table>
<thead>
<tr>
<th></th>
<th>Bills</th>
<th>Bonds</th>
<th>Equity</th>
<th>Housing</th>
<th>Bills</th>
<th>Bonds</th>
<th>Equity</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean return p.a.</strong></td>
<td>0.87</td>
<td>2.77</td>
<td>8.28</td>
<td>7.44</td>
<td>5.40</td>
<td>7.31</td>
<td>12.99</td>
<td>12.31</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>3.43</td>
<td>9.94</td>
<td>24.20</td>
<td>8.88</td>
<td>4.04</td>
<td>9.80</td>
<td>25.09</td>
<td>10.15</td>
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<tr>
<td>Geometric mean</td>
<td>0.81</td>
<td>2.30</td>
<td>5.54</td>
<td>7.10</td>
<td>5.33</td>
<td>6.89</td>
<td>10.28</td>
<td>11.90</td>
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<tr>
<td><strong>Mean excess return p.a.</strong></td>
<td>.</td>
<td>1.91</td>
<td>7.41</td>
<td>6.57</td>
<td>.</td>
<td>2.37</td>
<td>7.41</td>
<td>6.57</td>
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<tr>
<td>Std.dev.</td>
<td>.</td>
<td>9.20</td>
<td>23.77</td>
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<td>4.79</td>
<td>6.21</td>
<td>.</td>
<td>2.37</td>
<td>7.41</td>
<td>6.57</td>
</tr>
<tr>
<td>Observations</td>
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<td>1016</td>
<td>1016</td>
<td>1016</td>
<td>1016</td>
<td>1016</td>
<td>1016</td>
</tr>
</tbody>
</table>

**Note:** Annual global returns in 16 countries, equally weighted. Period coverage differs across countries. Consistent coverage within countries. Excess returns are computed relative to bills.
## Alternative benchmarks and approaches

<table>
<thead>
<tr>
<th></th>
<th>Equity</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Low initial</td>
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<tr>
<td>Mean return p.a.</td>
<td>6.89</td>
<td>7.05</td>
</tr>
<tr>
<td>Std.dev.</td>
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</tr>
<tr>
<td>Geometric mean</td>
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<td>6.61</td>
</tr>
<tr>
<td>Observations</td>
<td>1739</td>
<td>1739</td>
</tr>
<tr>
<td></td>
<td>High initial</td>
<td>Hist. sources</td>
</tr>
<tr>
<td>Mean return p.a.</td>
<td>6.27</td>
<td>7.89</td>
</tr>
<tr>
<td>Std.dev.</td>
<td>9.95</td>
<td>10.09</td>
</tr>
<tr>
<td>Geometric mean</td>
<td>5.83</td>
<td>7.44</td>
</tr>
<tr>
<td>Observations</td>
<td>1739</td>
<td>1739</td>
</tr>
<tr>
<td></td>
<td>Hist. sources</td>
<td>Balance sheet</td>
</tr>
<tr>
<td>Mean return p.a.</td>
<td>6.83</td>
<td>6.30</td>
</tr>
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<td>Std.dev.</td>
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<td>10.01</td>
</tr>
<tr>
<td>Geometric mean</td>
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<td>5.85</td>
</tr>
<tr>
<td>Observations</td>
<td>1739</td>
<td>1739</td>
</tr>
</tbody>
</table>

*Note: Total real returns across 16 countries, equally weighted.*
More checks

- Compare to REITS
- Compare to Piketty/Zucman
- Taxation
- Effect of leverage
<table>
<thead>
<tr>
<th>ADRESSE</th>
<th>Date Achat</th>
<th>Année Construction</th>
<th>Surface en m²</th>
<th>Prix Achat en 1000 F courants</th>
<th>Prix Achat en 1000 F 1995</th>
<th>Valeur 1995 en millions de F</th>
<th>Revenu brut annuel (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11, chaussée d'Antin - 16e</td>
<td>1899</td>
<td>1897</td>
<td>2.391</td>
<td>1.194,9</td>
<td>22.807,9</td>
<td>64,0</td>
<td></td>
</tr>
<tr>
<td>16, rue de Lubeck - 16e</td>
<td>1901</td>
<td>1890</td>
<td>1.170</td>
<td>555,0</td>
<td>10.593,8</td>
<td>34,0</td>
<td>6,0</td>
</tr>
<tr>
<td>34, rue Pierre-Sémard - 9e</td>
<td>1902</td>
<td>1900</td>
<td>1.111</td>
<td>332,7</td>
<td>6.351,3</td>
<td>22,0</td>
<td>6,3</td>
</tr>
<tr>
<td>80, rue du Rocher - 8e</td>
<td>1903</td>
<td>1900</td>
<td>1.995</td>
<td>780,0</td>
<td>14.888,6</td>
<td>40,0</td>
<td>6,5</td>
</tr>
<tr>
<td>5, rue du 4-Septembre - 2e</td>
<td>1904</td>
<td>1870</td>
<td>2.167</td>
<td>750,0</td>
<td>14.316,0</td>
<td>31,0</td>
<td></td>
</tr>
<tr>
<td>4, rue Léon-Cosnard - 17e</td>
<td>1905</td>
<td>1903</td>
<td>1.257</td>
<td>408,0</td>
<td>7.787,9</td>
<td>27,5</td>
<td>7,0</td>
</tr>
<tr>
<td>17, rue de Longchamp - 16e</td>
<td>1906</td>
<td>1900</td>
<td>1.543</td>
<td>382,5</td>
<td>7.909,7</td>
<td>36,0</td>
<td>6,6</td>
</tr>
<tr>
<td>25, rue du Colonel Moll - 17e</td>
<td>1906</td>
<td>1900</td>
<td>1.017</td>
<td>595,0</td>
<td>12.304,0</td>
<td>27,0</td>
<td>7,0</td>
</tr>
<tr>
<td>32, boulevard Poissonnière - 9e</td>
<td>1907</td>
<td>1900</td>
<td>1.138</td>
<td>1.045,0</td>
<td>19.947,0</td>
<td>19,0</td>
<td>6,0 (net)</td>
</tr>
<tr>
<td>63bis, rue Danrémont - 18e</td>
<td>1908</td>
<td>1906</td>
<td>1.584</td>
<td>420,0</td>
<td>8.017,0</td>
<td>30,0</td>
<td>7,8</td>
</tr>
<tr>
<td>21, rue Poncet - 17e</td>
<td>1909</td>
<td>1900</td>
<td>1.603</td>
<td>330,0</td>
<td>6.299,0</td>
<td>31,0</td>
<td></td>
</tr>
<tr>
<td>40, rue des Abbesses - 18e</td>
<td>1909</td>
<td>1907</td>
<td>1.966</td>
<td>560,0</td>
<td>10.689,3</td>
<td>34,0</td>
<td></td>
</tr>
<tr>
<td>121, rue de Courcelles - 17e</td>
<td>1910</td>
<td>1900</td>
<td>1.156</td>
<td>500,0</td>
<td>9.544,0</td>
<td>27,0</td>
<td></td>
</tr>
<tr>
<td>7, rue Saint-Senoch - 17e</td>
<td>1911</td>
<td>1904</td>
<td>1.934</td>
<td>737,0</td>
<td>12.192,2</td>
<td>43,0</td>
<td>7,1</td>
</tr>
<tr>
<td>16, rue Pérignon - 7e</td>
<td>1913</td>
<td>1900</td>
<td>1.902</td>
<td>598,0</td>
<td>9.892,7</td>
<td>46,0</td>
<td>7,4</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>23.934</td>
<td>9.570,6</td>
<td>173 540,4</td>
<td>511,5</td>
<td></td>
</tr>
</tbody>
</table>

(1) Revenu brut annuel au moment de l'acquisition (qui est souvent précisé dans le Rapport annuel de l'année suivante, qui décrit l'opération d'achat.)
Comparing French housing return with La Fourmi

<table>
<thead>
<tr>
<th></th>
<th>Fourmi immobilière</th>
<th>French Housing</th>
<th>French Equities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean return p.a.</strong></td>
<td>16.93</td>
<td>15.69</td>
<td>8.79</td>
</tr>
<tr>
<td><strong>Std.dev.</strong></td>
<td>31.35</td>
<td>10.37</td>
<td>24.54</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>87</td>
<td>87</td>
<td>87</td>
</tr>
</tbody>
</table>

*Note: Arithmetic average annual returns. Consistent sample coverage.*
Housing returns compared to REITS

USA

- US REITs, unlevered: 5-year moving average
- US Housing: 5-year moving average

France

- La Fourmi immobiliere: decadal moving average
- French Housing: decadal moving average
Comparing with Piketty/Zucman 2018

Piketty’s \( r^{Pik} \) is the sum of capital gain and yield, but computed using national accounts data

- Yield component: capital income divided by total wealth:

\[
\text{Yield: } D_t^{Pik} = \alpha / \beta = Y_{cap,t} / W_t, \tag{1}
\]

where \( \alpha \) is the capital share in GDP, \( \beta \) is the wealth-to-income ratio, \( Y_{cap} \) is capital income, and \( W \) is national wealth.

- Capital gain is a residual: the growth in national wealth not explained by investment.

\[
\text{Capital gain: } \Delta P_t^{Pik} = W_t / W_{t-1} - i_{t-1} * Y_{t-1} / W_{t-1}, \tag{2}
\]

\( i \) is the investment rate.
Housing returns in the US

Note: Five-year moving average real total return. Piketty et al. returns are from Piketty, Saez and Zucman (2018) “Distributional National Accounts”.
All our returns are pre-tax (too much variation in property and capital income taxation to track)

But: corporate profits are post-tax.

Does it make a difference?

Clearly not for households as investors, but fundamentally.
History of corporate taxation

Figure: Effective corporate tax rate, average of 5 countries

Note: Average effective tax rate in Australia, France, Germany, Japan and US, equally weighted. Japanese tax rate interpolated between 1900 and 1930. Effective tax rate is total taxes paid / net corporate profits. Where effective data are not available, we extrapolate the series using statutory (top marginal) tax rates.
# Effects of corporate taxation

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Adjusting dividends</th>
<th>Adjusting profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>7.88</td>
<td>8.29</td>
<td>9.17</td>
</tr>
<tr>
<td>France</td>
<td>3.97</td>
<td>4.19</td>
<td>4.44</td>
</tr>
<tr>
<td>Germany</td>
<td>6.85</td>
<td>6.98</td>
<td>7.03</td>
</tr>
<tr>
<td>Japan</td>
<td>6.09</td>
<td>6.57</td>
<td>8.45</td>
</tr>
<tr>
<td>United States</td>
<td>8.46</td>
<td>8.94</td>
<td>10.54</td>
</tr>
</tbody>
</table>

*Note: Arithmetic average annual returns over the full sample. Period coverage differs across countries. Consistent coverage within countries.*
Leverage

- Our housing returns are returns on asset.
- Stock returns are returns on equity.
- Solution: relever housing or deleverage equity returns.
Leverage of US corporates, 1920–today

Debt-to-Capital

Corporation leverage (%)

Total debt / Capital
Long-term debt / Capital

Source: Graham/Leary/Roberts (2014)
## Returns: deleveraged and tax adjusted

<table>
<thead>
<tr>
<th>Country</th>
<th>Baseline</th>
<th>Deleveraged Adjusting dividends</th>
<th>Adjusting profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>7.88</td>
<td>6.57</td>
<td>6.85</td>
</tr>
<tr>
<td>France</td>
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<td>3.12</td>
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<td>5.94</td>
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<tr>
<td>Japan</td>
<td>6.09</td>
<td>4.85</td>
<td>5.22</td>
</tr>
<tr>
<td>United States</td>
<td>8.46</td>
<td>7.11</td>
<td>7.47</td>
</tr>
</tbody>
</table>

*Note:* Arithmetic average of deleveraged annual equity returns. Returns are deleveraged using data on debt/capital of U.S. firms. Period coverage differs across countries. Consistent coverage within countries.
Returns across countries
And the winner is:

<table>
<thead>
<tr>
<th>Country</th>
<th>Bills</th>
<th>Bonds</th>
<th>Equity</th>
<th>Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1.29</td>
<td>2.26</td>
<td>7.75</td>
<td>6.54</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.70</td>
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36/56
And the winner is: **Finland**

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## Decomposition of returns

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Note: annual returns, pooled over countries.
Returns on equities versus housing
Risk and return of equities and housing

Return and Risk

Sharpe ratios

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Returns on equities versus housing

Correlations

\[ \text{Corr}_{i,t} = \frac{\sum_j \sum_{k \neq j} \text{Corr}(r_{i,j,t \in T}, r_{i,k,t \in T})}{\sum_j \sum_{k \neq j} 1} \]

for asset \( i \), \( T = (t - 5, t + 5) \); \( j \) and \( k \) denote the country pairs
Takeaways

- Returns from just equities (Mehra-Prescott, 1985; Campbell, 2003) to all risky assets.

- Housing & equity returns → avg. 7% real p.a.

- Housing rtns ≈ equity rtns, yet less volatile → puzzle? Diversification harder, local/national vol. in house prices?

- Low covariance of equity and housing returns → diversification gains

- International diversification → equity returns increasingly cross-correlated, not housing

- Capital gain: housing ≈ 50 – 55%; equities ≈ 65 – 70%

Before this paper, we couldn’t quantify these features.
Safe rates of return
Safe assets

- **More data:** from about 30 to 145 years
- **Larger swings** in safe returns than risky returns
- **Bigger term premium** since the 1980s
- World wars *very* low safe returns ($\ll 0$), also 1970s inflation/growth crises
- Drop since 1980s $\approx$ decline from 1870 to WW1: why safe return so high in mid-1980s?
Returns on bills versus bonds

Per cent


Real bill rate: decadal moving average
Real bond return: decadal moving average
Risk premium
The risk premium, \( r_{\text{risky}} - r_{\text{safe}} \)

Cross-country means
\[ r > g \]
Returns on total wealth and growth

\( r > g \)
## Returns on wealth and growth

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Main takeways

1. Housing returns similar to equity returns

2. Safe returns more variable than risky returns

3. Risk premium shows large swings

4. $r \gg g$ across time and countries

5. Cross-country equity returns increasingly correlated, but not housing