
# Greek Economic Growth:

## Past and Future

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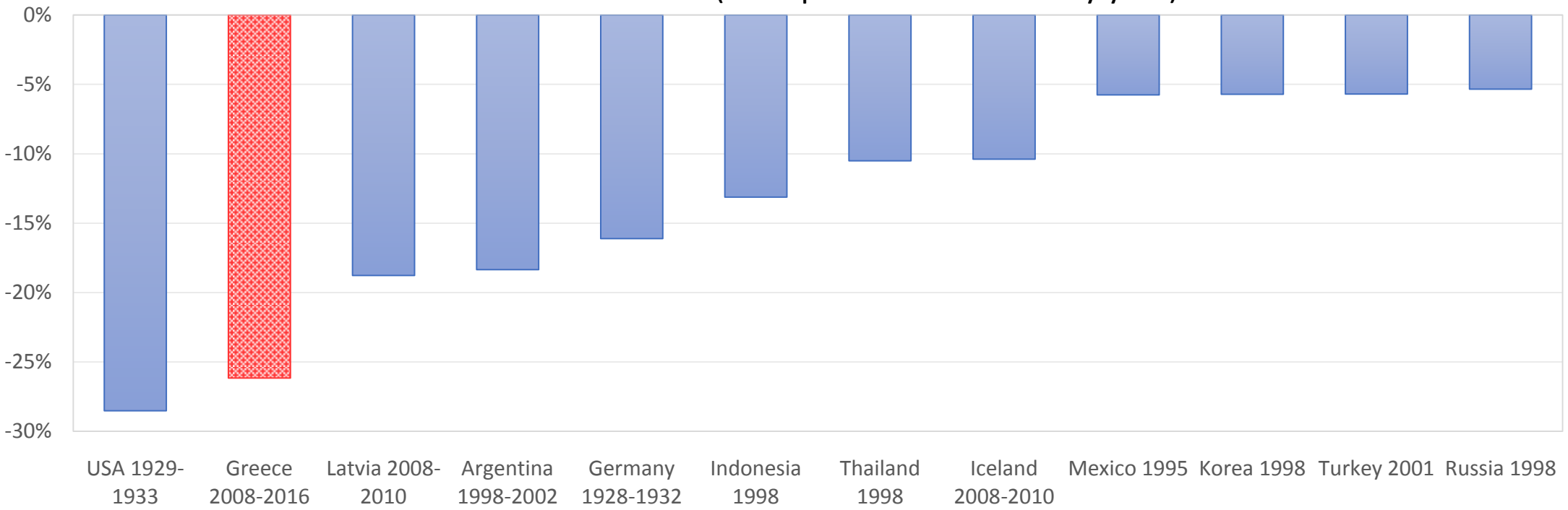
12 April 2019

"Greece and the Euro" Conference

**Figure 1**

Real GDP Growth in Crisis (from peak to first recovery year)

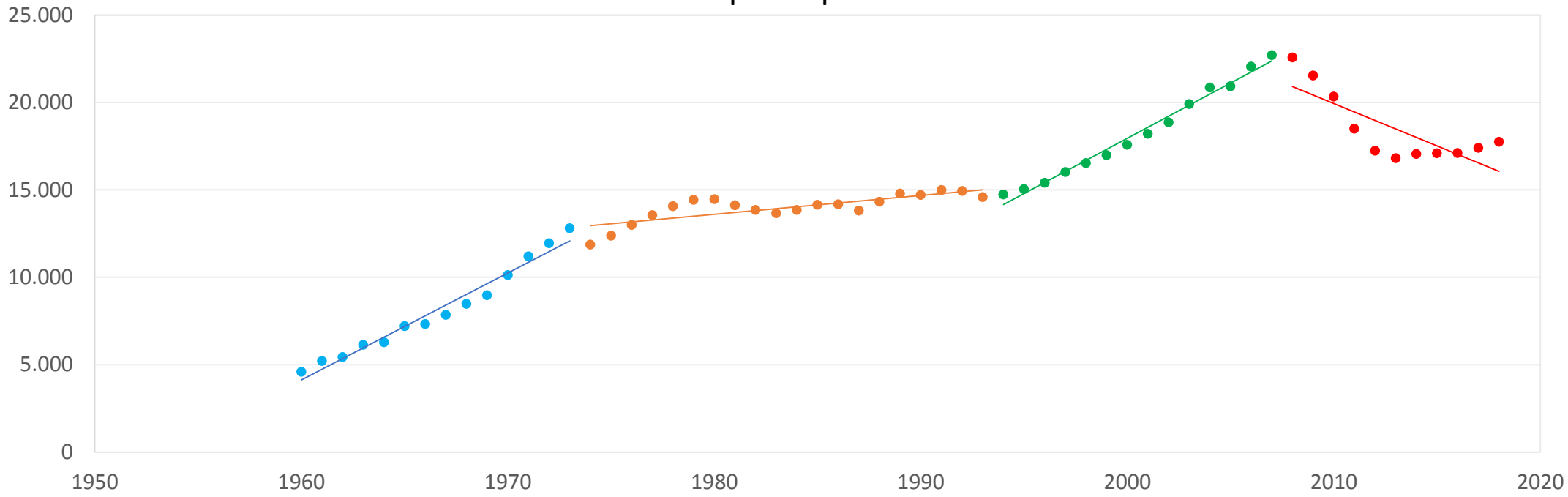



Source: IMF, Angus Maddison Historical Statistics of the World Economy, Authors' calculations

The figure compares the contraction in Greek GDP during the crisis with contractions experienced historically in other major crises.

**Figure 2**

GDP per Capita




Source: Authors' calculations

Great Expansion (1960 – 1973), Long Stagnation (1974 – 1993), Recovery (1994 – 2007) and Great Depression (2008-2017)

**Table 1**

Growth Decomposition with Capital Stocks and Total Hours Worked

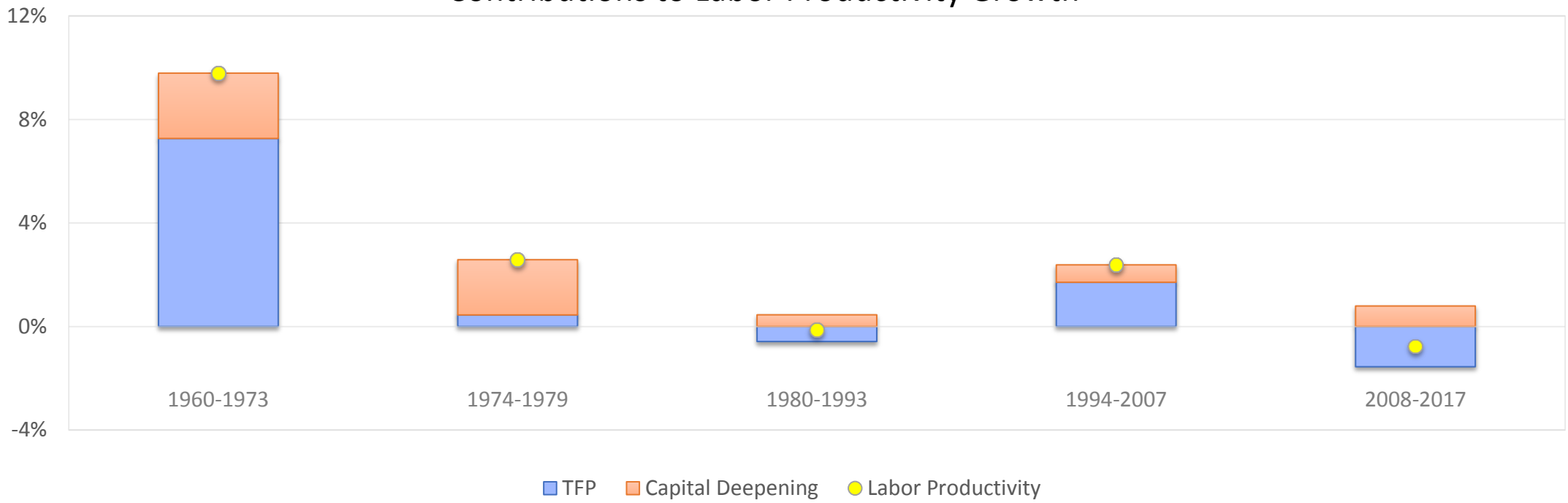
| | GDP | Labour Input | Labour Input breaks into: Total Employment | Average Hours Worked | Net Capital Stock | TFP |
|---|---|---|---|---|---|---|
| 1961-1973 | 8.87% | -0.71% | -0.38% | -0.33% | 2.32% | 7.38% |
| 1974-1979 | 3.28% | 0.36% | 0.32% | 0.03% | 2.48% | 0.44% |
| 1980-1993 | 0.75% | 0.50% | 0.49% | 0.00% | 0.84% | -0.58% |
| 1994-2007 | 3.62% | 0.71% | 0.78% | -0.07% | 1.21% | 1.71% |
| 2008-2017 | -2.82% | -1.26% | -1.18% | -0.08% | 0.00% | -1.56% |

Source: Authors' calculations

The calculations are based on Solow's growth accounting formula: $\mathbf{\Delta LnY_t = g_t + S_{K,t} * \Delta LnK_t + S_{L,t} * \Delta LnL_t}$ , according to which the growth in GDP is decomposed into the contributions of TFP, capital input and labor input respectively. See appendix A1 for more information.

**Figure 3**

Contributions to Labor Productivity Growth

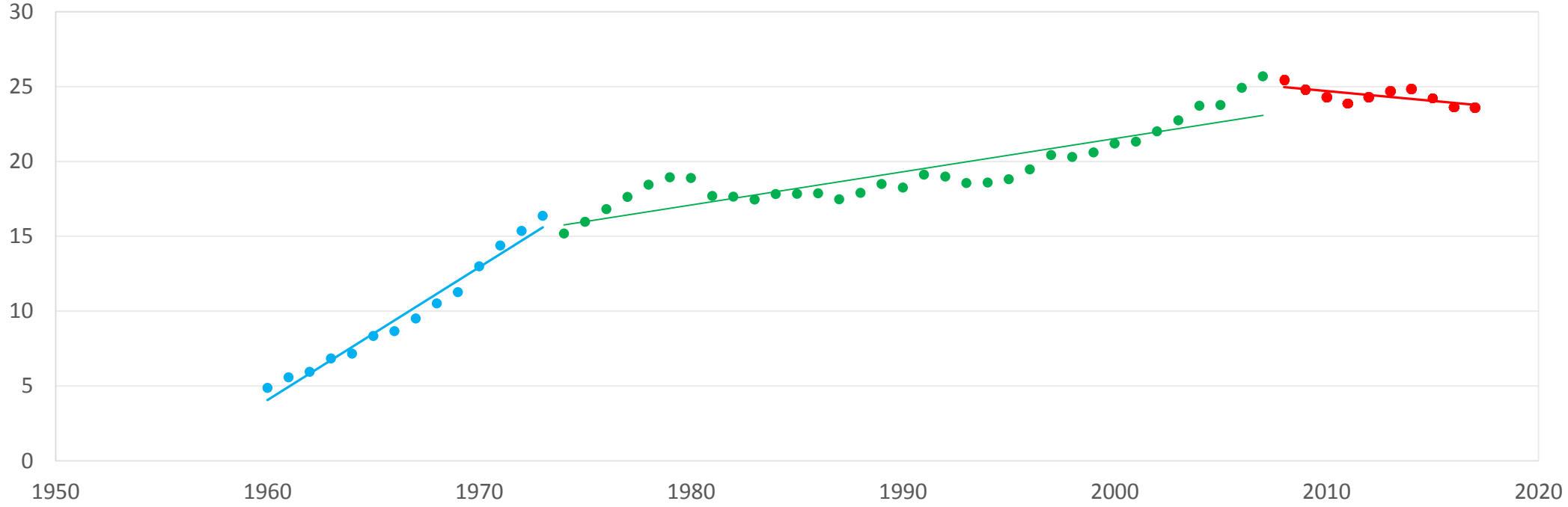



Source: Authors' calculations

The calculations are based on the formula: $\mathbf{\Delta Ln\frac{Y_t}{L_t} = g_t + S_{K,t} * \Delta Ln\frac{K_t}{L_t}}$, according to which the growth in labor productivity equals the contributions TFP and capital deepening.

**Figure 4**

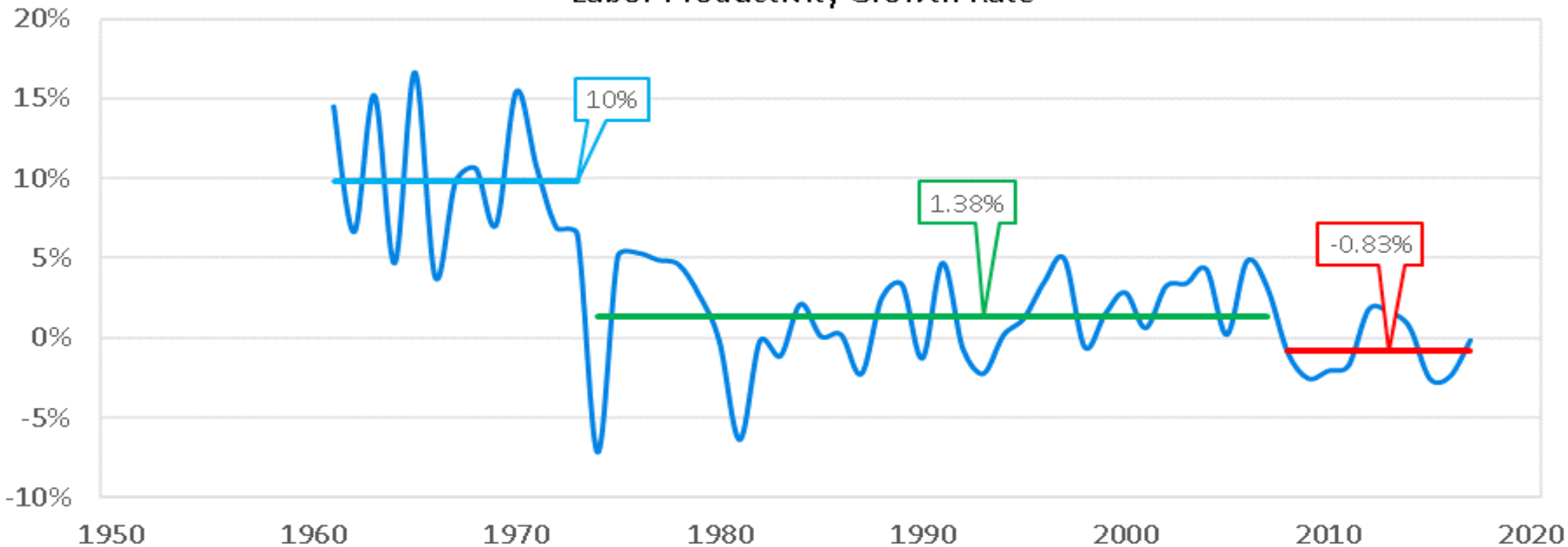
Labor Productivity




Source: Authors' calculations

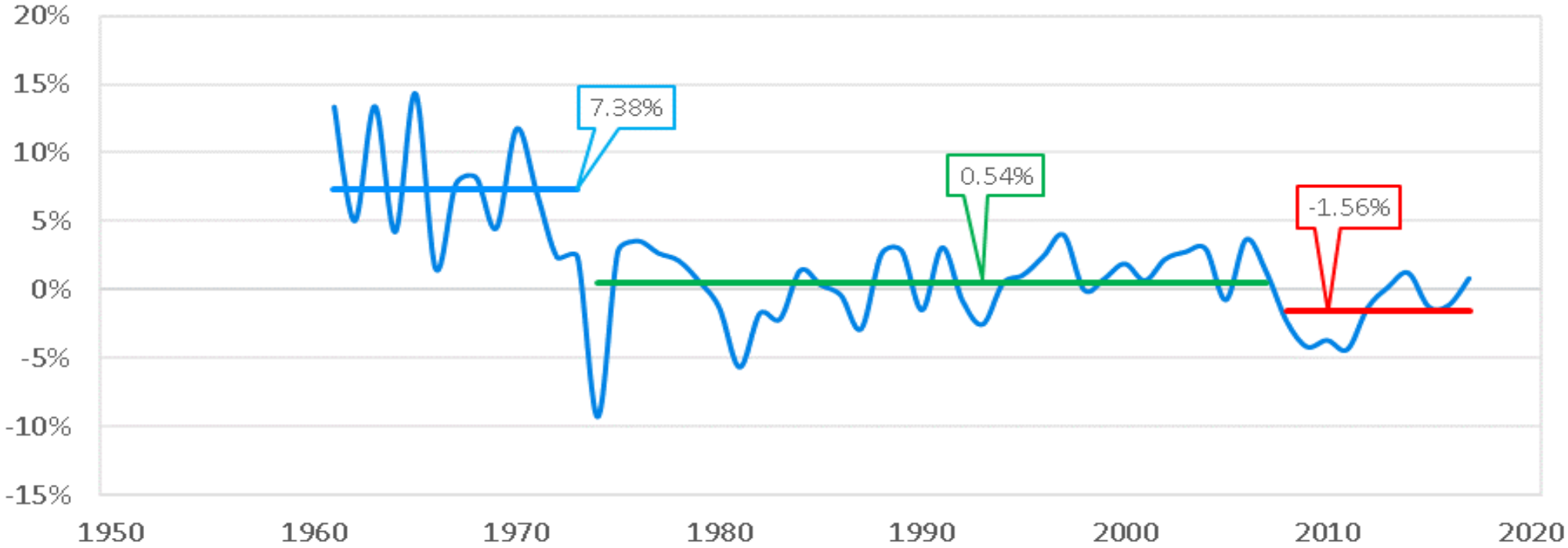
**Figure 5**

Labor Productivity Growth Rate




Source: Authors' calculations

**Figure 6**
TFP Growth Rate




Source: Authors' calculations

# The Crisis

- Shortfall in output of 50% compared to trend
- All loss is permanent (unit root tests)
- Decomposition of shortfall into components of output
- Productivity is key

## Table 4

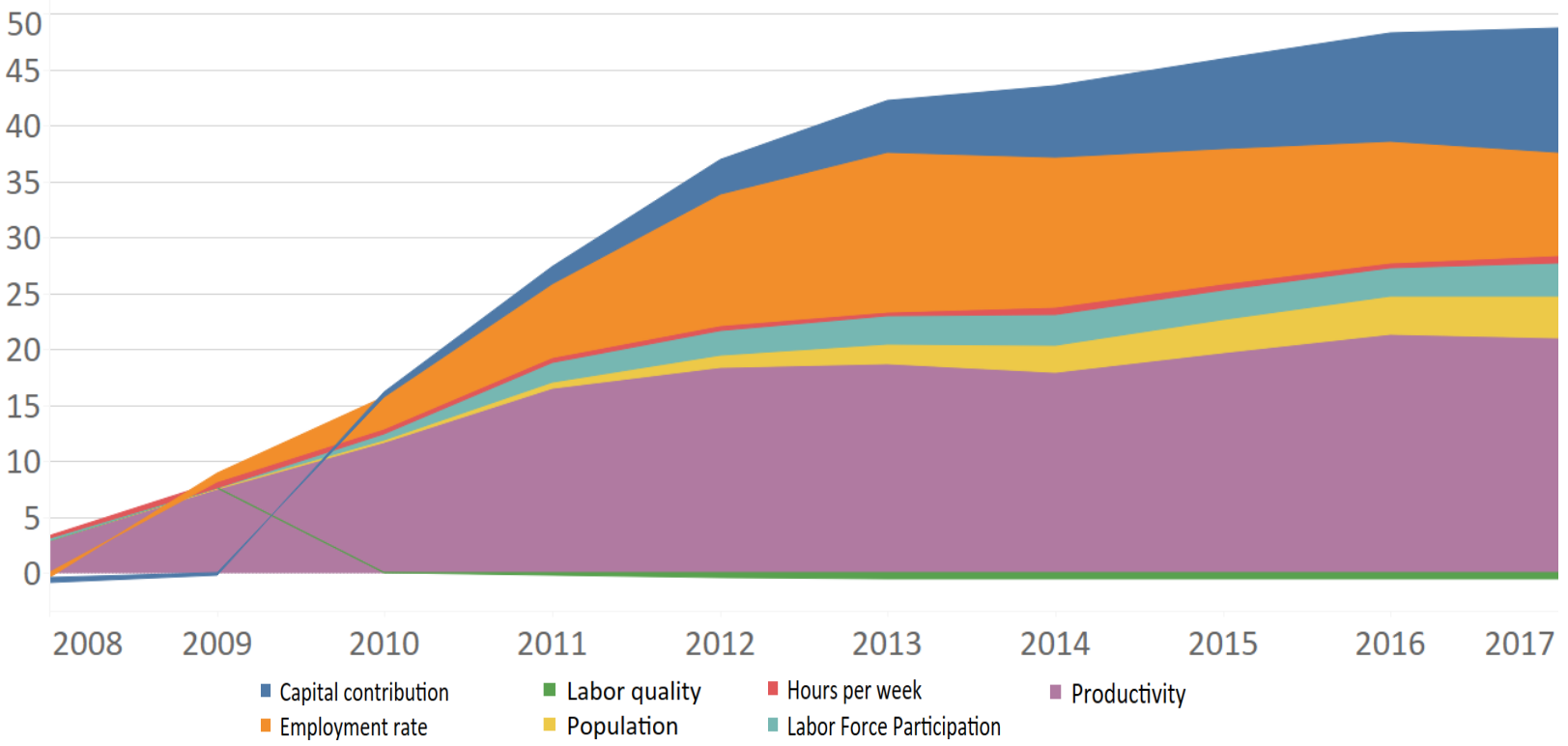
Components of the Shortfall of Output Two, Five and Ten Years into the Depression (1974-2007 trend)

| Year(s) | *Output* = | *Productivity* + | *Capital contribution* + | *Population* + | *Labor-Force Participation* + | *Employment rate* + | *Hours per week* + | *Labor quality* |
|---|---|---|---|---|---|---|---|---|
| 2008 | 2.3 | 2.8 | -0.4 | 0.0 | 0.2 | -0.5 | 0.2 | 0.0 |
| 2009 | 6.3 | 4.7 | 0.2 | 0.1 | -0.2 | 1.2 | 0.4 | 0.0 |
| 2010 | 7.5 | 4.2 | 0.7 | 0.1 | 0.5 | 2.1 | -0.1 | 0.0 |
| 2011 | 11.1 | 4.9 | 1.1 | 0.3 | 1.3 | 3.8 | -0.1 | -0.2 |
| 2012 | 9.3 | 1.8 | 1.5 | 0.6 | 0.4 | 5.2 | 0.1 | -0.3 |
| 2013 | 5.2 | 0.3 | 1.6 | 0.7 | 0.3 | 2.4 | -0.1 | -0.1 |
| 2014 | 1.3 | -0.7 | 1.7 | 0.6 | 0.2 | -0.9 | 0.3 | 0.0 |
| 2015 | 2.4 | 1.7 | 1.7 | 0.6 | -0.2 | -1.4 | -0.1 | 0.0 |
| 2016 | 2.3 | 1.6 | 1.6 | 0.4 | 0.0 | -1.1 | -0.3 | 0.0 |
| 2017 | 0.5 | -0.3 | 1.5 | 0.3 | 0.4 | -1.7 | 0.3 | 0.0 |
| 2007 through 2010 | 16.1 | 11.7 | 0.5 | 0.2 | 0.5 | 2.8 | 0.5 | 0.0 |
| 2007 through 2013 | 41.7 | 18.6 | 4.6 | 1.8 | 2.5 | 14.3 | 0.4 | -0.6 |
| 2007 through 2017 | 48.2 | 21.3 | 9.6 | 3.4 | 2.6 | 10.9 | 0.4 | -0.6 |

Source: Authors' calculations

**Figure 7**

Components of Shortfall (1974-2007 trend)

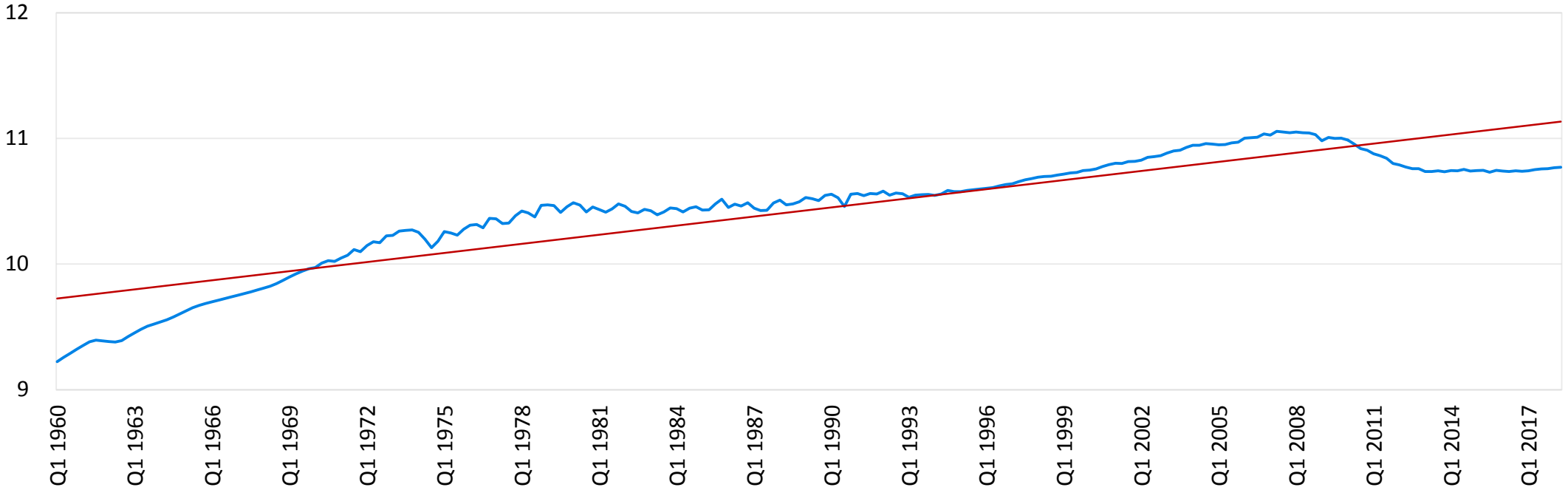



Source: Authors' calculations

The shortfall for each factor is first calculated yearly as the counterfactual % change based on the 1974-2007 trend minus the actual % change. For the chart, we aggregate the previous results up to a given year in order to obtain the cumulative shortfall for that year. For example, 2011 figures show the cumulative shortfall over 2008, 2009, 2010, and 2011.

**Figure 9**

Quarterly log GDP




Source: Authors' calculations

Quarterly, seasonally adjusted, real GDP data are obtained from the OECD. The figure shows long oscillations around a linear trend

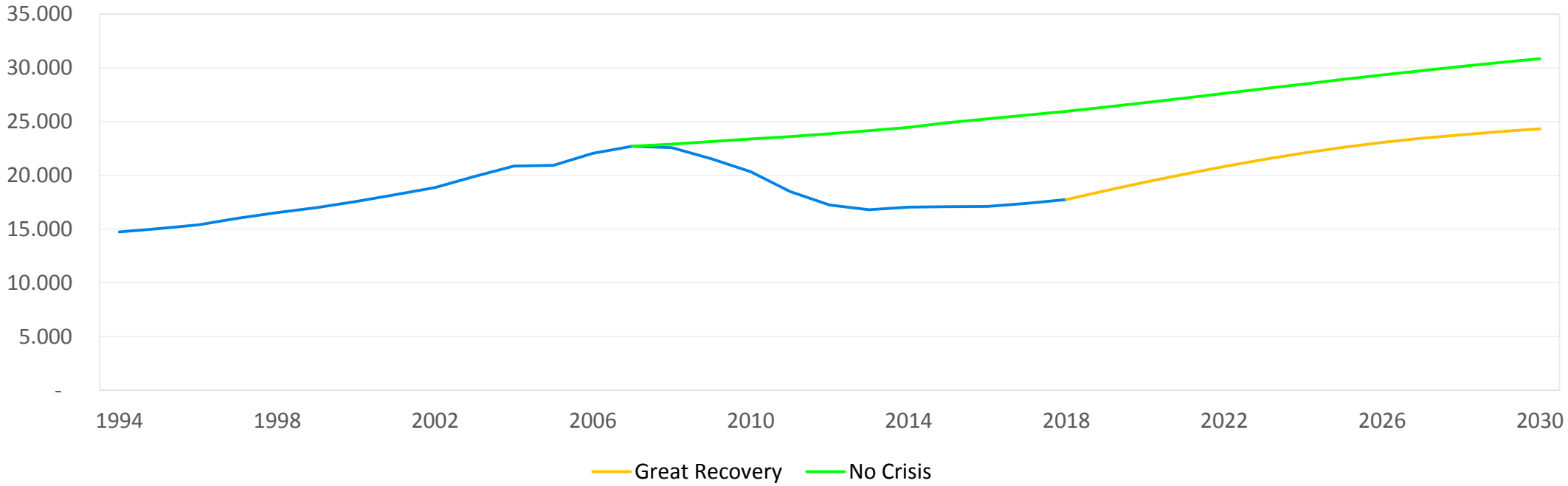
# Projecting the future

- Scenarios for growth to 2030

- *Output growth = labor productivity growth + capital contribution + labor contribution.*
- *labor contribution = labor share × change in log labor input.*
- *Change in log labor input = change in log population + change in log participation rate + change in log employment rate + change in log hours per week + change in log labor quality*

**Figure 10**

GDP per Capita Projection

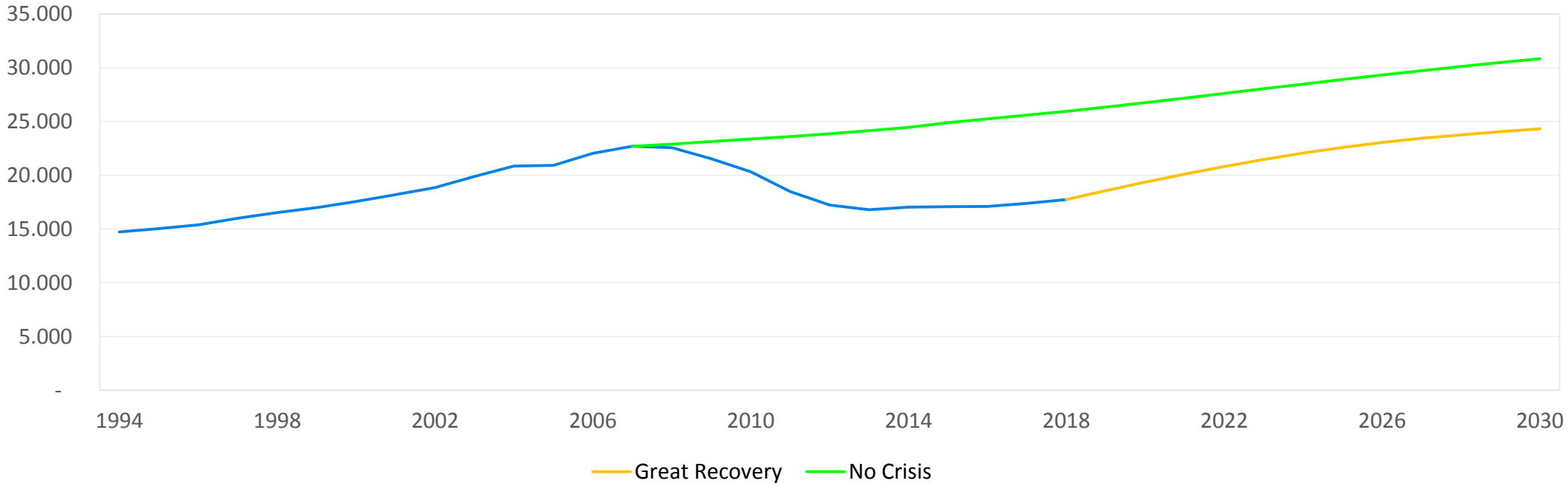



Source: OECD, own calculations

For both scenarios, ALP growth assumed at 1.38% (its 1974 to 2007 average). **Great Recovery**: Reduction of unemployment rate to 8% from current level by 2027 starting in 2019. **No Crisis**: unemployment rate is held constant to 2007 level of 8%. We use OECD's forecast for 2018 Real GDP and unemployment rate (€ 190,610 million and 0.20 respectively).

**Figure 10**

GDP per Capita Projection




Source: OECD, own calculations

For both scenarios, ALP growth assumed at 1.38% (its 1974 to 2007 average). **Great Recovery**: Reduction of unemployment rate to 8% from current level by 2027 starting in 2019. **No Crisis**: unemployment rate is held constant to 2007 level of 8%. We use OECD's forecast for 2018 Real GDP and unemployment rate (€ 190,610 million and 0.20 respectively).

# Appendix

**Table 2**

Labor Productivity Decomposition

| | 1961-1973 | 1974-1979 | 1980-1993 | 1994-2007 | 2008-2017 |
|---|---|---|---|---|---|
| Labor Productivity | 9.79% | 2.58% | -0.13% | 2.38% | -0.77% |
| Capital Deepening | 2.52% | 2.13% | 0.45% | 0.67% | 0.79% |
| TFP | 7.26% | 0.44% | -0.58% | 1.71% | -1.56% |

Source: Authors' calculations

**Table 3**

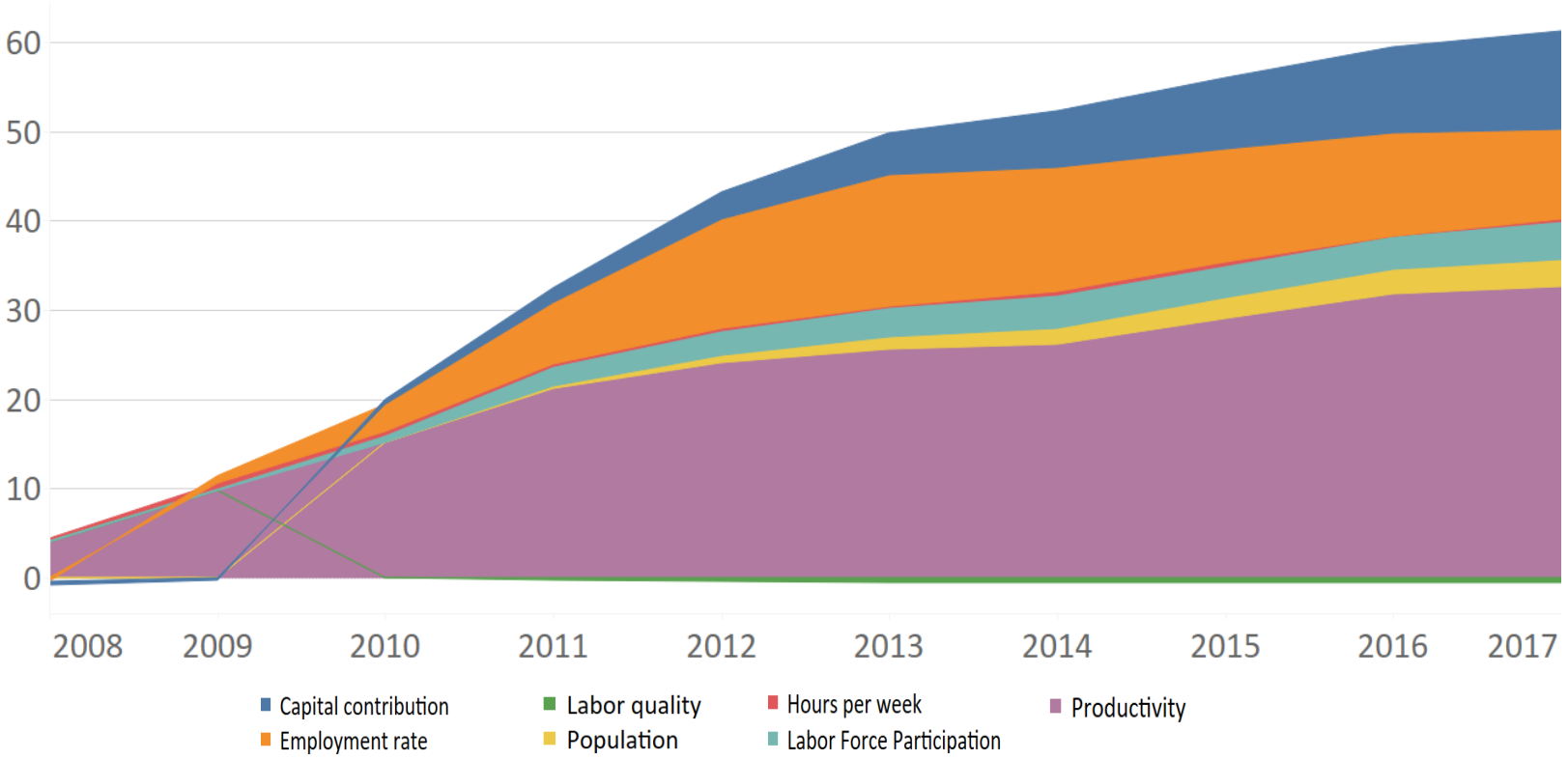
Breakpoint Tests

| | ADF Test | Unit Root with Break | Bai-Perron | | |
|---|---|---|---|---|---|
| | | | sequential | global | information criteria |
| GDP per Capita | Stationarity | stationarity with break in 1974 | break in 1974<br>break in 2008 | rejects the null of no breaks, global optimizers for two breaks: 1974, 2008 | break in 1974<br>break in 2008 |
| Labor Productivity | Stationarity | stationarity with break in 1973 | break in 1974 | rejects the null of no breaks, global optimizers for one break: 1974, 2008 | break in 1974 |
| TFP | Stationarity | stationarity with break in 1974 | break in 1972 | rejects the null of no breaks, global optimizers for one break: 1972 | break in 1972 |

Source: Authors' calculations

**Figure 8**

Components of Shortfall (1994-2007 trend)




Source: Authors' calculations

The shortfall for each factor is first calculated yearly as the counterfactual % change based on the 1994-2007 trend minus the actual % change. For the chart, we aggregate the previous results up to a given year in order to obtain the cumulative shortfall for that year. For example, 2011 figures show the cumulative shortfall over 2008, 2009, 2010, and 2011.

## Table 5

Components of the Shortfall of Output Two, Five and Ten Years into the Depression (1994-2007 trend)

| Year(s) | *Output* = | *Productivity* + | *Capital contribution* + | *Population* + | *Labor-Force Participation* + | *Employment rate* + | *Hours per week* + | *Labor quality* |
|---|---|---|---|---|---|---|---|---|
| 2008 | 3.6 | 4.0 | -0.4 | 0.0 | 0.3 | -0.4 | 0.2 | 0.0 |
| 2009 | 7.6 | 5.8 | 0.2 | 0.0 | 0.0 | 1.3 | 0.4 | 0.0 |
| 2010 | 8.7 | 5.3 | 0.7 | 0.1 | 0.6 | 2.2 | -0.1 | 0.0 |
| 2011 | 12.3 | 6.0 | 1.1 | 0.2 | 1.4 | 3.9 | -0.1 | -0.2 |
| 2012 | 10.5 | 3.0 | 1.5 | 0.5 | 0.6 | 5.3 | 0.0 | -0.3 |
| 2013 | 6.5 | 1.5 | 1.6 | 0.6 | 0.5 | 2.5 | -0.1 | -0.1 |
| 2014 | 2.5 | 0.4 | 1.7 | 0.5 | 0.4 | -0.8 | 0.3 | 0.0 |
| 2015 | 3.7 | 2.9 | 1.7 | 0.5 | 0.0 | -1.3 | -0.1 | 0.0 |
| 2016 | 3.5 | 2.8 | 1.6 | 0.3 | 0.1 | -1.1 | -0.3 | 0.0 |
| 2017 | 1.8 | 0.8 | 1.5 | 0.3 | 0.5 | -1.6 | 0.2 | 0.0 |
| 2007 through 2010 | 19.9 | 15.1 | 0.4 | 0.0 | 0.9 | 3.1 | 0.4 | 0.0 |
| 2007 through 2013 | 49.2 | 25.6 | 4.6 | 1.3 | 3.3 | 14.7 | 0.2 | -0.5 |
| 2007 through 2017 | 60.7 | 31.8 | 9.6 | 2.7 | 3.7 | 11.6 | 0.1 | -0.6 |

Source: Authors' calculations

**Table 6**

Growth Decomposition With Capital and Labor Services

| | | | Labor Input breaks into: | | | | Capital Services break into: | | |
|---|---|---|---|---|---|---|---|---|---|
| | GDP | Labour Input | Total Employment | Average Hours | Labor Composition | Capital Services | Net/Productive capital Stock | Quality Effect | TFP |
| 1997-2007 | 3.99% | 0.99% | 0.89% | -0.09% | 0.19% | 1.54% | 1.47% | 0.07% | 1.45% |
| 2008-2017 | -3.29% | -1.28% | -1.45% | -0.04% | 0.21% | -0.06% | 0.16% | -0.22% | -1.70% |

Source: Authors' calculations

**Table 7**

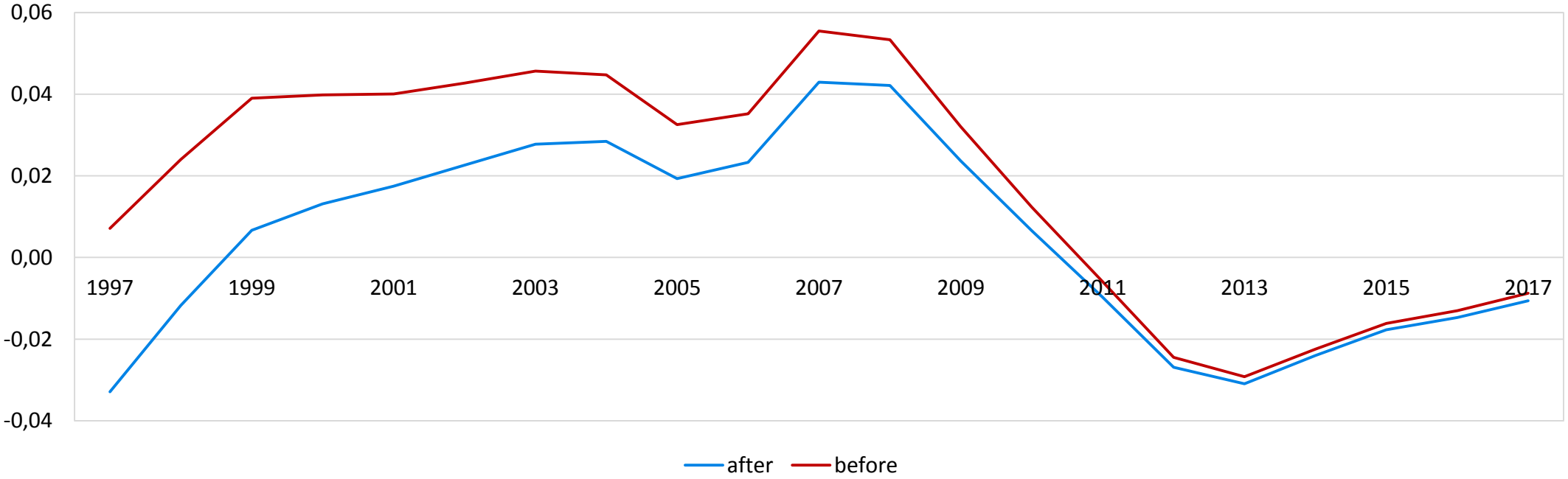
Growth Decomposition with Capital Stocks and Total Hours Worked

| | GDP | Labor Input | Labour Input breaks into: Total Employment | Average Hours | Net Capital Stock | TFP |
|---|---|---|---|---|---|---|
| 1997-2007 | 3.99% | 0.80% | 0.89% | -0.09% | 1.38% | 1.80% |
| 2008-2017 | -3.29% | -1.51% | -1.46% | -0.04% | 0.03% | -1.56% |

Source: Authors' calculations

**Figure 11**

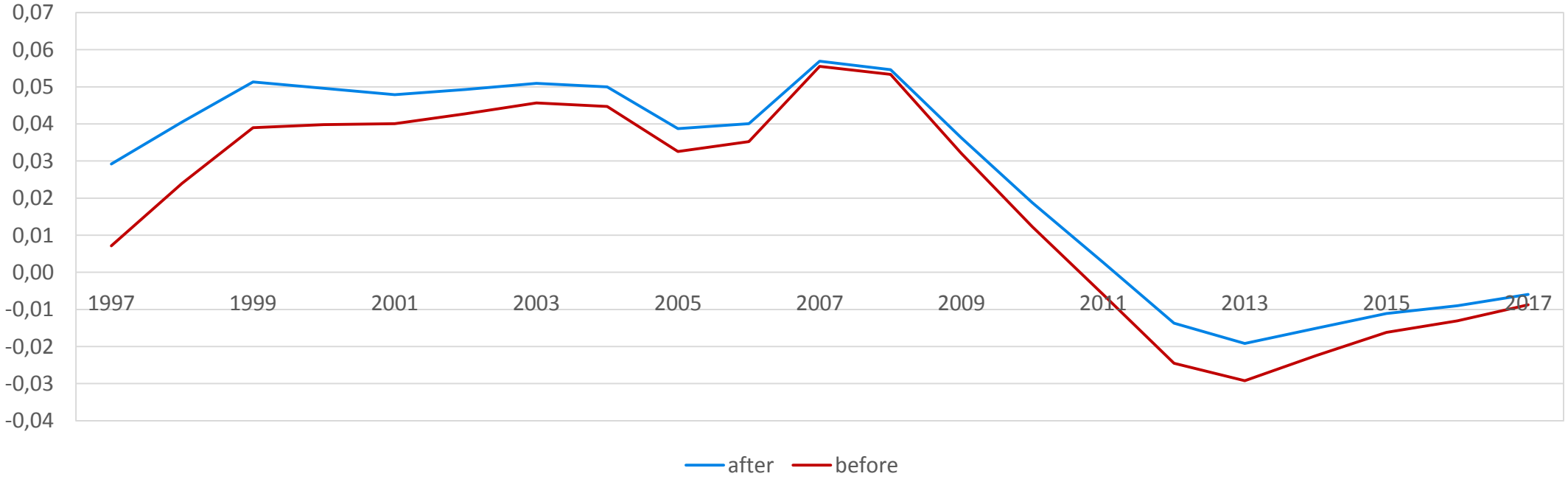
Capital services growth rates before and after a 50% increase in initial stocks




Source: Authors' calculations

**Figure 12**

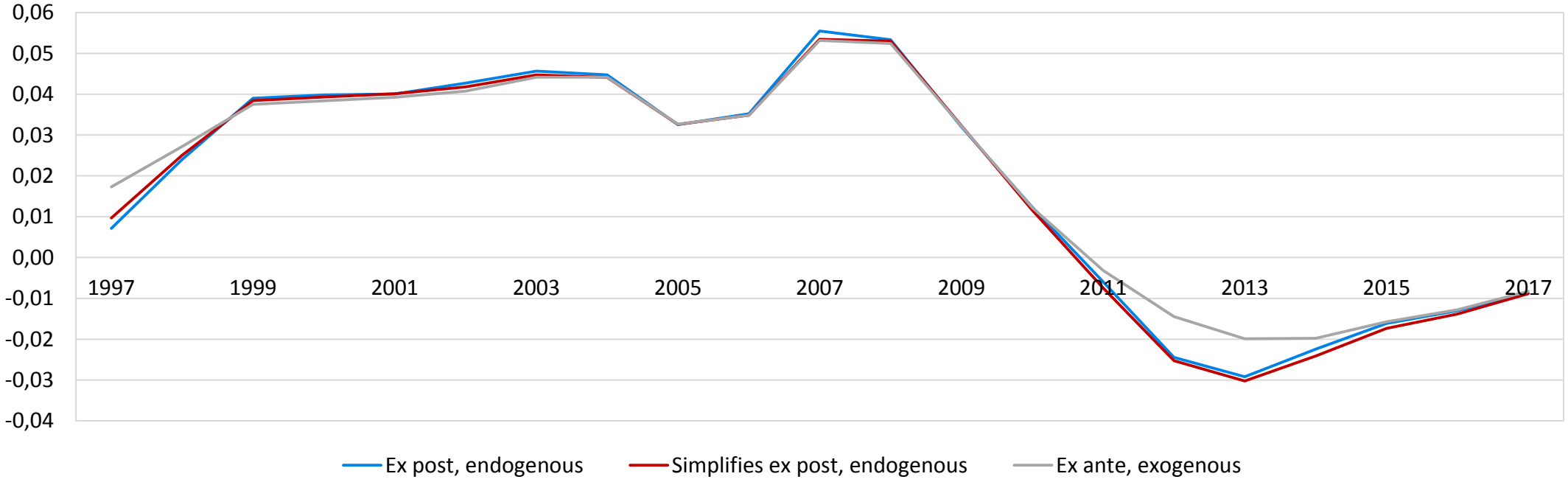
Capital services rate of change before and after a 25% decrease in all depreciation rates




Source: Authors' calculations

**Figure 13**

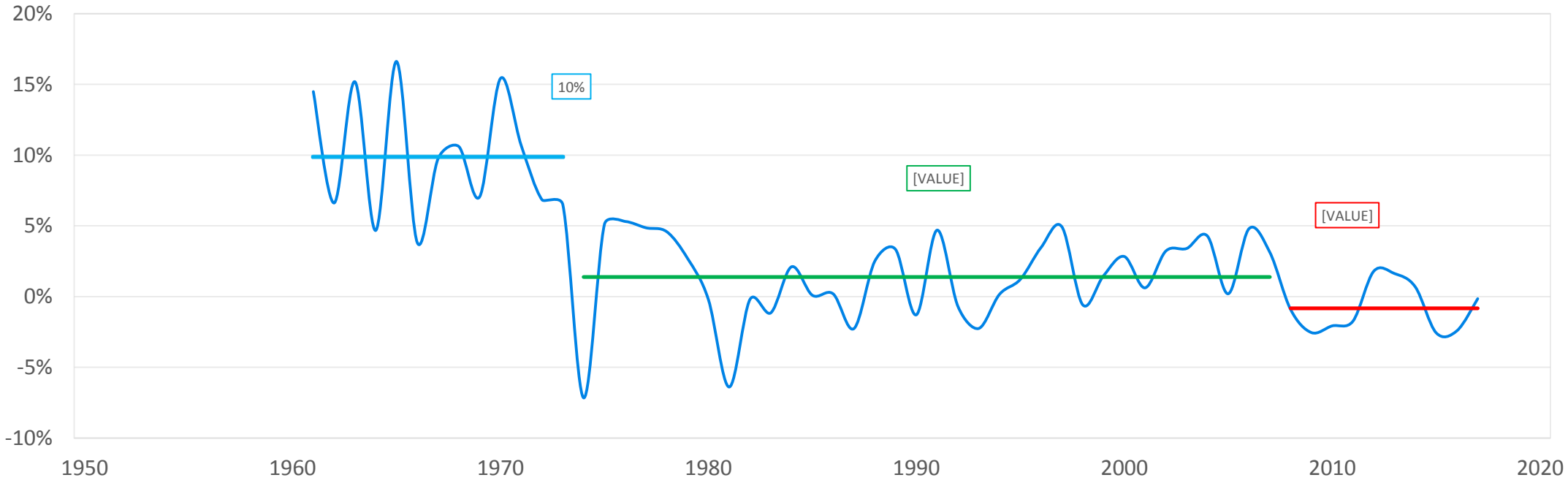
Tornqvist Indices




Source: Authors' calculations

**Figure 5**

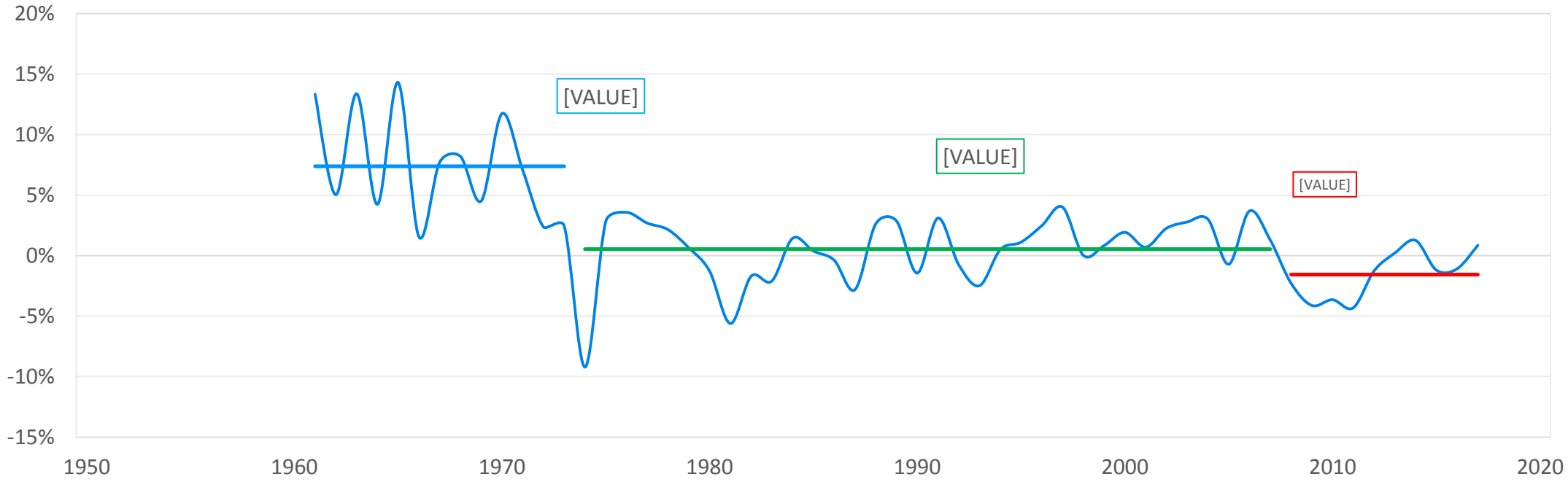
Labor Productivity Growth Rate




Source: Authors' calculations

**Figure 6**

TFP Growth Rate




Source: Authors' calculations