

Modeling Great Depressions: The Depression in Finland in the 1990s

Data Appendix

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Original Data for Finland: Description

- O.1 Gross Capital Formation (millions of euros)
- O.2 Gross Capital Formation (millions of 2000 euros)
- O.3 Taxes less Subsidies (millions of euros)
- O.4 Consumption of Fixed Capital (millions of euros)
- O.5 GDP (millions of euros)
- O.6 GDP (millions of 2000 euros)
- O.7 Compensation of Employees (millions of euros)
- O.8 Households Gross Operating Surplus and Mixed Income (millions of euros)
- O.9 Households Consumption of Fixed Capital (millions of euros)
- O.10 Household Final Consumption Expenditure (millions of euros)
- O.11 Final Consumption Expenditure of NPISH's (millions of euros)
- O.12 Government Final Consumption Expenditure (millions of euros)
- O.13 Final Consumption (millions of euros)
- O.14 Final Consumption (millions of 2000 euros)
- O.15 Exports (millions of euros)
- O.16 Exports (millions of 2000 euros)
- O.17 Imports (millions of euros)
- O.18 Imports (millions of 2000 euros)
- O.19 Gross Capital Formation (billions national currency)
- O.20 GDP at market prices (billions national currency)
- O.21 Real GDP (Index 2000=100)
- O.22 Unit Value of Exports (Index 1995=100)
- O.23 Export Prices (Index 2000=100)
- O.24 Unit Value of Imports (Index 1995=100)
- O.25 Import Goods (Index 2000=100)
- O.26 Population 15-64 (thousands)
- O.27 Total hours worked (thousands)
- O.28 1100 = Taxes on income, profits, and capital gains of individuals (millions of euros)
- O.29 1200 = Taxes on income, profits and capital gains of corporations (millions of euros)
- O.30 2000 = Total social security contributions (millions of euros)
- O.31 2200 = Employer's contributions to social security (millions of euros)
- O.32 3000 = Taxes on payroll and workforce (millions of euros)
- O.33 4100 = Recurrent taxes on immovable property (millions of euros)
- O.34 4400 = Taxes on financial and capital transactions (millions of euros)
- O.35 5110 = General taxes on goods and services (millions of euros)
- O.36 5121 = Excise taxes (millions of euros)

- O.37 GDP (millions of 1990 Geary-Khamis dollars)
- O.38 Population 15-64 (number)

Original Data for Finland: Source

- O.1-O.18 OECD Annual National Accounts - Volume 2, 1970-2005 - Detailed Aggregates
- O.19-O.25 International Financial Statistics CD-ROM, International Monetary Fund
- O.26 OECD Employment Statistics, <http://www.sourceoecd.org>
- O.27 Groningen Growth and Development Center GGDC, available on-line
- O.28-O.36 OECD Details of Tax Revenues of Member Countries
- O.37 Angus Maddison, Historical Statistics, *World Population, GDP and Per Capita GDP, 1-2001 AD*
- O.38 Statistics Finland, <http://tilastokeskus.fi>¹

Constructed Series for Finland: Description

- C.1 GDP at market prices (2000 million euros)
- C.2 Gross capital formation (2000 million euros)
- C.3 Capital Stock (2000 million euros)
- C.4 Effective tax rate on consumption
- C.5 Effective tax rate on labor income
- C.6 Effective tax rate on capital income
- C.7 Relative price of investment (Index 2000 = 1)
- C.8 Capital Stock in 2 sector model (2000 million euros)
- C.9 Terms of trade (Index 2000 = 1)
- C.10 Price of consumption-investment relative to exports (Index 2000 = 1)
- C.11 Capital Stock in open economy model (2000 million euros)
- C.12 GDP (2000 million euros)
- C.13 Population 15-64 (thousands)

Construction of Series

C.1 For the period 1970-2005 it is O.6. Prior to 1970 it is the series O.21 relative to its 1970 value and applied to O.6 in 1970.

C.2 First, we compute gross capital formation at current prices. For the period 1970-2005 it is O.1. Prior to 1970 it is the series O.19 relative to its 1970 value and applied to O.1 in 1970. Next, we need to deflate this series by the GDP deflator. We construct GDP at market prices in current euros. For the period 1970-2005 it is O.5. Prior to 1970 it is the series O.20 relative to its 1970 value and applied to O.5 in 1970. GDP at current euros relative to C.1 yields the GDP deflator. Finally, we divide gross capital formation at current prices 1960-2005 by the GDP deflator.

¹ Specifically, click Home > Statistics > Statistics by topic > Population > Population structure > Tables

C.3 The capital stock was generated using a perpetual inventory method. Given an initial capital stock in 1960, real investment 1960-2005 (C.2) was cumulated using the law of motion of capital:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

with a depreciation rate of 0.0556. The depreciation rate was chosen to match the average depreciation-output ratio obtained in the data 0.4/0.5 (equal to 16.9%). The initial capital stock was chosen iteratively such that the capital-output ratio in 1960 matched the average capital-output ratio over the period 1961-1970 (equal to 3.0065).

C.4-C.5-C.6 First, notice that households' net operating surplus and mixed income, 0.8-0.9, is non-wage income of the households. Unfortunately these numbers are only available since 1995. In order to recover non-wage income for previous periods, we assume that it has been throughout the previous periods a fraction of GDP equal to the average for the available years.

We are defining the labor income share as unambiguous labor income divided by the sum of unambiguous labor income and unambiguous capital income. Therefore, we need to subtract from GDP the ambiguous categories 0.8-0.9 and Net Taxes, 0.3. Then, we compute the aggregate economy labor income share, denoted by θ , as:

$$\theta = \frac{0.7}{0.5 - (0.8 - 0.9) - 0.3}$$

We finally match model variables with data as follows in order to define the tax base:

Consumption	0.10+0.11
Labor Income	$\theta \times (0.5 - 0.3)$
Net Capital Income	$(1 - \theta) \times (0.5 - 0.3) - 0.4$

The tax rates are computed as:

Consumption tax rate:

$$\tau_c = \left[\frac{0.35 + 0.36}{0.10 + 0.11 - 0.35 - 0.36} \right]$$

In order to construct labor and capital income taxes, we proceed as follows. As an intermediate step, first we compute the aggregate marginal tax rate on household's income:

$$\tau_h = adj \times \left[\frac{0.28}{0.7 - 0.31 + (0.8 - 0.9)} \right]$$

where adj is an adjustment factor to transform average into marginal tax rates, that we assume to be 1.6.

Finally, the marginal tax rate on labor income is computed as:

$$\tau_l = \left[\frac{\tau_h \times [0.7 - 0.31 + \theta \times (0.8 - 0.9)] + 0.30 + 0.32}{\theta \times (0.5 - 0.3)} \right]$$

and the marginal tax rate on capital is:

$$\tau_k = \left[\frac{\tau_h \times (1 - \theta) \times (0.8 - 0.9) + 0.29 + 0.33 + 0.34}{(1 - \theta) \times (0.5 - 0.3) - 0.4} \right]$$

C.7 It is $(0.1/0.2) / ((0.5-0.1) / (0.6-0.2))$ for the period 1970-2005. Using this series, we extrapolate backwards to find the relative price of investment prior to 1970.

C.8 The capital stock was generated using a perpetual inventory method. Given an initial capital stock in 1960, real investment 1960-2005 was cumulated using the law of motion of capital:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

with a depreciation rate of 0.0630. The depreciation rate was chosen to match the average depreciation-output ratio obtained in the data $0.4/0.5$ (equal to 16.9%). For 1970-2005 real investment is 0.2. Prior to 1970 real investment is nominal investment divided by the GDP price index and the investment price index relative to the GDP price index. Nominal investment is 0.19 relative to its value in 1970 and applied to 0.1 in 1970. The GDP price index is $(0.20/0.21)$ relative to its 1970 value and applied to $(0.5/0.6)$ in 1970. The investment price index is $(0.1/0.2)$ for the years 1970-2005. Using this series, along with the GDP price index $(0.5/0.6)$ for the years 1970-2005, we extrapolate backwards to find the investment price index relative to the GDP price index for the years prior to 1970. In this way, we are able to then construct real investment prior to 1970. The initial capital stock was chosen iteratively such that the capital-output ratio in 1960 matched the average capital-output ratio over the period 1961-1970 (equal to 2.7434), as described in the paper.

C.9 For the period 1970-2005 the terms of trade are the import price index $(0.17/0.18)$ divided by the export price index $(0.15/0.16)$. Prior to 1970 the import price index is constructed as follows: 1963-1970 is 0.25. Prior to 1963 it is 0.24 relative to its 1963 value and applied to 0.25 in 1963. Prior to 1970 the export price index is constructed as follows: 1963-1970 is 0.23. Prior to 1963 it is 0.22 relative to its 1963 value and applied to 0.23 in 1963. Prior to 1970 the terms of trade are the pre-1970 import price index divided by the pre-1970 export price index relative to this value in 1970 and applied to the 1970-2005 terms of trade in 1970.

C.10 It is the consumption-investment price index divided by the export price index. For the period 1970-2005 the consumption-investment price index is $(0.13+0.1)/(0.14+0.2)$. Prior to 1970 the consumption-investment price index is the GDP deflator (see C.2 above) relative to its 1970 value and applied to $(0.13+0.1)/(0.14+0.2)$ in 1970. For the period 1960-2005 the export price index is constructed the same way as in C.9 above.

C.11 The capital stock was generated using a perpetual inventory method. Given an initial capital stock in 1960, real investment 1960-2005 was cumulated using the law of motion of capital:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

with a depreciation rate of 0.0583. Real investment is nominal investment divided by the consumption-investment price index. Nominal investment is O.1 for the years 1970-2005. Prior to 1970 nominal investment is O.13 relative to its value in 1970 and applied to O.1 in 1970. The consumption-investment price index is constructed the same way as in C.10 above. The depreciation rate was chosen to match the average depreciation-output ratio obtained in the data O.4/O.5 (equal to 16.9%). The initial capital stock was chosen iteratively such that the capital-output ratio in 1960 matched the average capital-output ratio over the period 1961-1970 (equal to 3.0462), as described in the paper.

C.12 For the period 1970-2005 it is O.6. Prior to 1970 it is O.37 relative to its 1970 value and applied to O.6 in 1970.

C.13 For the period 1960-2005 it is O.26. Prior to 1960 it is O.38 relative to its 1960 value and applied to O.26 in 1960.

Figures for Finland:

Figure 2: The solid line is the log with base 2 of C.12 divided by C.13. The dashed line is the log with base 2 of the 2 percent annual trend.

Figure 3: The solid line is O.6 divided by O.26 and detrended by 2 percent per year. The dashed line is the C.12 divided by C.13 and detrended by 2 percent per year.

Figure 5: The solid line, Y/N , is C.1 divided by O.26. The solid line, L/N , is O.27 divided by O.26. The dashed line, $A^{1-\alpha}$, is calculated as

$$A_t^{1-\alpha} = [Y_t / (K_t^\alpha L_t^{1-\alpha})]^{1-\alpha},$$

where $\alpha = .3590$, C.3 is the capital stock, O.27 is total hours worked, and C.1 is output. The

capital stock, C.3, and output, C.1, are used to calculate the dashed line, $\left(\frac{K}{Y}\right)^{\frac{\alpha}{1-\alpha}}$, where again

$\alpha = .3590$. α is constructed by first constructing the aggregate economy labor income share, as described above under the heading "C.4-C.5-C.6".

Figure 6: The solid line is O.6 divided by O.26 and detrended by 2 percent per year. The dashed lines are analogues from the models.

Figure 7: The solid line is O.27 divided by (O.26)*52. The dashed lines are analogues from the models.

Figure 8: The solid line is C.3 divided by C.1. The dashed lines are analogues from the models.

Figure 9: The solid line, consumption tax, is C.4. The dashed line, labor income tax, is C.5. The dashed line, capital income tax, is C.6

Figure 10: Note, the figure appearing in *Great Depressions of the Twentieth Century* is a misprint. The solid line should be $O.12$ divided by $O.5$.

Figure 11: The solid line is $O.6$ divided by $O.26$ and detrended by 2 percent year. The dashed lines are analogues from the models.

Figure 12: The solid line is $O.27$ divided by $(O.26)*52$. The dashed lines are analogues from the models.

Figure 13: The solid line is $C.3$ divided by $C.1$. The dashed lines are analogues from the models.

Figure 14: The solid line is $C.7$.

Figure 15: The solid line is $O.6$ divided by $O.26$ and detrended by 2 percent per year. The dashed lines are analogues from the models.

Figure 16: The solid line is $O.27$ divided by $(O.26)*52$. The dashed lines are analogues from the models.

Figure 17: The solid line is $C.8$ divided by $C.1$. The dashed lines are analogues from the models.

Figure 18: The solid line is $C.9$, and the dashed line is $C.10$.

Figure 19: The solid line is $O.6$ divided by $O.26$ and detrended by 2 percent per year. The dashed lines are analogues from the models.

Figure 20: The solid line is $O.27$ divided by $(O.26)*52$. The dashed lines are analogues from the models.

Figure 21: The solid line is $C.11$ divided by $C.1$. The dashed lines are analogues from the models.

Figure 22: The solid line is the TFP component constructed as in Figure 5 and detrended by 2 percent per year. The dashed lines are analogues from the models.

Original Data for USA: Description

- O.1 GDP (billions of dollars)
- O.2 Gross Domestic Investment (billions of dollars)
- O.3 Consumption of Fixed Capital (billions of dollars)
- O.4 Net Taxes (billions of dollars)
- O.5 Compensation of Employees (billions of dollars)
- O.6 Proprietors' Income (billions of dollars)
- O.7 GDP (billions of 2000 dollars)
- O.8 Gross Fixed Capital Formation (billions of dollars)
- O.9 Changes in Inventories (billions of dollars)
- O.10 GDP (billions of dollars)
- O.11 GDP deflator (Index 2000 = 100)
- O.12 Population 15-64 (thousands)
- O.13 Total hours worked (thousands)
- O.14 GDP (millions of 1990 Geary-Khamis dollars)
- O.15 GDP (billions of 2000 dollars)
- O.16 Population 15-64 (thousands)

Original Data for USA: Source

- O.1-O.7 Economic Report of the President
- O.8-O.11 International Financial Statistics CD-ROM, International Monetary Fund
- O.12-O.13 Groningen Growth and Development Center GGDC, available on-line
- O.14 Angus Maddison, Historical Statistics, *World Population, GDP and Per Capita GDP, 1-2001 AD*
- O.15 Bureau of Economic Analysis
- O.16 Statistical Abstract of the United States

Constructed Series for USA: Description

- C.1 GDP at market prices (2000 billion dollars)
- C.2 Gross capital formation (2000 billion dollars)
- C.3 Capital Stock (2000 billion dollars)
- C.4 GDP (2000 billion dollars)
- C.5 Population 15-64 (thousands)

Construction of Series

- C.1 For the period 1959-2005 it is O.7. Prior to 1959 it is the series $O.10 * 100 / O.11$.
- C.2 For the period 1959-2005 it is $O.2 / (O.1 / O.7)$. Prior to 1959 it is the series $(O.8 + O.9) * 100 / O.11$.

C.3 The capital stock was generated using a perpetual inventory method. Given an initial capital stock in 1954, real investment 1954-2005 (C.2) was cumulated using the law of motion of capital:

$$K_{t+1} = (1 - \delta)K_t + I_t.$$

with a depreciation rate of 0.0429. The depreciation rate was chosen to match the average depreciation-output ratio obtained in the data O.3/O.1 (equal to 11.3%). The initial capital stock was chosen iteratively such that the capital-output ratio in 1954 matched the average capital-output ratio over the period 1955-1959 (equal to 2.6739).

C.4 For the period 1929-2005 it is O.15. Prior to 1929 it is O.14 relative to its 1929 value and applied to O.15 in 1929.

C.5 For the period 1900-2002 it is O.16. After 2002 it is O.12 relative to its value in 2002 and applied to O.16 in 2002.

Figures for USA:

Figure 1: The solid line is the log with base 2 of C.4 divided by C.5. The dashed line is the log with base 2 of the 2 percent annual trend.

Figure 4: The solid line, Y/N , is C.1 divided by O.12. The solid line, L/N , is O.13 divided by O.12. The dashed line, $A^{\frac{1}{1-\alpha}}$, is calculated as

$$A_t^{\frac{1}{1-\alpha}} = [Y_t / (K_t^\alpha L_t^{1-\alpha})]^{\frac{1}{1-\alpha}},$$

where $\alpha = .3250$, C.3 is the capital stock, O.13 is total hours worked, and C.1 is output. The

capital stock, C.3, and output, C.1, are used to calculate the dashed line, $\left(\frac{K}{Y}\right)^{\frac{\alpha}{1-\alpha}}$, where again

$\alpha = .3250$. α is found by first constructing labor's share of income, $1 - \alpha_t$, from the data, which is $\frac{O.5}{O.1 - O.4 - O.6}$, and then averaging over the period 1959-2005.