

Table 1: National primary school reforms

| Reform Year | Content of the reform |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1889 | Increased school year. Maximum class size set to 40 in urban areas and 35 in rural areas. Minimum teacher wage introduced. New compulsory subjects were geography, history and physical education. |
| 1915 | Increased school year in rural areas. |
| 1917 | Increased school year in urban areas. Maximum class size reduced to 35 in urban areas. |
| 1920 | Introduction of the 7 years comprehensive school. Before 1920, the students could choose between a 7 years primary education and 5+4 years of continuation to secondary school. |
| 1936 | Increased school year in rural areas. Maximum class size reduced to 30. More emphasize on practical and esthetic subjects. |
| 1955 | Increased school year in rural areas. |
| 1959 | Equalization of the school systems in rural and urban areas. Experiments with 9 years compulsory school started up. Increased emphasis on auxiliary teaching. |
| 1969 | 9 years compulsory school for all. Increased school year. Major changes in the content of the subjects, including increased discretion for the schools. This law was decided by the parliament in 1969 and implemented in 1971. |
| 1975 | The responsibility for disabled children was taken over by the local governments to integrate them in ordinary schools. |
| 1987 | Change of national curriculum. |

Table 2: Accounting for the growth in school spending; 10 year average growth rates

| Year | Total spending per capita | Teacher wage | Non-wage spending per teacher | Teachers per class | Classes per student | Student share |
|---------------------|---------------------------|--------------|-------------------------------|--------------------|---------------------|---------------|
| 1880s | 3.02 | 1.97 | 0.68 | 0.71 | -0.55 | 1.12 |
| 1890s | 3.65 | 0.89 | 3.16 | 0.97 | 0.65 | 0.71 |
| 1900s | 3.44 | 2.82 | 1.59 | 0.00 | 0.42 | 0.43 |
| 1910s | 3.96 | 1.31 | 4.72 | 1.98 | 0.44 | -0.50 |
| 1920s | 3.67 | 4.69 | 2.85 | -0.29 | -0.07 | -0.24 |
| 1930s ¹⁾ | 1.06 | -0.28 | 3.90 | 1.14 | 1.12 | -1.94 |
| 1950s | 4.47 ²⁾ | 3.60 | -3.83 ³⁾ | 2.14 | -1.90 | 3.29 |
| 1960s | - | 1.98 | - | 3.08 | -0.55 | -0.34 |
| 1970s | 3.16 ⁴⁾ | 0.95 | 0.29 ⁵⁾ | 1.43 | 0.17 | -0.18 |
| 1980s | 0.24 | 0.04 | -1.85 | 2.23 | 0.84 | -2.66 |

Deflated with the consumer price index. ¹⁾1930 - 1939. ²⁾1950 - 1959. ³⁾1950 - 1957. ⁴⁾1971 - 1980. ⁵⁾1973 - 1980.

Table 3: Determinants of legislative school reforms

| | Mean | (1) | (2) | (3) | (4) | (5) |
|----------------------------------------------------|---------------------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|--------------------------------|
| Change in log of real GDP per capita | 0.0239 {0.0248} | -0.401 (-0.05) [-0.07] | -5.126 (-0.54) [-0.73] | -6.166 (-0.67) [-0.94] | - | - |
| Deviation from trend in log of real GDP per capita | 0.00081 {0.0233} | 10.61 (0.93) [1.79] | 5.485 (0.35) [0.78] | 10.76 (0.76) [1.65] | - | - |
| Inflation | 0.0326 {0.0550} | 6.762 (1.95)* [1.14] | -0.350 (-0.08) [-0.05] | 3.648 (0.91) [0.56] | - | - |
| Change in log of student share of the population | 0.00073 {0.0162} | 4.465 (0.43) [0.75] | 14.71 (0.62) [2.10] | -13.52 (-0.85) [-2.07] | - | - |
| Change in log of divorce rate | 0.0571 {0.0731} | 1.970 (0.70) [0.33] | 1.972 (0.45) [0.28] | 4.099 (1.24) [0.63] | - | - |
| Socialist share in the parliament | 0.310 {0.210} | - | 7.594 (2.11)** [1.08] | 2.898 (1.70)* [0.44] | 5.649 (2.46)** [0.82] | 1.943 (1.73)* [0.31] |
| Liberal or socialist government | 0.678 {0.319} | - | 2.609 (1.73)* [0.37] | 0.736 (0.96) [0.11] | 2.130 (2.06)** [0.31] | 0.764 (1.14) [0.12] |
| Government with majority in the parliament | 0.511 {0.428} | - | 3.169 (2.32)** [0.45] | 1.582 (2.04)** [0.24] | 2.755 (2.82)** [0.40] | 1.245 (2.24)** [0.20] |
| Total duration of the government in years | 6.801 {6.359} | - | -0.283 (-1.81)* [-0.040] | - | -0.206 (-2.53)** [-0.030] | - |
| Accumulated duration of the government in years | 4.155 {4.186} | - | - | -0.087 (-0.99) [-0.013] | - | -0.117 (-1.50) [-0.019] |
| Constant | - | -1.702 (-4.32)** [-0.29] | -5.655 (-2.80)** [-0.81] | -3.644 (-2.96)** [-0.56] | -4.913 (-3.26)** [-0.71] | -2.699 (-3.88)** [-0.43] |
| SSR | | 8.410 | 7.841 | 7.990 | 7.921 | 8.608 |
| Log-likelihood | | -29.15 | -24.69 | -26.33 | -25.21 | -28.05 |

Probit estimation where the depended variable is equal to 1 in the reform years and 0 otherwise. All explanatory variables are 4 year averages. t-values in (), mean probability derivatives in [], and standard deviations in { }. The sample period is 1887 - 1939, 1950 - 1990, where the starting point is restricted by the introduction of parliamentarism in 1884. * and ** denote significance at 10% and 5% respectively.

Table 4: Stability of the reform model

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|--------------------------------------------|--------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|-------------------------------|
| Socialist share in the parliament | 7.668 (1.87)* [0.85] | 5.958 (1.71)* [0.76] | 5.564 (1.63) [0.79] | 6.750 (2.44)** [0.92] | 5.515 (2.34)** [0.83] | 5.924 (2.52)** [0.86] | -15.06 (-0.70) [-2.64] |
| Liberal or socialist government | 4.815 (1.50) [0.53] | 2.642 (1.63) [0.34] | 2.554 (1.60) [0.36] | 2.195 (1.94)* [0.30] | 2.161 (2.01)** [0.33] | 2.287 (2.14)** [0.33] | 2.597 (1.12) [0.46] |
| Government with majority in the parliament | 3.699 (1.66)* [0.41] | 2.646 (1.90)* [0.34] | 2.485 (1.81)* [0.35] | 2.963 (2.66)** [0.40] | 2.354 (2.41)** [0.36] | 2.753 (2.82)** [0.40] | 2.924 (1.59) [0.51] |
| Total duration of the government in years | -0.725 (-1.08) [-0.080] | -0.236 (-1.97)** [-0.030] | -0.206 (-1.83)* [-0.029] | -0.244 (-2.54)** [-0.033] | -0.201 (-2.39)** [-0.030] | -0.220 (-2.64)** [-0.032] | -0.139 (-1.03) [-0.024] |
| Constant | -5.915 (-2.72)** [-0.65] | -5.153 (-2.86)** [-0.66] | -5.025 (-2.85)** [-0.71] | -5.093 (-3.10)** [-0.69] | -4.594 (-3.11)** [-0.70] | -5.005 (-3.27)** [-0.72] | 4.409 (0.46) [0.77] |
| Sample period | 1887-1937 | 1887-1956 | 1887-1960 | 1887-1970 | 1887-1976 | 1887-1988 | 1949-1990 |
| No. of reforms in sample | 5 | 6 | 7 | 8 | 9 | 10 | 5 |
| SSR | 3.671 | 4.713 | 5.552 | 6.129 | 7.261 | 7.898 | 3.845 |
| Log-likelihood | -10.65 | -14.58 | -17.15 | -18.99 | -22.71 | -24.96 | -13.28 |

The model is specified as Model (4) Table 3. The sample period, excluding 1940 - 1948, is increased throughout the first part of the table to capture the next reform +1 year. The sample period in the last column is the post-WW2 period.

Table 5: Robustness of the reform model specification

| | (1) | (2) | (3) | (4) | (5) | (6) |
|------------------------------------------------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------------------|
| Number of year averages in the explanatory variables | 1 | 2 | 3 | 4 | 5 | 6 |
| Socialist share in the parliament | 1.090 (0.83) [0.20] | 2.742 (1.56) [0.45] | 4.271 (2.14)** [0.67] | 5.453 (2.40)** [0.80] | 4.566 (2.21)** [0.71] | 3.945 (2.11)** [0.64] |
| Liberal or socialist government | 0.465 (0.98) [0.08] | 1.404 (1.92)* [0.23] | 1.754 (2.01)** [0.27] | 2.177 (2.13)** [0.32] | 1.727 (1.76)* [0.27] | 0.974 (1.00) [0.16] |
| Government with majority in the parliament | 0.547 (1.15) [0.10] | 1.393 (1.96)* [0.23] | 2.147 (2.56)** [0.34] | 2.770 (2.87)** [0.41] | 2.334 (2.60)** [0.37] | 2.155 (2.51)** [0.35] |
| Total duration of the government in years | -0.002 (-0.51) [-0.000] | -0.092 (-1.51) [-0.015] | -0.151 (-2.14)** [-0.024] | -0.201 (-2.52)** [-0.029] | -0.168 (-2.23)** [-0.026] | -0.138 (-1.95)* [-0.023] |
| Constant | -2.050 (-3.30)** [-0.37] | -3.337 (-3.16)** [-0.55] | -4.144 (-3.30)** [-0.65] | -4.882 (-3.30)** [-0.71] | -4.149 (-3.26)** [-0.65] | -3.466 (-3.17)** [-0.56] |
| SSR | 8.605 | 8.327 | 7.952 | 7.827 | 8.210 | 8.355 |
| Log-likelihood | -30.17 | -27.68 | -26.04 | -24.63 | -26.36 | -27.43 |

The model is specified as Model (4) Table 3. The number of years used to calculate the explanatory variables are specified in row 2. The sample period is 1889 - 1939, 1951 - 1990.

Table 6: Economic and political determinants of school spending components

| Dependent variable | Teacher input per class | Class size | Teacher real wage |
|-------------------------------------------------|------------------------------|-----------------|------------------------------|
| Real GDP per capita | 1.65 (7.78) | - | 0.76 (8.35) |
| Student share of the population | - | 0.35 (9.46) | 0.38 (1.69) |
| Population size | -3.40 (4.46) | -0.26 (5.22) | - |
| Divorce rate | - | -0.03 (5.02) | - |
| Elderly share of the population | - | 0.42 (9.31) | - |
| Index for geographical income variation | - | - | 0.15 (2.89) |
| Socialist share in the parliament | 0.10 ^a (1.72) | - | 0.23 ^a (2.80) |
| Minority coalition government | - | - | -0.11 ^b (2.30) |
| Total duration of the government in years | -0.03 ^a (1.80) | - | - |
| Index for party fragmentation in the parliament | -0.12 ^a (2.57) | - | - |

The reported coefficients are long run elasticities, the calculations are based on Appendix Table A1. ^a Elasticity at mean. ^b Percentage effect. Absolute t-values in parentheses calculated with approximated large-sample variance.

Table 7: The effects of legislative reform

| | <u>Change in log of Teacher input per class</u> | <u>Change in log of Class size</u> | <u>Change in log of Real teacher wage</u> |
|-----------------------|-----------------------------------------------------|----------------------------------------|-----------------------------------------------|
| REFORM _{t-4} | 0.0054 (1.66) | 0.0044 (2.07)** | -0.0158 (1.38) |
| REFORM _{t-3} | 0.0103 (3.16)** | 0.0024 (1.13) | -0.0167 (1.47) |
| REFORM _{t-2} | 0.0064 (1.95)* | 0.0036 (1.76)* | -0.0125 (1.15) |
| REFORM _{t-1} | 0.0080 (2.62)** | 0.0047 (2.53)** | -0.0010 (0.10) |
| REFORM _t | 0.0053 (1.87)* | 0.0015 (0.78) | -0.0076 (0.71) |
| REFORM _{t+1} | 0.0006 (0.18) | 0.0039 (1.94)* | 0.0050 (0.43) |
| REFORM _{t+2} | 0.0161 (4.85)** | 0.0041 (1.90)* | -0.0239 (2.03)** |
| REFORM _{t+3} | 0.0127 (3.70)** | -0.0006 (0.25) | -0.0238 (1.88)* |
| REFORM _{t+4} | 0.0107 (2.71)** | 0.0026 (1.00) | 0.0009 (0.07) |
| F | 3.225 _{9,62} ** | 1.493 _{9,71} | 0.954 _{9,65} |

Absolute t-values in parentheses. F is an F-test for no effects of the dummy variables for reforms where lowered values are degrees of freedom. The rest of the models are reported in Appendix Table A1 columns (2a) - (2c). Sample period is 1885 - 1939, 1950 - 1990. * and ** denote significance at 10% and 5% level respectively.

Table 8: Quadratic functional form of legislative reform effects

| | <u>Change in log of Teacher input per class</u> | <u>Change in log of Class size</u> | <u>Change in log of Real teacher wage</u> |
|-----------------------------------|-----------------------------------------------------|----------------------------------------|-----------------------------------------------|
| REF _t | 0.0057 (3.00)** | 0.0023 (2.19)** | -0.0117 (1.94)* |
| REF _t ² | -0.0009 (2.33)** | -0.0004 (1.71)* | 0.0024 (1.94)* |
| REFPOST _t | 0.0104 (3.47)** | - | - |
| REFPOST _t ² | -0.0030 (3.87)** | - | - |
| F(no effects) | 6.762 _{4,67} ** | 5.351 _{2,78} ** | 3.760 _{2,72} ** |
| F(restrictions) | 0.568 _{5,62} | 0.464 _{7,71} | 0.233 _{7,65} |

Absolute t-values in parentheses. The variables are defined in the text. F(no effects) is an F-test of no effects of the reported variables, and F(restrictions) tests whether the models are allowable reductions of the models in Table 6, lowered values are degrees of freedom.

Appendix Table A1: The effect of the economic, demographic and political conditions

| Dependent variable | $\Delta(\text{Teacher input per class})_t$ | | | $\Delta(\text{Class size})_t$ | | | $\Delta(\text{Teacher real wage})_t$ | | |
|------------------------------------------------------|--------------------------------------------|------------------|------------------|-------------------------------|------------------|------------------|--------------------------------------|------------------|------------------|
| | (1a) | (2a) | (3a) | (1b) | (2b) | (3b) | (1c) | (2c) | (3c) |
| (Teacher input per class) _{t-1} | -0.131 (5.94) | -0.136 (6.45) | -0.140 (6.81) | - | - | - | - | - | - |
| (Class size) _{t-4} | - | - | - | -0.299 (8.68) | -0.304 (8.52) | -0.297 (8.88) | - | - | - |
| (Real teacher wage) _{t-1} | - | - | - | - | - | - | -0.232 (7.89) | -0.243 (8.06) | -0.284 (9.15) |
| (Real GDP per capita) _{t-1} | 0.216 (10.1) | 0.210 (11.1) | 0.216 (10.6) | - | - | - | 0.176 (9.26) | 0.170 (9.09) | 0.211 (9.33) |
| (Student share of the population) _{t-1} | - | - | - | 0.106 (6.00) | 0.107 (5.76) | 0.105 (6.12) | 0.088 (1.68) | 0.048 (0.83) | 0.147 (2.57) |
| (Elderly share of the population) _{t-1} | - | - | - | 0.126 (7.21) | 0.131 (7.21) | 0.128 (7.51) | - | - | - |
| (Divorce rate) _{t-1} | - | - | - | -0.009 (4.82) | -0.009 (4.32) | -0.009 (4.41) | - | - | - |
| (Population) _{t-1} | -0.446 (7.44) | -0.400 (7.36) | -0.405 (7.14) | -0.077 (3.94) | -0.087 (4.32) | -0.089 (4.39) | - | - | - |
| (Geographical income variation) _{t-1} | - | - | - | - | - | - | 0.273 (3.00) | 0.300 (3.08) | 0.283 (3.29) |
| $\Delta(\text{Teacher input per class})_{t-1}$ | 0.196 (2.89) | 0.104 (1.65) | 0.097 (1.61) | - | - | - | - | - | - |
| $\Delta^2(\text{Class size})_{t-1}$ | - | - | - | 0.550 (8.51) | 0.582 (8.90) | 0.581 (8.98) | - | - | - |
| $\Delta(\text{Real teacher wage})_{t-1}$ | - | - | - | - | - | - | 0.336 (5.18) | 0.331 (5.25) | 0.356 (6.16) |
| $\Delta(\text{Real GDP per capita})_t$ | 0.085 (4.78) | 0.076 (4.45) | 0.095 (5.50) | - | - | - | - | - | - |
| $\Delta(\text{Real GDP per capita})_{t-1}$ | -0.164 (6.28) | -0.160 (6.81) | -0.159 (7.31) | - | - | - | - | - | - |
| $\Delta(\text{Student share of population})_t$ | - | - | - | - | - | - | 1.067 (2.94) | 1.034 (2.90) | 0.759 (2.35) |
| $\Delta(\text{Student share of population})_{t-1}$ | -0.268 (3.05) | -0.241 (3.19) | -0.274 (4.00) | - | - | - | - | - | - |
| $\Delta^2(\text{Student share of population})_t$ | - | - | - | 0.449 (4.16) | 0.459 (4.34) | 0.490 (4.81) | - | - | - |
| $\Delta(\text{Student share of population})_{t-2}$ | - | - | - | 0.237 (3.48) | 0.254 (3.78) | 0.220 (3.43) | - | - | - |
| $\Delta(\text{Relative price public/private})_t$ | - | - | - | -0.063 (3.93) | -0.057 (3.29) | -0.056 (3.36) | - | - | - |
| $\Delta(\text{Relative price public/private})_{t-1}$ | 0.146 (4.83) | 0.174 (6.11) | 0.161 (6.02) | - | - | - | -0.269 (2.58) | -0.342 (3.14) | -0.467 (4.61) |
| $\Delta(\text{Population})_t$ | -2.106 (4.24) | -2.171 (5.05) | -2.445 (5.32) | - | - | - | - | - | - |
| $\Delta(\text{Population})_{t-1}$ | - | - | - | -0.535 (2.48) | -0.502 (3.29) | -0.741 (3.39) | 3.657 (2.94) | 3.913 (3.20) | 3.238 (2.90) |

| | | | | | | | | | |
|------------------------------------------------------------------|-------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| $\Delta(\text{Population})_{t-3}$ | 1.778 (4.14) | 1.774 (4.50) | 1.811 (4.66) | - | - | - | - | - | - |
| $\Delta(\text{Divorce rate})_t$ | 0.020 (3.47) | 0.013 (2.62) | 0.012 (2.65) | - | - | - | - | - | - |
| $\Delta(\text{Divorce rate})_{t-1}$ | 0.017 (2.94) | 0.016 (3.04) | 0.017 (3.62) | - | - | - | - | - | - |
| $(\text{Inflation})_t$ | -0.129 (6.40) | -0.124 (7.01) | -0.120 (7.02) | - | - | - | -0.666 (11.2) | -0.654 (11.2) | -0.607 (10.7) |
| $(\text{Deviation from trend in GDP})_{t-1}$ | 0.111 (2.56) | 0.130 (3.42) | 0.141 (4.05) | - | - | - | -0.427 (4.37) | -0.435 (4.63) | -0.353 (3.86) |
| $\Delta(\text{Manufacturing wage})_t$ | - | - | - | - | - | - | 0.196 (2.76) | 0.181 (2.54) | 0.211 (3.27) |
| $\Delta(\text{Real local government debt})_{t-1}$ | - | - | - | - | - | - | -0.215 (4.59) | -0.210 (4.61) | -0.189 (4.51) |
| $(\text{Total duration of the government in years})_{t-1}$ | -0.0005 (1.80) | -0.0006 (2.08) | -0.0007 (2.43) | - | - | - | - | - | - |
| $(\text{Index for party fragmentation in the parliament})_{t-1}$ | -0.046 (2.87) | -0.032 (2.20) | -0.033 (2.42) | - | - | - | - | - | - |
| $(\text{Minority coalition government})_{t-1}$ | - | - | - | - | - | - | -0.025 (2.45) | -0.031 (3.05) | -0.015 (1.56) |
| $(\text{Socialist share in the parliament})_{t-1}$ | 0.040 (1.88) | 0.014 (0.67) | 0.006 (0.30) | - | - | - | 0.171 (2.40) | 0.194 (2.68) | 0.201 (3.08) |
| $(\text{Majority of the social democratic party, SDM})_t$ | 0.766 (3.25) | 0.633 (2.78) | 0.561 (2.48) | -0.010 (2.57) | -0.012 (3.03) | -0.009 (2.16) | 2.665 (2.54) | 2.894 (2.44) | 1.698 (1.45) |
| $(\text{Real GDP per capita})_{t-1} * \text{SDM}_t$ | 0.093 (3.24) | 0.076 (2.77) | 0.067 (2.46) | - | - | - | 0.328 (2.56) | 0.356 (2.45) | 0.209 (1.461) |
| Constant | 8.491 (8.14) | 7.759 (8.30) | 7.888 (7.98) | 2.512 (5.89) | 2.698 (6.01) | 2.688 (6.16) | 2.999 (9.50) | 2.922 (9.43) | 3.712 (9.67) |
| Number of dummy variables for reform | 0 | 12 | 21 | 0 | 12 | 21 | 0 | 12 | 21 |
| SSR | 0.0061 | 0.0042 | 0.0031 | 0.0024 | 0.0020 | 0.0016 | 0.0608 | 0.0537 | 0.0413 |
| DW | 2.098 | 2.172 | 2.229 | 1.966 | 2.050 | 2.145 | 2.028 | 2.145 | 2.215 |
| AR | 0.454 | 2.391 | 4.334** | 0.058 | 0.219 | 0.893 | 0.028 | 0.876 | 1.691 |
| CHOW | 1.495 | 0.979 | 0.547 | 0.819 | 0.575 | 0.776 | 0.744 | 0.533 | 0.513 |

All variables, except the political variables and Geographical income variation, are included at logarithmic form; the coefficients are elasticities. Δ is a differential operator. The sample period is 1885 - 1939, 1950 - 1990, 96 observations. Estimated absolute t-values in parentheses. Estimation method is seemingly unrelated regressions. Columns (1a), (1b) and (1c) are the first system, and so on. The first system is the model in Falch and Rattsø (1997). In addition to reported variables, a dummy variable equal to 1 in 1959-1990 is included in the wage equation and a dummy variable equal to 1 in 1973-1990 is included in the teacher input per class equation, both at level and differenced from, and both because of break in data. A dummy variable equal to 1 in 1959-1975 is included in the class size equation to represent the introduction of the compulsory secondary school. In addition, dummy variables for the years 1916, 1957 and 1972, which are halfway between reforms, are included when dummy variables for reforms are included, see section IV. All test statistics are individual equation diagnostics; the residuals of each equation of the system are treated as if they are from a single equation. SSR is the sum of squared residuals, DW is the Durbin-Watson statistic, AR is a LM-test of autocorrelation of order 1 (F-form is presented), and CHOW is the Chow test for parameter stability with the second world war as break point. * and ** denotes significance at 10% and 5% level of the test statistics respectively.

