*Online Appendix*

Incentives that (could have) saved lives

This appendix is not intended for publication, but will be posted online. We first describe our sources in greater detail, and then discuss several modelling issues that arise in the text. The appendix tables are numbered separately as Appendix Table A.1 etc. Appendix Tables A.1 and A.2 report descriptive statistics for the estimation sub-samples used in Tables 4–5.

We constructed the “BGS database” from the annual reports of the RVA. The RVA in turn based these reports on annual filings from each BGS. We cite these reports below as Reichs-Versicherungsamt (ed.), *Amtliche Nachrichten des Reichs-Versicherungsamts.* We augmented the RVA information with two measures drawn from the archival files in the collection R 89 of the *Bundesarchiv* in Berlin. These are (1) *Number of risk classes,* the number of distinct classes in the periodic revisions of the insurance tariff and (2) *Span of risk levels* is the ratio of the highest to the lowest risk level in each tariff. Since most BGS set the lowest risk at unity, span is usually equivalent to the largest absolute difference (minus one). Information on the number of risk classes and spans of risk levels are taken from various files in which the RVA collected printed tariffs, letters, and other documents that dealt with the development of each BGS’s particular tariff system. These files can be located with the help of *Findbücher zu Beständen des Bundesarchivs Bd. 32: Reichsversicherungsamt Bestand R 89, Teil 2: Unfallversicherung, bearbeitet von Hans-Dieter Kreikamp, Koblenz 1987, Abschnitt 5.4: Gefahrentarife der Berufsgenossenschaften, p. 384 ff.*

In Table 3 we report means of rates for three types of accident: fatal, disabling, and serious. The text provides precise definitions and notes that correlations among the rates might also reflect the operation of the accident-insurance system. Because of potential problems with reporting, we focus our analysis on fatal accidents. In the text we note that there might be statistical relationships between two or more types of accident rates because of improvements in safety that make a given accident less serious, or because a given accident is reported one way in one year and another way in later years. Appendix Table A.3 reports a series of models that regress one accident rate on another. These models all include BGS and year fixed effects. Lagging the regressor makes little difference to the estimated elasticities. Fatal accidents are positively correlated with both disabling and serious accidents, which is what one expects if all accidents reflect a dangerous environment. Disabling accidents, on the other hand, are negatively correlated with serious accidents. This correlation implies that there is a margin along which reducing the number of disabling accidents occurs partly by shifting such accidents to the “serious” category.

We did not collect the policy variables for all of our BGS, because they have to be extracted from scattered archival files. Most of the BGS lacking the tariff information would drop out of our analysis sub-samples for other reasons. In most cases these BGS are in a sector with one or possibly two funds, and thus would not be eligible for inclusion in the IV regressions reported in Table 5. Others, like trade or insurance, were organized late in our period and would, if used, contribute to the panel’s lack of balance. Appendix Table A.4 focuses on the sub-sample underlying the estimates reported in Table 4. We report means and standard deviations for BGS that fall into the two groups, as well as t-tests for difference in mean values. With one exception we cannot reject the null of no difference in means between the two groups. BGS with tariff information have lower mean wages than those without.

The three policy tools (enforcement, tariff classes, and span in risk figures) are correlated at the sample level and are much more highly correlated within sector. Appendix Table A.5 reports these correlations for the entire sample as well as for six sectors with multiple BGS.

The panel underlying the models reported in Table 4 is, for the “all BGS” models, slightly unbalanced. In a few cases a BGS did not make the required report for one year. Models estimated with unbalanced panels raise the possibility of a form of selection bias; if the missing years differ in some systematic way from those in the panel, then estimates will be inconsistent. In our data, the BGS for which we are missing yearly observations clearly are different, but not because of the standard selection-bias problem. For example, the insurance industry BGS does not appear in our data until 1913 because it did not exist until that year. The “missing” observations, however, do clearly differ in systematic ways. Average earnings in the insurance sector were 1,156 Marks compared to 793 for all BGS. Nearly all of these BGS would drop out of our IV models because they have only a few BGS or only one tariff period and thus our IV strategy does not work.

We constructed a balanced panel by first deleting all observations before 1888, and then dropping any BGS that did not have 30 full observations. The former restriction adjusts for a few BGS that organized slowly or did not submit the required reports their first year of operation. The latter restriction eliminates BGS that missed later reports as well as BGS such as insurance that organized later in the period. These restrictions reduce the sample to 1,539 BGS-years The results for models parallel to those reported in the text Table 4 are substantively similar to those in the actual
Table 4.

The panel that underlies Table 5 is balanced by construction.

Appendix Table A.6 reports the first stages for the IV estimates reported in Table 5, Column (1). These first stage models of course include all the excluded and included exogenous variables, in particular, BGS and year fixed effects as well as BGS-specific trends. The other first-stage results differ only because of changes in the estimation sub-samples.

Appendix Table A.1

Descriptive statistics for Table 4

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | N | Mean | Standard deviation |
|   |   |   |   |
| Span | 1,358 | 0.196 | 0.179 |
| Classes | 1,420 | 0.132 | 0.0846 |
| Insured per establishment | 1,807 | 47.96 | 90.30 |
| Average wage | 1,807 | 8.133 | 2.355 |
| Enforcement costs | 1,807 | 0.138 | 0.229 |
| Fatal accident rate | 1,807 | 0.674 | 0.669 |
|  |  |  |  |
|  |  |  |  |

Appendix Table A.2

Descriptive statistics for Table 5

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Variables | N | Mean | Standard Deviation |
|   |   |   |   |
| Span | 672 | 0.252 | 0.200 |
| Classes | 672 | 0.144 | 0.0813 |
| Insured per plant | 672 | 63.42 | 121.3 |
| Average wages | 672 | 815.3 | 242.1 |
| Enforcement costs | 672 | 0.118 | 0.119 |
| Enforcement instrument | 672 | 0.128 | 0.112 |
| Span instrument | 672 | 0.252 | 0.156 |
| Classes instrument  | 672 | 0.144 | 0.0614 |
| Reserves instrument | 672 | 2.325e+06 | 1.774e+06 |
|   |   |   |   |

Appendix Table A.3

Correlations among accident types

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Dependent  | Regressor |  |  |  |  | Number of |
| Variable | Type | Lagged? | Estimate | SE | Elasticity | R-squared | BGS | Observations |
|  |  |  |  |  |  |  |  |  |
| Fatal accidents | Disabling accidents | No | 0.0352 | 0.0097 | 0.1718 | 0.0812 | 68 | 1,824 |
| Fatal accidents | Disabling accidents | Yes | 0.0347 | 0.0093 | 0.1716 | 0.0821 | 69 | 1,756 |
| Fatal accidents | Serious accidents | No | 0.0276 | 0.0105 | 0.1101 | 0.08 | 68 | 1,824 |
| Fatal accidents | Serious accidents | Yes | 0.0154 | 0.01 | 0.0622 | 0.0632 | 68 | 1,756 |
|  |  |  |  |  |  |  |  |  |
| Disabling accidents | Serious accidents | No | –0.2783 | 0.0382 | –0.2256 | 0.3382 | 68 | 1,824 |
| Disabling accidents | Serious accidents | Yes | –0.2574 | 0.0398 | –0.2042 | 0.3228 | 68 | 1,756 |

*Note*: The estimate and robust standard errors are from a regression of one accident rate on another, with BGS and year fixed effects. The elasticities are evaluated at the mean.

Appendix Table A.4

Comparison of BGS with and without tariff information
(classes and span)

|  |  |  |  |
| --- | --- | --- | --- |
|  | BGS without Classes and Span Information | BGS with Classes and Span | T-tests |
|  | Mean | SD | Mean | SD | T-statistic | p-value |
| Year | 1901 | 8.403 | 1900 | 8.355 | 0.931 | 0.352 |
| Workers | 111,511.30 | 154,050.10 | 103,233.40 | 74,430.19 | 1.527 | 0.127 |
| Average yearly earnings | 864.86 | 12.70 | 798.12 | 6.06 | 5.045 | 0.000 |
| Fatal accident rate | 0.66 | 0.64 | 0.64 | 0.67 | 0.606 | 0.544 |
| Disabling accident rate | 3.24 | 2.24 | 3.40 | 2.01 | –1.449 | 0.148 |
| Serious accident rate | 2.70 | 2.31 | 2.74 | 2.68 | –0.300 | 0.764 |

*Note*: p-values are for the null hypothesis of no difference.

Appendix Table A.5

Correlations among policy variables for all BGS and

For BGS in selected industries

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Classes and Span | Classesand Enforcement | Enforcement and Span |  |
| BGS | Correlation | p-value | Correlation | p-value | Correlation | p-value | N |
| All | 0.1152 | 0 | –0.0664 | 0.0123 | 0.1352 | 0 | 1477 |
|  |  |  |  |  |  |  |  |
| Textiles | 0.0602 | 0.4016 | 0.1295 | 0.0706 | 0.2641 | 0.0002 | 210 |
|  |  |  |  |  |  |  |  |
| Construction | 0.0602 | 0.4016 | 0.1295 | 0.0706 | 0.2641 | 0.0002 | 293 |
|  |  |  |  |  |  |  |  |
| Steel | 0.2529 | 0.0001 | 0.3319 | 0 | 0.1733 | 0.0093 | 240 |
|  |  |  |  |  |  |  |  |
| Food | 0.0668 | 0.5137 | –0.2333 | 0.0189 | 0.1667 | 0.1008 | 102 |
|  |  |  |  |  |  |  |  |
| Alcohol/Tobacco | 0.6074 | 0 | –0.4319 | 0 | –0.6713 | 0 | 90 |
|  |  |  |  |  |  |  |  |
| Shipbuilding | 0.7122 | 0 | 0.5886 | 0 | 0.59 | 0 | 87 |

*Note*: Correlations are zero-order correlations between the variables noted. The p-value is for the null hypothesis of zero correlation.

Appendix Table A.6

First stage regressions for Table 5

|  |  |  |  |
| --- | --- | --- | --- |
|  | Enforcement | Span | Classes |
|  | Estimate | SE | Estimate | SE | Estimate | SE |
| Controls: |  |  |  |  |  |  |
|  Average wages |   .0000313 |    .0000619 |      .0000232 |   .0000797 | –2.57e-06  |   .0000364 |
|  Insured per plant |   –.0003442 |    .0001897 |    .000338 |   .0004179 |      .0005512 |   .0002157 |
|  |  |  |  |  |  |  |
| Instruments: |  |  |  |  |  |  |
|  Enforcement |   .5345953 |    .1366576 |    .1617657 |   .1841371 |   –.1262682 |   .0805554 |
|  Span |   .0214728 |    .0841178 |  –.7142946 |   .2353225 |   .2602824 |   .0887883 |
|  Classses |   –.0678474 |   .143762 |    .1627108 |   .4726763 |   –.2107161 |   .2132929 |
|  Reserves | –2.18e-09 | 1.91e-08 | 2.14e-07 |  4.23e-08 | 4.28e-08 | 1.88e-08 |
| *Note*: From the first-stage regression for Column (1), Table 5. The model includes BGS and year fixed effects, as well as BGS-specific time trends. |