THE ECONOMIC EFFECT OF CORRUPTION IN ITALY: A REGIONAL PANEL ANALYSIS (M. LISCIANDRA & E. MILLEMACI)

APPENDIX A: CORRUPTION CRIMES AND GROWTH RATES

Figure A1 shows an apparently negative correlation between the average number of corruption crimes per (100,000) capita and the average real GDP per capita growth rate. The correlation is not significant when considering only the averages, while it becomes significant for the whole panel ($\rho=-0.2357$, 860 observations).

Figure A1. Scatterplot of corruption crimes and growth rates (1968-2011)

SOURCE: The Italian Institute of Statistics (Istat) and Crenos.

NOTES: Corruption crimes are per capita (100,000).

Figure A1 also illustrates the bad average performances of northern regions such as Aosta Valley, Friuli Venezia Giulia, and Liguria relative to that of a southern region such as Campania, which is perceived to be highly corrupt. A rationale could be the relatively larger numbers of public employees per capita of the above-mentioned regions than that of Campania (0.089, 0.072, and 0.065, respectively, vs. 0.058; average 2001-2011). If the number of public employees is high, the probability to incur in a corrupt episode may increase. This could contribute to explain the relatively higher rates of corruption experienced in average by some regions, especially the smaller ones (e.g., Aosta Valley and Molise) in which the presence of the government is reasonably not strictly

proportional to the number of individuals. As a final remark, during the recent years (average 2001-2011), Campania – as the other southern regions – significantly worsened its position in the regional ranking with 5.14 corruption crimes per capita (100,000) vs. 3.53, 4.52, and 4.02 of Aosta Valley, Friuli Venezia Giulia, and Liguria, respectively.

APPENDIX B: ALTERNATIVE MEASURES OF CORRUPTION

The number of *convictions* for corruption could appear as an alternative measure to the number of crimes reported to prosecution departments resulting in criminal proceedings. However, data on convictions in Italy do not cover a time span as large as that of reported cases. Additionally, if the prosecution and judicial systems are themselves corrupt, the underestimation of conviction rates adds up to that of the rates of crimes resulting in criminal proceedings. Finally, the time interval between the date of the final judicial decision of a conviction and the date in which the crime is committed can be very large and more subject to variability with respect to that of the reported cases.

The two measures are reasonably correlated when considering the appropriate time delays. In particular, the second measure is available for 12 years (from 2000 to 2011). In this time interval (240 observations), the highest Pearson's correlation coefficient is obtained between the number of convictions per capita and the second lag number of reported cases per capita, i.e. 0.3487. The correlation coefficient of the 5-year averages (40 observations - first two 5-year periods) reaches its peak with the fourth lag of the average number of reported cases per capita, i.e. 0.6320. Averaging procedure better captures the correspondence between the reported cases with a criminal proceeding and the convictions that may come within a range of a few years. In fact, some cases can end up with convictions within the same year or the year after, some other cases after several years, and other cases still may never end up with convictions.

An alternative measure of corruption is the number of *reported individuals* for whom a criminal proceeding has started. This measure of corruption is available for the interval 1974-2005. As expected, the number of crimes is strongly correlated with the number of reported individuals. In particular, the correlation coefficient of the per capita measures is 0.7042 (640 observations), while by taking the 5-year averages the correlation coefficient increases to 0.7871 (120 observations – first six 5-year periods). Thus, the two measures could provide very similar results but the number of reported crimes appears preferable because of the larger time interval (12 years more) and the previous adoption by other studies.

APPENDIX C: ALTERNATIVE MEASURES OF CORRUPTION

Figure C1. Scatterplot of corruption crimes and regional perception index

with the averages of the data from the adjacent years. The results are very similar in both cases.

The corruption data for the small regions Molise and the Aosta Valley are likely to be more imprecise. Therefore, they have been treated as outliers and removed from the sample. All specifications and estimators provide similar results to those previously reported.

A different measure of corruption has provided a good robustness check to the use of the proposed proxy for corruption. In particular, the number of reported individuals (instead of crimes) with criminal proceeding for corruption has done the job. This measure is available for the interval 1974-2005. Confirming results in the coefficients sign are found, but the coefficients' statistical significance decreases, most probably because of the lower number of observations.

As the estimates from the GMM estimator may be in principle sensitive to the choice of the particular type of GMM, alternative GMM specifications are considered. In particular, in addition to the one-step DIF-GMM estimator, the two-step DIF-GMM, the one-step system GMM, and the two-step system GMM are tested. The results are stable across all different types of the GMM estimator. This is true in terms of statistical significance, magnitude and sign.

BUONANNO and LEONIDA (2009) put in evidence that crime negatively affects economic growth through the human capital channel since higher levels of crime reduce human capital accumulation. To test on whether any multiplicative effect occurs, an interaction term between the human capital proxy and corruption is added to the model. However, the evidence is not conclusive.

The technological and industrial advantages of the northern regions relative to the southern regions is well known. Therefore, a control for this issue appears appropriate because a potential omitted variable problem could occur. A commonly adopted proxy for technology innovation is the growth rate of the ratio between R&D expenditure and GDP. In this regard, regional data are available in the time interval 1977-2011. This control variable is included in specifications II and III, in which corruption enters both linearly and non-linearly. The coefficient of the proxy is generally not statistically significant and in no circumstances, the introduction of this additional control variable seems to affect the coefficients of the linear and quadratic term of corruption.

Finally, the legislative, social, and political shocks of the first half of the 1990s in Italy could have affected the estimates of corruption on economic growth. To verify this hypothesis, the same specifications as before (I-VI) have been run according to three different datasets: the first dataset excludes the observations from the time interval 1988-1993; the second dataset excludes the time interval 1994-1999; the last dataset excludes the time interval 1988-1999. Throughout all sub-periods and estimators, the coefficients on corruption appear very similar to

those obtained by running the whole sample. A final check has consisted in testing whether at the beginning of the nineties a structural break occurred. Also in this case, the evidence suggests a statistically significant stability of the parameters on corruption.¹

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¹ All results of robustness checks can be provided upon request.