The Extractive Industries in Italy, 1861-1913: General Methods and Specific Estimates

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This note has three concerns: the general methodology of reconstructing historical time series when the data base is grossly incomplete; the specific methodology of measuring the net output of the extractive industries; and the path of that net output in post-Unification Italy.[1]

The new estimates for the extractive industries display a time path that is quite different from that of the series in the existing literature.[2] The sectoral growth rate is much increased from 1861 to 1882 and again from 1895 to 1913; within the latter period, in particular, the post-1905 decline indicated by the current series is here replaced by strong continued growth.

In part, these differences are due to a careful revision of the existing data to eliminate spurious changes in the basic product-specific series; but to a large extent they are due to a basic methodological difference. The standard practice, reflected by the existing sectoral series, is to combine the available product-specific series — which cover much less than the entire sector at

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[1] These new estimates have been obtained as part of an ongoing re-estimation of industrial production in Italy from 1861 to 1913. The corresponding series for the other ISIC major divisions of non-manufacturing industry have been presented elsewhere; see S. FENOALTEA, "The Growth of the Utilities Industries in Italy, 1861-1913," *Journal of Economic History* 42 (Sept. 1982), pp. 601-27; "Construction in Italy, 1861-1913," *Rivista di storia economica*, 2d, ser., 4 International Issue (1987), pp. 21-53. New estimates for manufacturing industry are currently in preparation. The full set of results, along with detailed descriptions of the sources and methods, will appear in due course in S. FENOALTEA, *Italian Industrial Production, 1861-1913: A Statistical Reconstruction* (New York, forthcoming).

[2] These series are those estimated by A. GERSCHENKRON and O. VITALI. The former, which appears in A. Gerschenkron, *Economic Backwardness in Historical Perspective* (Cambridge, Mass., 1962), p. 75, is a pure index (1900 = 100); the latter, which appears in G. FUA', ed., *Lo sviluppo economico in Italia*, 2d ed. (Milan, 1975), vol. 3, pp. 410-11, is instead a 1938-price value added series.

hand — into an aggregate which is considered an index of production movements for the entire sector.[3] The ostensible justification for this standard procedure is that it avoids adding guesses to the data; but that is a delusion, for if the data are incomplete guesses are unavoidable. The ostensible refusal to guess is, in fact, the very precise guess that the unknown sub-sector moved exactly like the known one; and in most cases that is a very poor guess indeed.[4]

The Italian extractive industries are a typical case in point. Mining output data are relatively abundant, but quarrying output data are extremely scarce. The existing series implicitly assume that the output of the quarries moved like that of the mines; but this is an assumption that no one would consciously make or try to defend, as the mines supplied materials to the metalmaking and chemical industries and were relatively export-oriented, while the quarries supplied materials to the construction industry and were oriented primarily to the domestic market.

The methodological principle adopted here is that where guesses cannot be avoided they should be explicit, and as reasonable as possible: rooted in the economic realities of input-output relationships, that is to say, and not in the arbitrary groupings of industrial classifications.[5] The present series thus explicitly assume that the consumption and therefore (given negligible international trade) the output of ordinary construction materials moved like the output of the domestic industries that consumed them (non-metallic mineral products and construction): still a guess, but by all odds an improvement over the one underlying the existing estimates.

The other methodological novelty underlying the present estimates con-

[3] This practice underlies the sectoral production series estimated for other countries as well; see for example C. H. Feinstein, *National Income, Expenditure and Output of the United Kingdom, 1855-1965* (Cambridge, 1972), F. Crouzet, "Essai de construction d'un annuel de la production industrielle française au XIXe siècle," *Annales. (Economies, Sociétés, Civilisations)*, 25 (1970), pp. 56-99, W. G. Hoffman, *Das Wachstum der Deutschen Wirtschaft seit der Mitte des 19. Jahrunderts* (Berlin, 1965).

[4] A justification for the standard practice might be the claim that the available sample is a random one, representative of the population from which it is drawn; but in most cases a moment's thought reveals that the sample is neither the one nor the other. In general, though, the standard practice is not so much justified as considered inevitable: "it has to be assumed that the output of that part of an industry for which one has no indicator, even of an imperfect character, changed at the same rate as the other part(s) of the industry for which data are available" (Feinstein, *National Income*, p. 207).

[5] Of course, it is best to avoid guesses if one can; and further research often allows one substantially to reduce their scope. The major corrections to the sectoral series for the Italian utilities industries are thus due precisely to the substitution of direct evidence on the growth of the water supply industry for the (poor) guess that it moved like electricity and gas together.

cerns the calculation of value added. Standard practice is to deduct from the sales of the extractive industries only the purchases from other industries; the present estimates define value added to exclude depletion as well, as this definition alone treats the extractive industries in a manner consistent with the treatment of all other industries.

The reason, of course, is that extraction is an activity that transforms goods underground into goods above ground (perhaps with some further processing), exactly as weaving, say, transforms cotton yarn into cotton cloth, or transportation transforms grapes in California into grapes in Boston. The value added by the weaving and transportation industries is properly calculated by deducting the value of the goods consumed from the value of the goods produced; the value added of the extractive industries is properly calculated in exactly the same way.[6] Current practice, in contrast, treats the extractive industries as if they created their output out of thin air — and leads incidentally to absurdities such as world-beating per-capita income figures for oil exporters, where most of that "income" is not income at all but a mere transformation of existing wealth from one form into another.[7]

Section 1 below is a brief summary of the basic sources and procedures that yield the present estimates. Section 2 presents the new estimates for mining, for quarrying, and for the extractive industries as a whole, and compares them to the series in the existing literature.

[6] The fact that the materials in the earth are not currently produced is immaterial. The value of the inputs consumed is excluded from value added (gross product) whether they are currently produced or not: in the former case to avoid double-counting intermediate production, in the latter because the reduction of inventories is not current production at all but disinvestment. If inventories of materials in the earth are to be treated like all other inventories — if the production of the extractive industries is to be measured on the same net basis as that of all other industries — the value of the reserves consumed by current production must be excluded from their value added. On the other hand, value added properly includes the value of preparatory activity by the industry, even if it does not result in sold output; the value of the results of this activity is the increase in value of the material in the ground, at constant output prices. On the identity of the value of activity and the value of the results of this activity when value added is properly defined, see S. Fenoaltea, "Real Value Added and the Measurement of Industrial Production," *Annals of Economic and Social Measurement* 5 (Winter 1976), pp. 113-39.

[7] Specialists in the field are aware of this, and a revision of national accounts to conform to the practice adopted here may not be too far away; see for example T. R. Stauffer, *Accounting for "Wasting Assets": Income Measurement for Oil and Mineral-Exporting Rentier States* (Vienna, 1984), J. S. Landefeld and J. R. Hines, "Valuing Nonrenewable Natural Resources: The Mining Industries," *The Review of Income and Wealth*, series 31, no. 1 (March 1985), pp. 1-20, and M. J. Boskin, M. S. Robinson, T. O'Reilly, and P. Kumar, "New Estimates of the Value of Federal Mineral Rights and Land," *American Economic Review* 75 (December 1985), pp. 923-36.

1. *Sources and methods*

The present sectoral sereis are simple sums of quantity series, weighted by the value added per unit at 1911 prices. Apart from the change in the definition of value added, this procedure reproduces that underlying the existing series; it is of course justified by its minimal data requirements rather than by its theoretical optimality.[8]

The Corpo delle Miniere provided relatively complete production data for Italy's mines.[9] The present series for the mining group is built up from 26 separate series, covering, respectively, iron, copper, lead, zinc, silver, gold, manganese, antimony, mercury, and sulphur ore; ground sulphur, fused sulphur, iron pyrites, solid mineral fuels, oil, natural gas, rock salt, brine salt, asphalt rock, boric acid, graphite, alunite, bauxite, and minor ores (nickel, tin, arsenic, wolfram); and also sea salt and peat.[10] A number of these series are revised on the basis of the original disaggregated data; the more significant corrections include the shifting of fiscal-year data (for Sardinian and Elban output) back to a calendar-year basis, the reclassification of the cupriferous pyrite produced at Agordo in 1861-94 from copper ore to iron pyrite (as in 1895 ff.), the recalculation of lignite and asphalt rock output on a homogeneous basis, and a correction to the sea salt series to allow for neglected output from private works in the early years. The sulphur and mercury ore series are extrapolated back to 1861 on the basis of the corresponding outputs of fused sulphur and metallic mercury; and the peat series is extrapolated on the basis of scattered data for the early years. While these revisions and extensions are occasionally of major significance for the individual product at stake, in general they affect the corresponding aggregate only in matters of detail.

The major novelty here is the new series for the quarrying group, obtained as a weighted sum of 5 series representing, respectively, marble, kiln materials (disaggregated into gypsum, limestone, and clay and sand), and other quarry products. Marble was a highly atypical quarry output, as (like Italy's major ores) it was produced largely for export; it is also atypical in that relatively abundant output data were again provided by the Corpo delle

[8] On the other hand, it is not a poorer approximation to a properly defined optimum than the common alternatives; see Fenoaltea, "Real Value Added."

[9] Corpo delle Miniere, *Notizie statistiche sull'industria mineraria in Italia dal 1860 al 1880* (Rome, 1881), *Relazione sul servizio minerario* (1877-82), *Rivista del servizio minerario* (1883 ff.). See Istituto Centrale di Statistica, *Sommario di statistiche storiche italiane, 1861-1955* (Rome, 1958), pp. 121-25.

[10] The production of crude sulphur by liquating or grinding the ore is included here in imitation of standard practice in Italy; see Istituto Centrale di Statistica, *Indagine statistica sullo sviluppo del reddito nazionale dell'Italia dal 1861 al 1956. Annali di statistica*, series 8, vol. 9 (Rome, 1957), p. 77.

Miniere.[11] The present series recalculates the available data on a consistent block-marble basis, and includes estimates for the minor producing centres outside the Apuan Alps. The output estimates for kiln materials are derived from the corresponding output estimates for kiln products (themselves obtained by interpolating the available benchmarks on the basis of construction activity, allowing for international trade): gypsum from plaster, limestone from lime and cement, and clay and sand from bricks and tiles, terra cotta, ceramic, and glass. The output of other quarry products (overwhelmingly non-traded construction materials used directly by the construction industry) is estimated by extrapolating the available benckmarks provided by the Corpo delle Miniere on the basis of construction movements.[12]

For the reasons indicated above, the 1911-price value added estimates with which these series are combined are designed to exclude the in-ground value of the extracted materials. Such values are unknown; where they were plausibly significant (most mine products, marble) value-added is estimated directly on the basis of the wage and salary bill (calculated from employment and wage data) and an allowance for capital costs (calculated on the basis of 500 lire per year per horsepower). This allowance is naturally tentative; but it leads to a very reasonable pattern of rents (12 million lire in 1911 for sulphur, 7 million for iron, 6 million for lead and zinc and as much again for marble, 3 million for mercury, 2 million for asphalt). For common materials, where the rent was plausibly negligible, value added is instead estimated by deducting a small allowance from the value of output.

Since the disaggregated estimates are designed to cover the entire industry at hand, the sectoral and aggregate series are simple sums of the value-added-weighted output series.

2. *Results*

The new series for mining, quarrying, and the extractive industries as a whole are transcribed in Table 1 and illustrated in Figure 1. The results amply bear out the initial suspicion that mining output is a poor proxy for quarry output: the two move quite differently, both from year to year and over the longer term. The existing series are included for comparison (with the Vitali 1938-price series scaled to yield in 1911 the official estimate of value added minus depreciation, which seems conceptually close to value added properly defined).[13] These series are based primarily or exclusively on the mining data;

[11] The sources are those listed in footnote 9. Marble output seems to be included in the Vitali series from 1901; see Fuà, *Sviluppo economico*, vol. 3, p. 480.

[12] The production and consumption of other quarry products, like those of kiln products, are estimated on the basis of the disaggregated construction series, re-weighted to reflect the relative incidence of each type of material.

[13] Istituto Centrale di Statistica, *Indagine statistica*, p. 211. This figure is 32%

Table 1

PRODUCTION ESTIMATES FOR THE EXTRACTIVE INDUSTRIES IN ITALY, 1861-1913

(value added at 1911 prices: million lire)

Year	(1) Present estimates Mining	(2) Present estimates Quarrying	(3) Present estimates Total[a]	(4) Gerschenkron Index (1900 = 100)	(5) Istat/ Vitali estimates	(6) Ratio of col. 3 to col. 5
1861	17.2	18.2	35.4		74.5	.48
1862	17.1	20.3	37.4		65.9	.57
1863	18.6	21.6	40.2		68.2	.59
1864	19.1	21.6	40.8		65.0	.63
1865	18.6	22.4	41.0		66.3	.62
1866	21.1	19.4	40.5		63.8	.63
1867	23.6	19.5	43.0		69.2	.62
1868	27.1	19.8	47.0		68.9	.68
1869	28.6	20.4	49.0		68.6	.71
1870	27.6	20.9	48.5		66.6	.73
1871	27.4	21.4	48.8		68.1	.72
1872	30.7	23.1	53.8		70.5	.76
1873	32.3	26.8	59.1		74.4	.79
1874	30.2	27.6	57.8		72.3	.80
1875	28.0	24.3	52.3		68.8	.76
1876	34.2	23.0	57.2		72.7	.79
1877	34.1	24.2	58.3		72.5	.80
1878	36.5	24.0	60.5		75.0	.81
1879	41.8	24.9	66.7		80.1	.83
1880	41.3	28.1	69.3		79.8	.87
1881	42.7	28.7	71.4	71	82.0	.87
1882	47.9	31.9	79.8	79	86.2	.93
1883	48.3	34.1	82.3	80	86.3	.95
1884	46.3	35.4	81.7	77	83.6	.98
1885	47.6	36.3	83.8	77	84.2	1.00
1886	45.6	36.6	82.3	72	80.9	1.02
1887	43.2	36.2	79.5	68	79.6	1.00
1888	45.2	36.1	81.3	70	81.9	.99
1889	46.6	36.2	82.8	71	81.7	1.01
1890	47.6	36.9	84.5	72	82.0	1.03
1891	49.3	35.4	84.7	76	84.7	1.00
1892	51.6	34.5	86.1	82	89.6	.96
1893	51.3	34.2	85.4	80	88.9	.96
1894	49.5	33.6	83.1	79	87.6	.95

Table 1 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
1895	46.8	30.8	77.6	72	84.2	.92
1896	49.4	30.4	79.8	79	88.9	.90
1897	55.8	31.7	87.4	90	96.1	.91
1898	58.0	32.3	90.4	92	97.2	.93
1899	62.8	34.7	97.5	88	102.7	.95
1900	62.6	35.8	98.4	100	102.0	.96
1901	63.8	38.2	102.0	103	103.9	.98
1902	63.8	42.4	106.1	100	102.3	1.04
1903	65.5	45.2	110.8	107	106.0	1.05
1904	65.4	47.7	113.1	106	107.7	1.05
1905	66.9	50.8	117.7	108	109.6	1.07
1906	66.4	55.0	121.3	103	105.9	1.15
1907	64.4	57.7	122.1	99	103.0	1.19
1908	62.5	60.5	123.0	98	100.2	1.23
1909	59.7	67.1	126.8	93	98.4	1.29
1910	59.8	76.3	136.0	95	98.5	1.38
1911	59.5	82.4	141.9	89	97.0	1.46
1912	62.5	85.4	147.9	96	100.2	1.48
1913	64.3	84.3	148.6	98	101.2	1.47

[a] numbers need not add, due to rounding.
Source: See text.

not surprisingly, they move much more like the present estimates for mining alone than the present estimates for mining and quarrying together.[14]

As the final column in Table 1 makes clear, the best existing estimates are very thoroughly altered by the careful recalculation undertaken here. On a comparable basis, value-added is revised upward by 47% in 1913, and down-

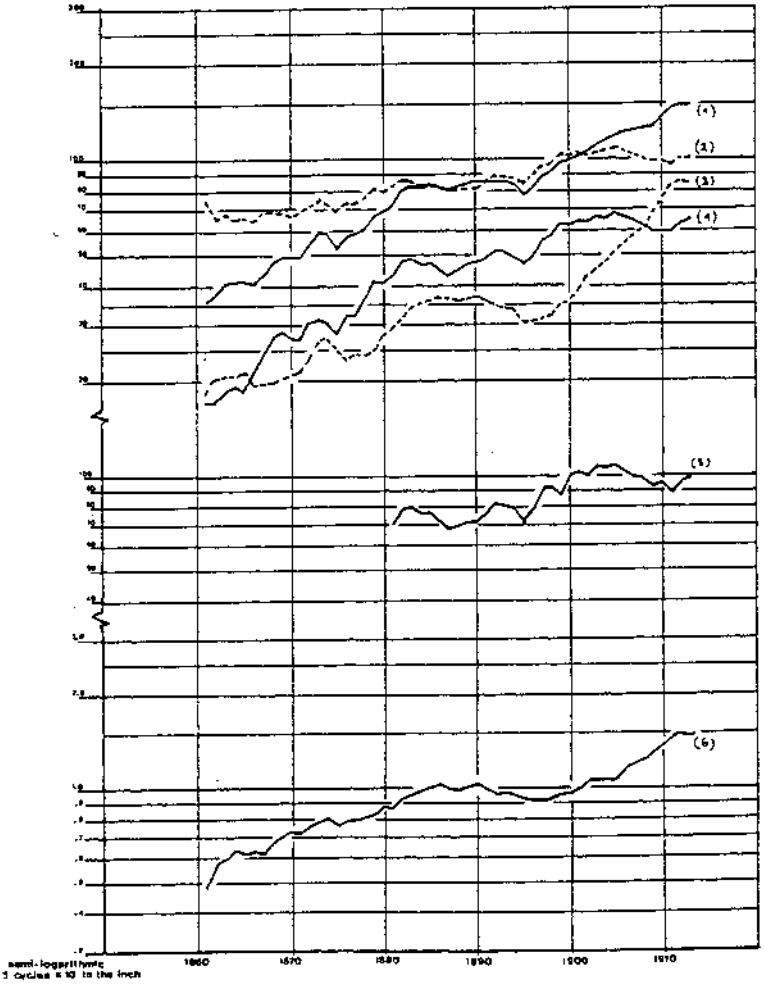
below the present estimate, even though the value-added figure gross of depreciation includes the current value of quarry output. The main reason for this discrepancy seems to be that the quarry output statistics for 1911 were taken at face value; their reconstruction from the basic disaggregated data reveals instead that the aggregate output figures published after 1901 were actually mere repetition of that benchmark, updated only for marble and very little else. As a result, the totals reported for 1911 actually reflect output in 1901, and thus miss the surge in 1901-11.

[14] The reason for the relatively slow growth of the Vitali series in the 1860s and 1870s is far from clear: since most products exhibited substantial growth, it must give an inordinately high weight to the few lagging items.

Figure 1
Production Estimates for the Extractive Industries in Italy, 1861-1913
(value added at 1911 prices: million lire)

Key: (1) Present estimates for the extractive industries (Table 1, col. 3).
(2) Istat/Vitali estimates for the extractive industries (Table 1, col. 5).
(3) Present estimates for quarrying production only (Table 1, col. 2).
(4) Present estimates for mining production only (Table 1, col. 1).
(5) Gerschenkron production index for the extractive industries (Table 1, col. 4).
(6) Ratio of the present estimates for the extractive industries to the Istat/Vitali estimates for the extractive industries (Table 1, col. 6).

Source: See text.



ward by 52% in 1861; the long-term average annual growth rate from 1861 to 1913 is revised upward from 0.6% to 2.8%.

Since these gross errors appear to be the direct result of the traditional, unsound methodology, their magnitude calls into question the entire existing quantitative corpus.[15] The pioneering work of the first Kuznetsian historians and their contemporaries has been immensely useful, and further progress would be impossible but for their efforts; but a careful revision of the quantitative record seems very much in order.

[15] Similarly gross errors show up in the estimates for the utilities and construction; see the articles cited in footnote 1 above. As recalled in footnote 3 above, the Italian statistics here seem entirely typical of those for other countries as well.