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Catching up or falling behind? Italy's economic growth, 1895-1947[1]

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In 1913, neither Asquith nor Giolitti would have wagered a bottle of claret that their two countries would enjoy roughly the same level of prosperity (measured by income per caput) well before the end of the century. After the event, however, this outcome does not surprise many economic historians and growth economists. The former speak of 'catching up' by 'latecomers' on the basis of some evidence from the economic history of today's developed countries; the latter of 'growth rates convergence' by assuming decreasing returns to capital accumulation. However, neither quantitative historical evidence nor modern growth theory provides firm ground for assuming 'catching up' as a universal growth pattern. Rather, they seem to support Abramovitz's view that long run convergence 'is only a tendency which emerges in the average experience of a group of countries', while an individual country's 'capability to exploit emerging technology depends on a social history that is particular to itself'.[2] A glance at table 1 illustrates this point. Secular growth rates are only roughly consistent with *ex ante* expectations based on the ranking of GNP per caput in 1900. Overall, Italy's performance is only slightly better than that of the entire group. As the 'catching up' approach predicts, Italy is outperformed by a 'latecomer' (Japan). The prediction, however, is not fulfilled in the case of such 'early comers' as Canada, Germany, and France, all of which have growth rates that are not significantly different from Italy's.

Table 1 demonstrates Italy's economic performance to be quite respectable, relative both to that of other countries[3] and to Italy's own economic record in the previous three centuries.[4] At the same time, given Italy's relative backwardness around the turn of the century, a higher long-term growth rate might have been expected. Therefore, the question of the country's

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[2] Abramovitz, *Thinking about growth*, p. 406. He adds that 'there are changes in the character of technological advance that make it more congruent with the resources and institutional outfits of some countries but less congruent with those of others'. His suggestion seems to have been taken up by recent developments in growth theory which highlight the role of positive externalities (e.g. from investment in physical or human capital), institutional variables (such as more or less adequate protection of property rights), social factors (such as fertility), and government policies (such as distortionary taxation and public expenditure) in endogenously generating growth. For a survey, see P. M. Romer, 'Increasing returns and new developments in the theory of growth', NBER Working Paper no. 3098 (1989).

[3] Italy's recently acquired 'membership' of the club of the largest world economies, the G7 (group of 7) makes it appropriate to compare its performance with that of the club's members, of which all but Japan enjoyed a higher per caput income than Italy around the turn of the century.

[4] A recent book on the Italian economy since the unification bears the telling subtitle, 'Italy's second economic renaissance' (Zamagni, *Dalla periferia al centro*).

Table 1. *Growth rates in real per caput GDP, G7 countries, 1900-1987 (per cent, per annum)*

	1900-89	*1900-13*	*1913-50*	*1950-73*	*1973-87*
Canada	2.32	3.23	1.51	2.92	2.21
France	2.06	1.47	1.14	4.43	1.25
Italy	2.23	2.16	0.73	4.80	2.02
Germany	2.17	1.57	0.74	4.94	1.96
Japan	3.16	1.24	0.92	7.84	2.81
UK	1.38	0.70	0.84	2.53	1.54
USA	1.81	2.01	1.56	2.17	1.52
G7 Countries	2.06	1.93	1.31	3.44	1.89

Source: Maddison, *World economy*.

capability of exploiting domestic and international growth opportunities and offsetting its own disadvantages may legitimately be raised: 'could Italy have grown faster?'. Looking at the four sub-periods in table 1, the years 1913-50 and 1950-73 stand out, the former for a very low and the latter for a very high Italian growth rate relative to the G7 average. During 1900-13 and 1973-87, on the other hand, Italy's performance comes fairly close to the group average. In fact, during the interwar years, Italy's 'catching up' was not only halted but actually reversed. Had its 1913-50 growth rate been equal to the G7 average for the same period, Italy's secular (1900-87) growth rate would have risen to 2.46 per cent per annum, enough to produce a full 'catching up' by the late 1980s.[5] As table 1 shows, the economic performance of all European countries during 1913-50 was relatively poor,[6] as also was Japan's. However, Italy's growth in the same period turns out to be particularly unsatisfactory and, since wars, depression, and other exogenous shocks were common to all the countries in table 1, part of the slowdown in Italian economic growth is likely to depend on country specific factors: structural weaknesses and misguided policies. Therefore, in analysing Italy's long-run economic performance, attention should be focused on the period 1913-50.

This paper provides fresh quantitative evidence about the first half century in Italy's 'modern economic growth': we offer a new analysis of the 'structural features' of the Italian economy and pose the question: 'What, if anything, went wrong in the period when the country's growth rate in per caput income was far below its secular trend?'.

Among the factors most frequently stressed as characterizing Italy's recent economic history, the sizeable market power enjoyed by the 'representative firm' stands out. Other elements specific to Italy frequently quoted as affecting its growth are the lack of raw materials (reflected in the dependence on imports), and a combination of a mix of industries and timing of industrialization leading to an important role for economies of scale. Besides

[5] By 1987, Italy's GNP per caput would have been equal to the average for the G7 group.

[6] In fact, Abramovitz has pointed out that the catching-up process was, if anything, much weaker before than after 1950; Abramovitz, *Thinking about growth*, pp. 190-5.

looking at technical progress, the variable most likely to be the prime candidate in explaining economic development, our analysis will focus on the above mentioned features of the Italian economy. For this purpose, we have constructed a comprehensive database, providing quantitative information hitherto unavailable (see appendix A), and an econometric model that is particularly well suited to account for short-run disequilibria, economies of scale, and market power.

We shall proceed as follows. Section I describes the model. Section II provides a brief outline of Italy's economic history between 1896 and 1946. Section III discusses the most important structural features of the Italian economy and assesses the impact of technical progress, economies of scale, and market imperfections on growth. The last section is devoted to pulling the threads together and to making some final remarks. Relevant technical details are left to the two appendices.

I

Reviewing Rostow's monumental essay on theories of economic growth,[7] Dorfman 'scolds' the author for 'neglecting the right people ... those who studied the statistical data to detect the sources of the increases in productivity in progressing countries'.[8] The omission is particularly bewildering given Rostow's standing in the economic history profession, in which the causes of productivity growth are an important area of research: significantly the volume in the *Cambridge economic history of Europe* dealing with the development of modern industrial enterprises opens with a well-known essay on the sources of growth by Solow and Temin.[9]

There is, in fact, a fairly large body of historical literature in which aggregate production functions are used to analyse the economic performance of given countries or industries. As is well known, the standard finding of such studies is that total factor input 'explains' only a fraction of total output growth, the rest being accounted for by increases in the efficiency of production over time, that is in measures of total factor productivity (TFP). While such analyses have made an enormous contribution to our knowledge of the process of economic development, standard measures of TFP rest on assumptions that are not easy to establish for empirical reality. Those relating to perfect competition and full flexibility of factor inputs are particularly difficult to accept.

Drawing on the recent work by Morrison,[10] among others, this section outlines a general theoretical framework for productivity growth measurement which enables us to relax the binding assumptions of the traditional measures. Such a framework provides the conceptual basis for the empirical

[7] Rostow, *Theorists of economic growth.*

[8] Dorfman, 'Review article: economic development', p. 587.

[9] Solow and Temin, 'Introduction: the inputs for growth'.

[10] Morrison, 'Quasi-fixed inputs'; *idem*, 'Markups in US and Japanese manufacturing: a short run econometric analysis', NBER Working Paper no. 2799 (1988); *idem*, 'Unravelling the productivity growth slowdown in the US, Canada and Japan: the effects of subequilibrium, scale economies and markups', NBER Working Paper no. 2993 (1989); *idem*, 'Market power, economic profitability and productivity growth measurement: an integrated structural approach', NBER Working Paper no. 3355 (1990).

computations on which we base the analysis of the performance of the Italian economy.

To start with, let the representative firm's technology be described by a production function ($y = y(x,t)$), or equivalently, by a cost function ($c = c(w,y,t)$), where y is output, c is total cost, x is a vector of I inputs with corresponding price vector w, and t is a variable (usually a time counter) summarizing the state of technology. In this simplified setting, TFP growth is traditionally represented by total output (cost) growth net of the contributions of factor inputs (factor prices and output), that is by the output elasticity with respect to the technology indicator ($\partial \ln y/\partial t = \epsilon_{yt}$) or by the cost elasticity with respect to the same variable ($\partial \ln c/\partial t = \epsilon_{ct}$), respectively. Following Solow,[11] it can be shown that these residuals isolate increasing efficiency in production (technical change) if perfect competition prevails in the output market and if short-run as well as long-run fixities (increasing returns to scale) are ruled out.

Under these conditions, non-parametric estimation of productivity growth is usually accomplished by focusing alternatively on the revenue (primal) or cost (dual) component of the profit definition. In the primal measure, potential growth in output (for given inputs) when technology changes is given by

$$\epsilon_{yt} = (\dot{y}/y) - \sum_i s_{yi}(\dot{x}_i/x_i) \tag{1}$$

where s_{yi} is the share of the i-th input in terms of the value of total output ($w_i x_i/py$). Alternatively, and equivalently, the dual measure focuses on the potential cost reduction induced by technology changes (for given output and factor prices),

$$\epsilon_{ct} = (\dot{c}/c) - (\dot{y}/y) - \sum_i s_{ci}(\dot{w}_i/w_i) \tag{2}$$

where s_{ci} is the share of the i-th input in terms of the value of total costs ($w_i x_i/c$).

Once the above assumptions are relaxed, however, their impact on the productivity residual must be explicitly recognized. Returns arising from market power (imperfect competition), from varying utilization of inputs (short-run fixities), and from technological characteristics (scale economies) have to be accounted for, and the traditional productivity growth measures amended correspondingly. Therefore, let the reference model be given by a profit maximizing factor demand model under unrestricted returns to scale and quasi-fixed inputs. Imperfect competition is assumed to prevail in the output market. In this context, the functional characterization of the technology of a representative firm in short-run equilibrium is given by the restricted profit function or also by the restricted cost function. The latter ($c_v = c_v(w,y,k,t)$, otherwise known as the variable cost function) defines the minimum cost the firm incurs for a given volume of output (y), for a given vector of variable factor prices (the $I \times 1$ vector w), a given state of technology

[11] Solow, 'Technical change'.

(t), and a given level of quasi-fixed factors (indicated by the $M\times 1$ vector k). The restricted cost function allows us to distinguish neatly between variable factors of production (utilized in amounts corresponding to minimum variable costs) and quasi-fixed ones (utilized in amounts that do not necessarily correspond to minimum costs but are typically characterized by some sort of partial adjustment).

Applying Hotelling's lemma to the restricted cost function yields the demand system for variable factors:

$$x = \partial c_v(w,y,k,t)/\partial w \tag{3}$$

where x is the $I\times 1$ vector of the short-run cost minimizing input levels. Given the cost minimizing variable input demands, profit maximization (conditional on the quasi-fixed factors) is achieved, as usual, by setting marginal revenue equal to marginal cost or, equivalently,

$$p = -y(\partial d(y,.)/\partial y) + (\partial c_v(w,k,y,t)/\partial y) = [1/(1+\epsilon_{py})]c_m(w,k,y,t) \tag{4}$$

where $d(y,.)$ denotes the inverse demand function for the firm's output, $\epsilon_{py} = (\partial \ln d(y,.)/\partial \ln y)$ is the inverse price elasticity, and short-run marginal costs are indicated by $c_m(w,k,y,t) = (\partial c_v(w,k,y,t)/\partial y)$. The system of variable input demand equation (3) and the price equation (4) describe all the firm's decisions that are relevant in the present context.[12] However, the potential value of this approach, firmly based on neoclassical production theory, is not confined to the possibility of describing the productive structure in the short run. On the contrary, the main implication of a temporary equilibrium model lies in the calculation of the levels and determinants of factor utilization, profit margins, and returns to scale, and hence of adjusted TFP growth measures.

To highlight these issues, it is worth remarking that, for a given level of quasi-fixed factors, the variable cost function is simply the difference between the total short-term cost function ($c_t(w,r,y,k,t)$) and the cost of the quasi-fixed factors, i.e.:

$$c_t(w,r,y,k,t) = c_v(w,k,y,t) + r'k \tag{5}$$

where r denotes the $M\times 1$ vector of *ex ante* market prices of quasi-fixed factors. Obviously, given (5), the description of the firm's long run behaviour is provided by the long run cost function ($c(w,r,y,t)$) which can be derived by minimizing the total cost (5) with respect to quasi-fixed inputs for a given utilization of variable inputs and a given volume of output. The first order condition of the latter optimization problem is given by:

$$\partial c_t(w,r,y,k,t)/\partial k = \partial c_v(w,k,y,t)/\partial k + r = 0 \tag{6}$$

which establishes the equality between the market price (r) of a generic fixed factor and its shadow price (q), defined by the potential reduction in variable costs for a unit variation in the level of the fixed factor itself,

[12] The model could, in principle, also incorporate the firm's decisions about the path of the fixed inputs maximizing the present value of total net receipts. This would require deriving the relevant Euler first order condition. However, for the case at hand, equations (3) and (4) contain all relevant information.

$$q = -\partial c_v(w,k,y,t)/\partial k > 0 \tag{7}$$

Let $\bar{k}(w,r,y,t)$ be the solution to (6), i.e. the vector of optimal quantities of quasi-fixed factors. Substituting it for k in (7) we immediately obtain the long run cost function:

$$\begin{aligned} c_t(w,r,k,y,t) &= c_v(w,k,y,t) + r'k = c_v(w,\bar{k}(w,r,y,t),y) + r'\bar{k}(w,r,y,t) \\ &= c(w,r,y,t) \end{aligned} \tag{8}$$

Clearly, if equation (6) prevailed at all points in time, the firm's short-term equilibrium position would coincide with the long-term one, for equality between market price and shadow price would eliminate the incentive to change the quantities of quasi-fixed factors.

The difference between market and shadow prices for the quasi-fixed factor is therefore an obvious indicator of the existence of short-run fixities. In fact, Morrison has shown that:

$$\begin{aligned} 1 - \sum_j \epsilon_{ck_j} &= 1 - \sum_j (\partial c_t(w,r,k,y,t)/\partial k_j) \\ &= 1 - \sum_j (r_j - q_j)k_j/c_t(w,r,k,y,t) \end{aligned} \tag{9}$$

is a dual (cost) indicator of capacity utilization where capacity output is defined as the level of output that corresponds to the tangency point between short- and long-run cost curves or, to put it differently, the level of production the firm could attain if its productive factors were used efficiently.[13] Note that if demand is high with respect to supply, the firm will tend to make more intensive use of its stock of capital. Overutilization will result in a lowering of the productivity of capital and an increase in unit costs, which the firm must remedy by augmenting its stock of fixed factors to restore the equality between their shadow and market prices.[14]

In this generalized framework, Morrison[15] has shown that, in order to recognize sub-equilibrium and scale economies, dual (cost based) measures of productivity growth should be adapted as follows:[16]

$$\tilde{\epsilon}_{ct} = \epsilon_{ct} - \sum_j \epsilon_{ck_j}(\dot{k}_j/k_j) - \left[\left(1 - \sum_j \epsilon_{ck_j}\right)\epsilon_{cy} - 1\right](\dot{y}/y) \tag{10}$$

where $(1-\sum_j \epsilon_{ck_j})$ is the mentioned index of factor utilization rate and ϵ_{cy}

[13] This concept of capacity output, originally due to Cassels ('Excess capacity') and Klein ('Some theoretical issues'), should be contrasted with the one implied by measures of capacity utilization commonly used, that is the maximum possible output, given the state of technology and the volume of fixed factors. The latter is a perfectly legitimate evaluation from the engineering standpoint but it has no economic substance, because it does not vary with respect to the economic context in which firms operate.

[14] Clearly, in this situation, the (economic) utilization rate may exceed one, something that is inconceivable when a merely 'mechanical' concept of potential output is adopted.

[15] C. J. Morrison, 'Unraveling the productivity growth slowdown in the US, Canada and Japan, the effects of subequilibrium, scale economies and markups'. NBER Working Paper no. 2993 (1989).

[16] Notice that dual measures, being cost based, are not influenced by demand side adjustment such as the market power adjustment.

denotes the long-run elasticity of costs with respect to output and is an obvious indicator of scale economies. The two indexes adjust the traditional dual measure for short-run fixities and for non-constant returns, respectively. The corresponding primal measure of productivity growth is given by

$$\tilde{\epsilon}_{yt} = -\tilde{\epsilon}_{ct} + \tilde{\epsilon}_{ct}\left\{1 - \left[(1+\epsilon_{py})/\left(\left(1-\sum_j \epsilon_{ck_j}\right)\epsilon_{cy}\right)\right]\right\} \qquad (11)$$

where one plus the inverse demand elasticity facing the firm is a natural index of market power. Clearly, if all inputs are variable, $\epsilon_{ck_j} = o(\forall j)$. Furthermore, if returns to scale are absent and perfect competition prevails in the output market, $\epsilon_{cy} = (1+\epsilon_{py}) = 1$, and equations (10) and (11) reproduce the traditional primal and dual measures.

If reliable proxies were available for the indices measuring the deviations from Solow's assumptions, then computing adjusted productivity growth measures would be immediate. Unfortunately, this is not the case for most if not all historical data sets. It is therefore necessary to specify parametrically the representation of the firm's technology and to revert to econometric methods to obtain coherent estimates of the relevant magnitudes.

Appendices A and B report in detail the specification, estimation, and testing of the relevant econometric model as well as the underlying statistical information. It is worth noting that our database extends in a number of respects the available official sources recently reviewed in Rey.[17] In particular, a special effort was made to acquire a consistent estimate of labour input (total hours worked) and of the wage rate. Assuming two variable inputs (labour and imports) and a single quasi-fixed factor (capital), the parameters of the two equations system (3) have been estimated over the sample 1894-1947 (allowing for the shorter time span for which labour input information is available, that is 1907-39). Details of the estimation procedures as well as of the overall (economic and statistical) performance of the model are set out in appendix B. In both respects the model appears to perform remarkably well. In particular, it is worth noting that, thanks to the highly flexible specification of the technology, no structural break (in a statistical sense) shows up in the period under examination. Nevertheless, the estimated coefficients turn out to imply substantial variations in key magnitudes, such as own and cross price elasticities.

Finally, it should be noticed that, extending the previous theoretical analysis, the estimated models incorporate two crucial additional effects. First, internal adjustment costs (stemming from gross changes in the quasi-fixed factor) are incorporated in the variable cost function. Second, the model allows for a direct effect of the social overhead capital on the representative firm's cost structure.

II

Having briefly discussed the theoretical reference framework, we proceed now to provide an equally brief historical framework for the discussion of

[17] Rey, *I conti economici dell'Italia*.

Italy's economic performance between 1895 and 1947. Italy's political unification in 1861 did not produce sizeable economic effects. Fuà's[18] national accounting statistics show virtually no change in GNP per caput between 1861 and 1896. This picture is now considered too pessimistic: indirect evidence from living standards[19] and new estimates by Maddison[20] indicate that the Italian economy was characterized by slow growth rather than stagnation.[21] Nevertheless, during the 30-odd years after unification, instead of 'catching up', Italy lost ground with respect to the more advanced European countries. It was only after a severe crisis in the early 1890s that the new kingdom enjoyed a long spell of substantial growth and experienced its first period of 'catching up'.

A cyclical industrial upswing took place between 1879 and 1887. There followed a depression of investment demand and manufacturing output which precipitated bank failures on an unprecedented scale, and these in turn triggered a political crisis almost leading to a coup d'état. In 1893-5 a comprehensive reorganization of the banking sector took place with the creation of the Bank of Italy, which undertook to exercise the functions of an embryonic central bank, and the establishment of two large 'universal banks' of the German type. In 1896, the resignation of Prime Minister Crispi opened a new phase in Italian politics characterized by a shift in focus from foreign to domestic and economic issues. Social tension was eventually eased; labour relations improved, as did public finance.[22] In other words, an actual 'regime change' took place both in the political and in the economic sphere. This is seen by historians as creating the preconditions for Italy not only to join in the expansionary phase of the world economy, but also to begin a 'catching up' process relative to countries with more advanced economies (table 1).

In fact, the so-called 'Giolittian era'—roughly coinciding with the first period in table 1—saw the first long spell of rapid economic growth in the history of Italy since the seventeenth century. In 1895 industrial output began to recover from the depression of 1888-93, setting in motion an expansionary wave which lasted—with minor setbacks and a slowdown after 1907—until the spring of 1914. Industrial growth was particularly rapid during 1898-1908.[23] Agriculture grew at a hitherto unprecedented rate, while at the same time releasing low productivity labour to domestic industry and emigration. Fiscal and monetary policies were deliberately designed to assist economic development: the ratio of outstanding state debt to GNP was curtailed, thereby 'crowding in' private investment, and the newly created Bank of Italy helped to stabilize financial markets.[24] Expectations were also enhanced by exchange rate stability and falling domestic interest rates relative

[18] Fuà, *Lo sviluppo economico*, III.

[19] Federico and Toniolo, 'Italy'.

[20] A. Maddison, 'A revised estimate of Italian economic growth, 1861-1989', *Nota di Lavoro* 91.02 (Dipartimento di Scienze Economiche, Università di Venezia, 1991).

[21] Ibid. Estimates an annual growth rate in per caput income of 0.5 per cent between 1861 and 1890.

[22] See, among others, Toniolo, *An economic history of liberal Italy*; Zamagni, *Dalla periferia al centro*.

[23] Estimates of industrial growth for the period vary from 7.87 p.a. (Fenoaltea, 'Railways and the development') to 5.00 p.a. (Carreras, 'La producciò industrial espanyola i italiana').

[24] The Bank managed to avoid a banking crisis in 1907.

to those in Paris and London. A new political climate made it possible to improve industrial relations. Needless to say, during this spell of rapid growth, the Italian economy underwent substantial changes. They cannot be fully appreciated merely by observing that the share of agriculture in GNP declined from 42 per cent (1890) to 35 per cent (1913), while that of manufacturing rose from 17 to 21 per cent. Of equal if not greater importance is the fact that a peripheral rather closed economy became more open and established closer links with the most advanced countries of the time. The tariff wall created in 1887 was slowly but consistently reduced by the signing of commercial treaties with the main trading partners.[25] Imports climbed from 11 to 18 per cent of GNP. A substantial trade deficit was financed by 'invisible' earnings, particularly emigrant remittances, so that the lira, not formally on a 'gold standard', was often traded above its gold parity. Italy's international standing in this regard was confirmed in 1906 when foreign holders happily accepted the conversion of their Italian consols from 4.75 to 3.75 per cent.

Such promising economic growth and transformation, it is often argued, was cut short by the ill-advised decision to join the powers of the *Entente* in May 1915. The plant of social and economic 'modernization' was too tender to be exposed to the rigours of total warfare. Postwar turmoil ended in Fascism, which produced economic retardation through inept economic policies and, more generally, through the freezing of the country's social transformation which had had such promising beginnings in the 'Giolittian era'.[26] On the other hand, some historians maintain that the Italian economy displayed considerable dynamism under Fascism.[27] In particular they point to the development of such 'modern' industries as chemicals, artificial silk, aircraft building, and electric power, and to the emergence of large-scale plants and enterprises.

In actual fact, 1914-46 and even 1922-43 (the Fascist years) were far from being homogeneous periods: not only were there exogenous shocks of a hitherto unprecedented magnitude, but economic policies were anything but consistent over time.[28] In particular, the years from 1922 to 1925, when Mussolini still headed coalition governments, were characterized by *laissez faire* policies and rapid growth. In 1925, when Mussolini assumed full dictatorial powers, the finance minister was replaced, the 'corn laws' reintroduced, and a number of import duties increased. In 1926-7, the return to gold at a high parity required monetary and fiscal deflation, active intervention on labour markets, and forms of price control. *Laissez faire* was definitely abandoned. The most important industrial interests were compensated for the loss of exports with legislation in favour of mergers, agreements, and cartels. The economy had just begun to recover from the

[25] Most such treaties included the 'most favoured nation clause'.

[26] For this view of Fascism, see Foà, 'Le strutture economiche e la politica economica del regime fascista'; Sereni, 'La politica agraria'. This line of thinking is shared, with some qualifications by Grifone, *Il capitale finanziario in Italia*.

[27] See for instance Mori, 'Per una storia'.

[28] See Toniolo, *L'economia dell'Italia fascista*; Ciocca and Toniolo, eds., *L'economia italiana nel periodo fascista*.

effects of the revaluation of the lira when the great depression forced the government to confront the following choices: to go off gold, to introduce new deflationary policies, or to insulate the economy as much as possible. As prestige considerations ruled out the first option, a mix of the other two was followed. In 1935, fiscal expansion needed to prepare for the war in Abyssinia made it necessary to enforce stricter exchange rate controls. They remained in force until 1947, when they began to be eased after Italy joined the IMF and postwar inflation had definitely been checked.

III

It is in this historical context that the main empirical findings of this paper should be viewed. In the first place, our estimates[29] neatly underline some structural characteristics stubbornly prevailing in the Italian economy throughout 1895-1947. They may be summarized as follows:

(1) During the entire half century, revenues never fell short of covering costs of production, including appropriate returns to capital. Over the period, the product price exceeded average costs by 70 per cent on average, thereby giving rise to substantial economic profits.
(2) High profitability originated from profit-maximizing behaviour under monopolistic competition. The representative firm's market power (as given by the ratio between output price and marginal costs), while changing considerably over time, remained of sizeable magnitude during the whole period under investigation, averaging 1.8.
(3) On the cost side, the pre-Second World War Italian economy appears to have been characterized by substantial long-run returns to scale.[30]. The inverse long-run cost elasticity with respect to output averaged 1.5 in the period 1895-1947.
(4) Furthermore, in both 1895 and 1946 the Italian economy turned out to be heavily undercapitalized, the shadow price of capital substantially exceeding its market price on the margin. This condition dominates more than two-fifths of the sample time span.
(5) Finally, social overhead capital formation is shown to be a complement to rather than a substitute for private investment: by producing a sizeable reduction in the representative firm's variable costs, it provided additional incentives to private fixed capital accumulation.

These long-run features of the Italian economy are relevant both for methodological and for substantive reasons. From the point of view of method, they indicate that all the assumptions underlying the standard Solow residual are untenable, at least as far as the economy described by our data set is concerned. The approach chosen in this paper seems, therefore, particularly well suited to the analysis of the long-term performance of the

[29] See appendix B.

[30] The finding of non-constant returns to scale in the aggregate is of dubious interpretation and should not be taken to imply internal firm scale economies. An interesting possibility based on external economies has recently been put forward by the modern theory of economic growth. See, among others, Romer, 'Increasing returns'.

Italian economy. Turning to empirical issues, it is worth noting that the existence (and persistence) of market imperfections throughout the first half of the twentieth century is consistent with time honoured 'qualitative' interpretations of Italy's economic history.[31] Briefly stated, these interpretations hold that, characterized as it was by low levels of capital formation, tiny market size, and lack of raw materials, the Italian economy was bound to rely on the state playing an active role and on 'investment banks' for the creation both of social overhead capital and of modern factories requiring large fixed investments. The state and the so-called finance capital, therefore, were directly involved in promoting industrial enterprises, thereby introducing monopolistic conditions in a number of industries. Gerschenkron held a modified version of this view describing the German 'mixed banks' introduced into Italy at the end of the nineteenth century, as 'agents' of industrialization in conditions of moderate backwardness.[32] Other scholars do not see state intervention in the economy, and the attendant market distortions, as a necessary condition for growth in the case of a country which, in the second half of the nineteenth century, developed its export crops in agriculture and a thriving silk industry. Rather than directly promoting industrialization, they argue, the state should have increased its efforts in social overhead capital formation. In due time, the country's 'animal spirits' would have reacted, generating a process of industrialization based upon Italy's comparative advantages. An extreme version of this view argues that the country paid dearly for state subsidies to heavy industry and for the ill-advised tariff policy introduced in 1878 and reinforced 10 years later. By providing market power to large (and inefficient) firms as well as to the large grain producers the state created and sustained precisely those who were to be behind the government takeover by Mussolini in 1922.[33]

Focusing specifically on the Fascist period, most authors agree that the domestic policy response to the developments in international trade and finance resulted in a further shift from competitive conditions, especially after 1926.[34] In particular, the following policy measures are worth recalling:

(1) The reintroduction in 1925 of the import duty on corn which had been abolished 10 years earlier. Shortly afterwards, Fascism proclaimed its 'battle for wheat' which resulted in further insulation of the sector from international competition and produced widespread inefficiencies in agriculture.[35]

(2) After 1925, 'German-type' banks came to control an increasing number of large manufacturing concerns. In 1931-4, as a result of its operations as a lender of last resort, the state took over the ownership of most enterprises of this kind.[36] It is obvious that both the banks and the state tried to avoid competition between the enterprises under their control as much as possible.

[31] See, for instance, Grifone, *Il capitale finanziario in Italia*; Sereni, 'Capitalismo e mercato nazionale'.
[32] Gerschenkron, *Economic backwardness in historical perspective*.
[33] See Toniolo, *An economic history of liberal Italy*.
[34] See Toniolo, *L'economia dell'Italia fascista*.
[35] See Sereni, 'La politica agraria'; Tattara, 'La battaglia del grano'.
[36] Ciocca and Toniolo, 'Industry and finance in Italy'.

(3) From 1927, the government sought to regulate wage bargaining, at times ruling by decree.
(4) Import duties on some items were raised in 1927 and 1928 as compensation to some industries for the overvaluation of the lira, following the return to gold. When, after 1931, the lira became outrageously overvalued, a veritable flood of legislation on import duties came into being.[37]
(5) Official government committees were set up to promote agreements and cartels among Italian producers.[38]
(6) Exchange controls were introduced from 1934. At the same time, the stipulation of clearing agreements with a number of trading partners became the main policy tool in the field. After 1935, all the above measures were reinforced and state control over foreign trade as well as domestic production became pervasive.[39]

The long-term structural features of the Italian economy emerging from our estimates are consistent with the picture of a relatively underdeveloped economic system, where undercapitalization and market inefficiencies were the rule rather than the exception. While this finding is based upon new aggregate quantitative evidence, it will not surprise those economic historians who have framed their interpretation of Italy's growth in the context of the country's relative backwardness. Some surprise, on the other hand, may arise from the analysis of the behaviour over time of the mark-up and capacity utilization indicators, since it suggests a pattern in Italian economic history which defies standard historical interpretations. The capacity utilization index $(1-\epsilon_{ik})$ reveals whether or not the economy operates at the desired level of capital stock. Between 1895 and 1947, the index displays a U-shaped time profile (appendix B, table B3). In the mid 1890s, the actual capital level was about one-half of the desired (optimum) level: on the aggregate, the economy was heavily undercapitalized. The investment boom of the following years, however, resulted in capital stock becoming increasingly adequate to meet the economy's needs. From 1905 to 1925 the index was, by and large, never significantly different from one, meaning that the economy was developing with an optimum level of capital stock. After 1925, the indicator again takes positive values. Capital was slightly below the desired level until the early 1930s. Thereafter, undercapitalization was once more considerable.

A plausible interpretation for the U-shaped pattern of the utilization index runs as follows. Around 1895, the shadow price of capital (that is, the cost reduction following a unit increase in the quasi-fixed factor) exceeded its market price, thereby giving rise to a substantial undercapitalization of the Italian economy. The phenomenon can possibly be explained by the stagnation in investment which characterized the previous decade. Moreover, structural reasons, which are typical of a backward economy, might be

[37] Guarneri, *Battaglie economiche*, pp. 423-4.
[38] Ibid., pp. 424-9.
[39] Ibid. provides a first-hand account (although not an objective and detached one) of the policy of control over foreign trade and domestic production; Guarneri was the cabinet minister in charge of foreign trade regulation.

thought of as lying behind capital shortage at the end of the century: high adjustment costs due to inefficient markets and, possibly, a shortage of social overhead capital. When aggregate demand shifted forwards, it took 10 years of high rates of investment growth to produce an adequate (optimum) capital stock. Then, for two decades after 1905, actual and desired capital stock grew at roughly the same rate: disequilibria were short lived due to better functioning markets as well as to relative price stability, both accounting for low adjustment costs. After 1925 new rigidities began to creep into the economy, at first slowly, then faster and more pervasively. At the same time, major changes and fluctuations characterized relative price behaviour. It is no surprise that the depression years (1930-3) were characterized by capital shortage: part of the existing stock of capital had become obsolete due to changes (upward) in the relative price both of labour and of imports; more labour saving and raw material saving investments were postulated by the new situation. High adjustment costs are the possible explanation of capital shortage in the late 1930s and, notwithstanding increasing inflation, during the Second World War.

Support for the view that the market economy functioned better in 1905-25 than in the previous and subsequent periods comes from the behaviour of the market power $(1/(1+\epsilon_{py}))$ index,[40] taken as a proxy for market imperfection and inefficiencies (appendix B, table B3). While the index remains significantly positive throughout the half-century under investigation, its profile is again U-shaped. Starting from a high, and roughly constant, level around the turn of the century, the mark-up steadily declines from 1905 to the mid to late 1920s and picks up again thereafter. Market organization and functioning, typically inefficient in an underdeveloped economy, improved as a result of growth itself and of increasing international competition. The process continued until the mid 1920s when, as we have already recalled, tariff and non-tariff barriers were introduced step-wise and government intervention on domestic markets became ever more binding.[41] Similarly, economies of scale (as depicted by the reciprocal of the long-run cost elasticity with respect to output changes, ϵ_{cy}) present a U-shaped pattern, with constant returns to scale prevailing, by and large, from 1908 to 1928 (appendix B, table B3). Instead, in the 1895-1907 period (1929-39), marginal cost decreasingly (increasingly) falls short of average total cost over time. In short, the behaviour of the two indices of capital utilization and market efficiency suggests a new periodization for our analysis of Italy's economic performance: (1) 1895-1905, (2) 1905-25, (3) 1925-39. On this basis, we now turn to an analysis of Italy's economic growth. Table 2 synthesizes the performance of the Italian economy in the sub-periods suggested above by comparing a traditional measure of Solow residual with the adjusted measure,

[40] In the present simplified setting, the index is nothing more than the ratio of output price to marginal cost and, as such, it is uniquely determined by the price elasticity of demand. However, it can be shown that, in a more general framework, the index would also incorporate a measure of oligopoly such as the Hirschman-Herfindahl index of firms concentration.

[41] Along with a trend, a counter-cyclical pattern shows up clearly in the behaviour of the mark-up over time, confirming that in booms marginal cost increases more rapidly than price with the expansion of production, while the reverse occurs in downturns.

which takes into account the existence of quasi-fixed factors, of economies of scale, and of market power.

Table 2. *Total factor productivity growth: 1895-1939 (per cent, per annum)*

	1895-1905	*1905-25*	*1925-39*	*1895-1939*
Solow residual				
cost based (dual, ϵ_{ct})	−0.8	−0.2	−1.8	−0.8
revenue based (primal, ϵ_{yt})	1.6	1.0	1.4	1.3
Adjusted residual				
cost based (dual, $\tilde{\epsilon}_{ct}$)	0.3	−0.2	0.0	−0.1
revenue based (primal, $\tilde{\epsilon}_{yt}$)	−0.1	0.2	0.0	0.1
Bias				
cost based (dual, $\tilde{\epsilon}_{ct}-\epsilon_{ct}$)	1.1	0.0	1.8	0.7
revenue based (primal, $\tilde{\epsilon}_{yt}-\epsilon_{yt}$)	−1.7	−0.8	−1.4	−1.2

The evolution of TFP, as reflected in the traditional measure of Solow residual (measured as potential cost reduction for given factor inputs; that is, by the dual measure) reaches a trough between the 1910s and 1920s (0.2 per cent on average between 1905 and 1925), before picking up in the Fascist years (1.8 per cent on average between 1925 and 1939). In other words, by that measure, output growth in the first and second sub-periods could be largely imputed to factor growth, while increased efficiency in production would have counterbalanced the large drop in factor growth experienced in the Fascist years. As it turns out, though, much of this pattern simply reflects returns to scale and adjustment costs (short-run fixities). Once adjusted, as in the second panel of table 2, the dual TFP growth measure is severely reduced, with the periods 1895-1905 and 1925-39 showing no 'true productivity' gains.[42] More generally, here we have a different picture of the productivity pattern from the one deriving from Solow residuals. In the decade around the turn of the century, the dual measure of productivity shows a negative trend which is reversed in the following period (1905-25) where gains are moderate but positive. During the last period in table 2 there are no 'true productivity' gains. The impact of this adjustment is most apparent from the bias corrections reported in the bottom panel of table 2. Throughout the half century, output growth appears to be largely determined by input growth and cost characteristics. In particular, during the first and third sub-periods, cost decreases (productivity increases) far from originating from technical change, turn out to be attributed entirely to the combination of scale economies and short-run adjustment costs.[43]

When seen in this light, the performance of the Italian economy between 1895 and 1939 calls for a reassessment. First, productivity increases appear

[42] More generally, as in Morrison, 'Unraveling the productivity slowdown' (see note 15 above), adjusted residuals provide strong evidence of smaller productivity growth than generally thought.

[43] A similar message (incorporating also the effects of market power) is contained in the ratio between the primal and the (negative of the) dual (adjusted) TFP measures which, as equation (11) shows, is nothing more than a function of the indices assessing the extent of all the deviations with respect to Solow's original assumptions.

to be minor determinants of overall output growth, the latter being dominated by factor inputs growth and scale economies. Second, productivity increases coincide rather neatly with the years of increasing international competition. Third, the downturn of the Italian economy in the Fascist years incorporates a productivity slowdown. The latter's determinants cannot be assessed in the framework of the present analysis. However, the policy environment of the mid 1920s and of the 1930s can be safely expected to have militated against productivity improvements: higher barriers to entry, a lower rate of exit of the inefficient firms, and more generally the encouragement of restrictive practices all played a significant role in accounting for Italy's productivity trends. However, over and above these elements which, to a certain extent, also characterized the 1895-1905 period, we consider that increased insulation of the Fascist economy from the outside world meant a sudden, large drop in the import of capital goods, thereby halting the ability of the economy to import technology.[44]

IV

The macroeconomic literature has recently begun to re-focus attention on the importance and implication of characteristics of production processes such as instantaneous adjustment of inputs, constant returns to scale, and perfect competition. This paper shows that, far from being confined to the analysis of cyclical behaviour, these developments turn out to be of crucial importance for economic historians engaged in the assessment of long-term growth trends, as shown by our analysis here of Italian economic performance.

This has provided firmer quantitative foundations for time-honoured interpretations of Italy's economic growth. In particular, state intervention in the economy, and possibly the role of German-type banking, turn out to be a mixed blessing to the economy's aggregate performance. On the one hand, insofar as government and banks were responsible for the creation of economies of scale, they made a considerable contribution to growth. Moreover, public expenditure on social overhead capital has been shown to provide a powerful incentive to private fixed capital formation. On the other hand, indirect evidence has emerged pointing to government regulation of the economy as one of the main factors behind the slow down of the 1930s.

Our findings about the functioning of the market economy in Italy are quite novel and certainly deserve further research. Contrary to what seems to be the case in the US, late nineteenth-century markets appear to be far from perfect, burdened as they were with monopolistic competition and high adjustment costs. The 'corn laws' distorted the price mechanism and resource allocation in agriculture, while both the tariff and state subsidies endowed a number of industrial firms with substantial market power. Adjustment costs were high due to imperfect and segmented capital markets, poor

[44] In principle, the productivity slowdown could also be imputed to relative factor price changes if technical progress is biased towards the use of particular commodities. Alternatively, the role of research and development expenditures could be emphasized. However, while the behaviour of relative factor prices would tend to cast serious doubts on the first explanation, the time behaviour of industrial patents over the half century does not provide obvious support to the second.

transport and communication facilities, and high transaction costs owing to an inefficient bureaucracy and far from adequate law enforcement. Finally, profit expectations were lowered by government expenditure biased to military needs undertaken to accommodate what came to be known as 'beggar's imperialism'.[45] It is not difficult to recognize in this picture some of the distinctive features of an underdeveloped economy. As noted above, the situation began to improve around the turn of the century. New outward looking policies, lower import duties, better functioning capital markets, and improved transport and communications all contributed to better competitive conditions and lower adjustment costs. Interestingly enough, the First World War and the turbulent post war period did not alter this situation in any significant way. The first three years of Mussolini's government were characterized by a return to law and order, balanced budgets, free trade in agriculture, and mobility of labour and capital. The first departure from these conditions came *before* the great depression, as a byproduct of the restoration of the gold standard in 1926-7.

What, then, went wrong with Italy's economic performance after 1925? Our data show that labour and import inputs declined while capital input growth remained high. Government policies should have been aimed at making the most efficient use of investment, at least by keeping 'true productivity' growth at the previous level and possibly by enhancing it. Moreover, and probably more importantly, an attempt to lower adjustment costs was necessary in the face of the magnitude of the exogenous shocks. In the event, as we have seen, the government took exactly the opposite course of action. Imports of capital goods, most likely the main vehicle of technical progress, were severely curtailed, while at the same time what amounted to a mercantilistic economic system came to characterize the Italian economy.

Pending further research on an international basis, the present paper cannot produce conclusive evidence on the performance of the Italian economy as a 'catcher up' or a 'faller behind' vis-à-vis the major western economies. However, while casting serious doubts on the traditional assessment of economic convergence, it pinpoints Fascist economic policies of the 1930s as the most likely candidate for the role of the villain of the long-run performance story. If anything, it was Fascism that went wrong with the growth of the Italian economy in the long run.

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Appendix A: the data

This appendix contains a brief description of methods and sources underlying the construction of the database for the present paper.

To a large extent, figures are drawn from the existing national accounts estimates recently reviewed by Rey.[46] However, as far as labour input and wage rates are concerned, the present paper provides hitherto unavailable information.

[45] In Italian, 'Imperialismo straccione'.
[46] Rey, ed., *I conti economici dell'Italia*.

y: extended value added at 1938 prices defined as the sum of gross domestic product at factor costs and total imports. Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.1A

p: implicit price deflator of the extended value added (1938=1). Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.1B

x_i: total hours worked by fully employed male equivalents in the private sector.

(i) *fully employed male equivalents in agriculture*. Following the methodology outlined in O'Brien and Toniolo, 'The poverty of Italy', labour force figures at population census dates 1901, 1911, 1921, 1931, 1936, and 1951 (source: Vitali, *Aspetti dello sviluppo*), were initially transformed into fully employed male equivalent days of work and then linearly interpolated. To convert available workforces in agriculture into labour input, the following assumptions were made: (a) male farmers aged 15-65 (including owner-occupiers, tenants, and share-croppers) owned or rented sufficient land to keep themselves fully employed for 230 days a year; (b) landless male labourers (*braccianti*) worked 190 days a year; (c) females, children, and elderly males worked 104 days a year regardless of their status as family or landless labour; (d) finally, in converting the days of labour time supplied by females, children, and elderly males into male equivalents, allowance was made for productivity differentials. Figures for days worked were then transformed into hours worked with reference to the available information on the average length of the working day (source: Arcari, 'Le variazioni dei salari agricoli').

(ii) *fully employed male equivalents in mining and quarrying*. Employment figures at industrial census dates 1911, 1927, 1937-40, and 1951 (source: ISTAT, *Censimento industriale*), were interpolated by means of the following indicators: (a) blue-collar employment in mining (available for the years 1893-1901, 1906-29, and 1933-8; source: ISTAT, *Annuario statistico italiano*), (b) blue-collar employment in quarrying and furnaces (available for the years 1901, 1906-29, 1931, and 1933-8; source: ISTAT, *Annuario statistico italiano*). Figures for days worked were then transformed into hours worked making reference to the available information on the average length of the working day in industry (source: Zamagni, 'La dinamica dei salari').

(iii) *fully employed male equivalents in manufacturing and construction, electricity, gas, and water*. Employment figures at industrial census dates 1911, 1927, 1937-40, and 1951 (source: ISTAT, *Censimento industriale*), were interpolated by means of the following indicators: (a) blue-collar employment in metal fabrication and non-ferrous mineral products industries (available for the years 1910-29; source: ISTAT, *Annuario statistico italiano*), (b) blue-collar employment in factories subject to female and children protection legislation (available for the years 1906-16; source: ISTAT, *Annuario statistico italiano*), (c) blue-collar employment index in mining and quarrying, manufacturing, and construction (available for the years 1926-39; source: ISTAT, *Annuario statistico italiano*). Figures for days worked were then transformed into hours worked, with reference to the available information on the average length of the working day in industry (source: Zamagni, 'La dinamica dei salari').

(iv) *fully employed male equivalents in transport and communication*. Employment figures at industrial census dates 1927, 1937-40, and 1951, source: ISTAT, *Censimento industriale*, were interpolated by means of the following indicator: employment in railways (available for the years 1906-40; source: ISTAT, *Annuario statistico italiano*). Figures for days worked were then transformed into hours worked, with reference to the available information on the average length of the working day in industry (source: Zamagni, 'La dinamica dei salari').

(v) *fully employed male equivalents in trade, finance, insurance, and other miscellaneous services*. Employment figures at industrial census dates 1927, 1937-40, and 1951 (source: ISTAT, *Censimento industriale*), were interpolated by means of the following indicators: employment in savings banks (available for the years 1893-1936; source: private information from Banca d'Italia). Figures for days worked were then transformed into hours worked, with reference to the available information on the average length of the working day in industry (source: Zamagni, 'La dinamica dei salari').

w_l: hourly wage rate.

(i) *hourly wage in agriculture*. Source: Arcari, 'Le variazioni dei salari agricoli'; ISTAT, *Annuario statistico italiano*.

(ii) *hourly wage in industry and construction*. Source: Zamagni, 'La dinamica dei salari'; *idem*, 'The daily wages'; ISTAT, *Annuario statistico italiano*.

(iii) *hourly wage in services*. Proxied by wage rates of low ranking government employees. Source: ISTAT, *Sommario di statistiche storiche*.

x_m: total imports at 1938 prices. Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.1A

w_m: total imports implicit price deflator (1938=1). Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.1B

k: private fixed net capital stock at 1938 prices (beginning of period). Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.3.3

r: user cost of capital defined as $r = w_b(i-\pi+\delta)$ where w_b is the fixed gross private investment deflator (source: see below), δ is the depreciation rate (source: Fuà, *Lo sviluppo economico in Italia*, III, tables XII.3.3, XX.4.14A, XII.4.17) and $(i-\pi)$ is the expected real interest rate. The latter is defined as the expected value of the difference between the interest rate on consols i (source: Fratianni and Spinelli, *Storia monetaria*) and π, the expected rate of change of w_b. The expected real rate of interest has been computed as the one period ahead forecast of a second-order autoregressive rolling regression. It is worth noting that in estimating the above regression, negative values of the real interest rate were set to zero.

x: social overhead net capital stock at 1938 prices (beginning of period). Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.3.3

b: fixed gross private investment at 1938 prices. Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.14A

w_b: fixed gross private investment deflator (1938=1). Source: Fuà, *Lo sviluppo economico in Italia*, III, table XII.4.14B

Table A1. *Output, inputs, and relative prices, 1895-1939 (per cent growth, per annum)*

	1895-1905	*1905-25*	*1925-39*	*1895-1939*
Output	2.6	2.3	1.3	2.0
Labour input	0.9	1.3	−0.1	0.8
Import	4.5	3.3	−4.4	1.0
Capital input	1.3	2.2	2.8	2.2
Product price	0.2	10.2	−1.1	4.2
Wage rate	4.3	11.1	−0.2	5.6
Import price	0.8	10.1	−1.2	4.3
Rental price	−0.4	7.4	−0.5	3.0

Table A1 summarizes the trends in the main variables over our relevant sub-periods. In describing the evolution of the Italian economy, we draw attention to the fact that our findings do not always agree with those of the two previous attempts at measuring productivity growth over a secular time span.[47]

The following points are worth noticing:

(a) Output data differ in a number of ways from GNP in table 1 (taken from Maddison, *World economy*, for purposes of international comparison). In particular, our figures are defined as 'resource availability', are *not* in per caput terms and use a 1938 (rather than 1980) price deflator.

[47] Fuà, *Lo sviluppo economico in Italia*, I; Maddison, *Phases of capitalist development*.

(b) For the first two sub-periods (1895-1905 and 1905-25) our labour input growth rates are significantly higher than those computed by Fuà,[48] (0.9 and 1.3 per cent p.a. as against 0.3 and 0.5 per cent, respectively).[49] This is likely to be the consequence of our adjustment to agricultural employment figures which makes allowance for 'disguised unemployment'. In contrast, Fuà's definition of agricultural employment coincides with that of labour force. It is worth noting that our findings are consistent with the view[50] that, during this period, Italy's most important available resource consisted of a large supply of cheap, relatively well-educated labour and that this resource was efficiently exploited.

(c) The period 1925-39 shows a considerable slowdown in the rate of growth of labour inputs due both to higher unemployment rates and to a reduction in length of the working day. This latter effect is not taken into account by Fuà and, therefore, his labour input growth is higher than ours (0.4 per annum).[51]

Tables A2, A3, and A4 report the full data set.

Table A2. *Output and inputs (1938 lire, billions)*

Year	*Output*	*Labour*[a]	*Imports*	*Capital*
1894	68.9	39.5	7.0	135.1
1895	70.8	40.5	7.7	135.9
1896	71.8	40.5	7.6	137.0
1897	69.1	38.7	7.4	137.9
1898	74.0	40.2	8.3	139.1
1899	75.4	40.6	8.8	140.1
1900	81.0	42.3	9.8	142.0
1901	85.3	43.2	10.4	144.2
1902	84.4	42.1	10.6	146.7
1903	87.2	42.8	10.9	149.1
1904	87.5	42.7	11.1	151.9
1905	91.2	44.1	12.1	155.2
1906	95.0	45.7	14.3	159.6
1907	104.8	48.7	15.9	166.0
1908	104.8	53.4	16.1	173.7
1909	111.3	50.0	17.2	182.0
1910	106.8	50.0	17.3	190.1
1911	112.4	50.2	17.3	198.1
1912	115.7	50.1	18.4	205.4
1913	119.9	50.2	18.2	212.6
1914	115.8	50.6	14.8	219.3
1915	131.7	50.2	18.7	224.6
1916	148.1	53.8	23.2	224.9
1917	151.1	53.0	22.5	223.3
1918	150.4	54.7	20.3	221.7
1919	131.3	49.6	21.0	218.8
1920	128.8	49.6	26.5	219.7
1921	118.5	47.3	18.1	222.7
1922	123.0	48.7	17.1	223.6
1923	130.4	51.7	18.1	226.6

(*continued*)

[48] Fuà, *Lo sviluppo economico in Italia*, I, pp. 246 ff. Maddison, *Phases of capitalist development*, pp. 96 ff computes input growth rates for 1870-1913 which are not comparable with ours.

[49] Our entirely new estimates of labour input and our more precise definition of capital inputs are likely to account for such a large discrepancy between our growth rates and those by Fuà.

[50] Toniolo, *An economic history of liberal Italy*; Federico and Toniolo, 'Italy', pp. 211-3.

[51] The estimates in Maddison, *Phases of capitalist development*, pp. 210-1, on the other hand, are based on a rather implausible decline by 25 per cent in the annual hours worked per person and result in a yearly decline of 0.7 per cent (1913-38).

Table A2. *Continued*

Year	Output	Labour[a]	Imports	Capital
1924	134.1	54.0	20.2	231.3
1925	144.0	58.9	22.5	238.6
1926	144.1	61.5	21.4	249.2
1927	139.7	59.1	19.5	259.5
1928	151.1	56.6	22.5	267.9
1929	155.1	57.7	22.4	278.0
1930	145.4	55.7	19.2	289.3
1931	139.1	54.4	14.4	297.6
1932	139.6	51.0	11.2	302.4
1933	140.6	53.8	12.6	305.3
1934	139.6	53.7	11.1	307.4
1935	150.6	53.0	10.9	312.5
1936	147.8	52.1	7.9	321.6
1937	165.5	53.9	15.6	333.7
1938	163.3	54.3	12.3	343.8
1939	172.5	56.6	10.9	352.8
1940	173.6	56.3	10.9	363.0
1941	169.1	55.4	8.2	371.0
1942	166.5	55.8	7.9	377.9
1943	153.4	54.3	9.9	375.0
1944	122.6	49.2	5.8	362.4
1945	98.9	46.2	7.2	344.0
1946	130.2	52.4	10.3	329.5
1947	162.3	64.7	21.6	330.8

Note: [a]Labour inputs for the years 1894-1906 and 1940-7 are ex-post forecasts from the estimated econometric model.

Table A3. *Output and factor prices (1938=1)*

Year	*Output price*	*Wage rate*	*Import price*	*Rental rate*
1894	0.168	0.118	0.164	0.012
1895	0.169	0.089	0.164	0.014
1896	0.167	0.095	0.167	0.011
1897	0.169	0.097	0.171	0.013
1898	0.179	0.097	0.178	0.014
1899	0.177	0.097	0.180	0.011
1900	0.176	0.099	0.182	0.012
1901	0.171	0.101	0.173	0.010
1902	0.166	0.107	0.172	0.018
1903	0.175	0.110	0.176	0.015
1904	0.174	0.119	0.178	0.011
1905	0.173	0.136	0.177	0.014
1906	0.179	0.138	0.185	0.009
1907	0.186	0.151	0.189	0.014
1908	0.180	0.154	0.188	0.007
1909	0.184	0.154	0.189	0.017
1910	0.191	0.160	0.196	0.011
1911	0.199	0.168	0.204	0.020
1912	0.205	0.175	0.210	0.011
1913	0.204	0.182	0.211	0.012
1914	0.205	0.194	0.209	0.014
1915	0.229	0.217	0.242	0.021

(*continued*)

Table A3. *Continued*

Year	*Output price*	*Wage rate*	*Import price*	*Rental rate*
1916	0.300	0.258	0.351	0.013
1917	0.416	0.338	0.591	0.031
1918	0.546	0.456	0.743	0.044
1919	0.672	0.667	0.768	0.042
1920	0.958	0.863	1.038	0.110
1921	0.999	1.005	1.017	0.030
1922	1.002	1.025	0.997	0.081
1923	1.003	1.026	1.011	0.076
1924	1.023	1.039	1.040	0.095
1925	1.205	1.121	1.222	0.058
1926	1.262	1.175	1.294	0.062
1927	1.106	1.124	1.131	0.075
1928	1.037	1.027	1.047	0.170
1929	1.007	1.013	1.019	0.098
1930	0.942	0.988	0.974	0.057
1931	0.850	0.895	0.888	0.091
1932	0.802	0.860	0.813	0.071
1933	0.751	0.843	0.754	0.099
1934	0.753	0.817	0.762	0.064
1935	0.787	0.798	0.779	0.064
1936	0.852	0.851	0.844	0.058
1937	0.940	0.960	0.927	0.032
1938	1.000	1.000	0.999	0.038
1939	1.034	1.084	1.035	0.054
1940	1.211	1.320	1.252	0.100
1941	1.418	1.521	1.462	0.037
1942	1.804	1.701	1.796	0.078
1943	2.714	2.466	2.333	0.082
1944	6.318	4.498	9.302	0.149
1945	14.409	11.682	20.642	0.475
1946	25.077	21.627	26.117	0.933
1947	42.216	46.440	46.389	1.527

Table A4. *Miscellaneous variables (1938 lire, billions)*

Year	*Depreciation rate*	*Gross investment*	*Social overhead capital*
1894	0.026	4.3	47.0
1895	0.026	4.6	47.8
1896	0.026	4.6	48.4
1897	0.027	4.8	48.7
1898	0.027	4.8	48.7
1899	0.027	5.6	48.7
1900	0.028	6.3	48.6
1901	0.028	6.5	48.6
1902	0.028	6.5	48.6
1903	0.028	6.9	48.7
1904	0.028	7.5	48.9
1905	0.029	9.0	49.0
1906	0.029	10.9	49.2
1907	0.029	12.5	49.2
1908	0.029	13.3	49.3

(*continued*)

Table A4. *Continued*

Year	*Depreciation rate*	*Gross investment*	*Social overhead capital*
1909	0.029	13.4	49.6
1910	0.029	13.6	50.0
1911	0.030	13.2	50.7
1912	0.030	13.3	51.4
1913	0.030	12.9	52.2
1914	0.030	12.2	53.1
1915	0.031	7.5	54.1
1916	0.031	5.2	55.0
1917	0.032	5.6	55.2
1918	0.033	4.5	55.0
1919	0.034	8.3	54.6
1920	0.035	10.6	55.0
1921	0.035	8.9	55.6
1922	0.036	10.6	56.5
1923	0.037	12.8	57.9
1924	0.038	16.5	59.5
1925	0.039	20.1	60.4
1926	0.039	20.1	60.8
1927	0.039	18.7	61.6
1928	0.040	20.7	62.6
1929	0.040	21.8	63.6
1930	0.040	20.5	64.7
1931	0.041	17.1	66.3
1932	0.042	15.0	67.9
1933	0.042	15.4	69.5
1934	0.043	17.7	71.8
1935	0.044	23.1	74.0
1936	0.044	25.8	75.8
1937	0.045	25.6	77.2
1938	0.045	24.2	78.3
1939	0.046	26.6	79.1
1940	0.047	25.5	80.5
1941	0.048	24.1	82.4
1942	0.048	20.6	84.0
1943	0.049	15.9	84.4
1944	0.050	9.6	83.3
1945	0.051	8.0	81.2
1946	0.051	18.5	80.2
1947	0.051	24.4	82.7

Appendix B: the model

The empirical implementation of the theoretical model outlined in section I requires specification of the unknown restricted cost function $c_v = c_v(w,y,k,t)$.[52]

The description of short-run firm behaviour is based on a flexible functional form known as Generalized Leontief (GL) due to Diewert, modified where necessary to account for the existence of fixed factors. Assuming two variable inputs (labour and imports, denoted by the subscripts l and m, respectively) and a single fixed factor (capital, k), we let:

[52] A thorough analysis of the determinants of firm's market power goes beyond the aim of this paper. Therefore the inverse demand function for the firm's output (equation 4) has not been specified and estimated.

$$c_v(w,y,k,t,b,x) = y\Big[\sum_i\sum_j \alpha_{ij}(w_iw_j)^{0.5} + \sum_i \beta_{it}w_it^{0.5} + \sum_j \beta_{ib}w_ib^{0.5} + \sum_i \beta_{ix}w_ix^{0.5} \qquad \text{(B1)}$$

$$+ \sum_i \beta_{iy}w_iy^{0.5} + \sum_i w_i(\gamma_{yy}y + \gamma_{tt}t + \gamma_{bb}b + \gamma_{xx}x + \gamma_{yt}(yt)^{0.5} + \gamma_{yb}(yb)^{0.5}$$

$$+ \gamma_{yx}(yx)^{0.5} + \gamma_{tb}(tb)^{0.5} + \gamma_{tx}(tx)^{0.5} + \gamma_{bx}(bx)^{0.5})\Big]$$

$$+ y^{0.5}\Big[\sum_i \beta_{ik}w_ik^{0.5} + \sum_i w_i(\gamma_{yk}(yk)^{0.5} + \gamma_{tk}(tk)^{0.5}$$

$$+ \gamma_{bk}(bk)^{0.5} + \gamma_{xk}(xk)^{0.5})\Big] + \sum_i w_i\gamma_{kk}k$$

$$(i,j = l,m)$$

where the αs, βs and γs are technological parameters, and where the variable cost function has been extended so as to capture internal adjustment costs (stemming from investment in the quasi-fixed input, denoted by b) as well as an additional exogenous argument (x) representing the stock of public works.

Application of equation (3) yields the system of variable input demands:

$$x_i/y = (\partial c_v(w,k,y,t)/\partial w_i)(1/y) = \sum_j \alpha_{ij}(w_i/w_j)^{0.5} + \beta_{iy}y^{0.5} + \beta_{it}t^{0.5} + \beta_{ib}b^{0.5} + \beta_{ix}x^{0.5} \quad \text{(B2)}$$

$$+ \gamma_{yy}y + \gamma_{tt}t + \gamma_{bb}b + \gamma_{xx}x + \gamma_{yt}(yt)^{0.5} + \gamma_{yb}(yb)^{0.5}$$

$$+ \gamma_{yx}(yx)^{0.5} + \gamma_{tb}(tb)^{0.5} + \gamma_{tx}(tx)^{0.5} + \gamma_{bx}(bx)^{0.5} + \beta_{ik}(k/y)^{0.5} + \gamma_{yk}k^{0.5}$$

$$+ \gamma_{tk}(tk/y)^{0.5} + \gamma_{bk}(bk/y)^{0.5} + \gamma_{xk}(xk/y)^{0.5} + \gamma_{kk}(k/y)$$

Notice that, from the system of equations (B2), all the parameters characterizing the firm's short-run technology can be uniquely recovered, thereby allowing the computation of the market power and (short- and long-run) fixities referred to in the text.

The simultaneous system of equations (B2) has been estimated with maximum likelihood estimation methods over the sample period 1894-1947.[53] Table B1 reports some tests of specification and misspecification designed to shed some light on the overall performance of the model as well as on the admissibility of selected hypotheses of theoretical interest.

The first thing to notice is that some of the technological parameters turned out to be poorly determined and were therefore set to zero. The first line of table B1 provides a

Table B1. *Specification and misspecification tests*

Specification tests	LR^a	$\chi^2_{0.05}(dof)$
zero restrictions	3.9	$\chi^2_{0.05}(7)$:14.1
constant returns to scale	18.1	$\chi^2_{0.05}(5)$:11.1
Misspecification tests		
dynamic specification	0.2	$\chi^2_{0.05}(4)$:9.5
structural stability: 1915-8	5.9	$\chi^2_{0.05}(6)$:12.6
structural stability: 1929-33	0.9	$\chi^2_{0.05}(10)$:18.3
structural stability: 1939-45	0.9	$\chi^2_{0.05}(12)$:21.0

Note: ^aLR denotes the likelihood ratio test, distributed as a $\chi^2(dof)$ where dof indicates the degrees of freedom.

[53] Actually, the estimation method takes into account the fact that the labour input ratio is only observed over the sub-sample 1907-39.

likelihood ratio test of the joint hypothesis H_0:$\alpha_{lm} = \gamma_{kk} = \gamma_{yy} = \gamma_{bx} = \gamma_{by} = \gamma_{tt} = \gamma_{tb} =$ 0. As is apparent from table B1, the hypothesis has not been rejected at customary levels of significance.[54] Given the above zero restrictions, the second line of table A1 tests the hypothesis of constant returns to scale (H_0: $\gamma_{ty} = \gamma_{xy} = \gamma_{yk} = \beta_{ty} = \beta_{\mu} = 0$) which is soundly rejected by the data.

The hypotheses of no short-run fixities ($\epsilon_{ck} = 0$) and perfect competition ($\mu = 1$) cannot, however, be expressed in purely parametric terms and can therefore only be tested with reference to a specific period. As it turns out, the Italian economy appears to have been significantly undercapitalized in the sub-periods 1894-1901 and 1934-47 (with t-statistics testing the hypothesis H_0: $\epsilon_{ck} = 0$ ranging from 2.1 to 5.5), while significant overcapitalization shows up in 1911, 1915, and 1918-23 (with t-statistics ranging from 2.1 to 4.1). In the remaining years the available capital stock is not significantly different from its optimal level. As far as market power is concerned, the hypothesis H_0: $\mu - 1 = 0$ is not to be rejected only in the periods 1911, 1915, 1918-23.

The lower panel of table B1 assesses the overall performance of the estimated model. The results seem to suggest that there is no apparent sign of dynamic misspecification and that, moreover, the model seems to work quite well for forecasting purposes. Structural stability tests over the more troubled sub-periods (that is the First and Second World Wars and the Great Depression) confirm the latter statement.

Table B2 instead presents parameter estimates (with their asymptotic standard errors, adjusted for heteroscedasticity). On the basis of these estimates, attention should be drawn to the finding that, for a given capital stock, input-output coefficients could well be generated by a Leontief technology, their evolution being driven by changes in capital stock, output, and the technical progress, rather than by relative factor prices. Furthermore, in the short run, the stock of capital tends to displace both variable inputs in the whole sample period. In the long run, on the other hand, substitution effects characterize the relationship between capital and labour, and capital and imports. Labour and imports, instead, tend to be complements. In general, long-run cross and own price elasticity tend to be large as well as to fluctuate substantially in the sample period.

Table B2. *Parameter estimates (sample period 1895-1947)*

α_{tt}	−2.5244 (1.0484)[a]	γ_{yk}	−0.0634 (0.0189)
β_{lt}	−0.4706 (0.0645)	γ_{tk}	0.4568 (0.0828)
β_{lb}	0.1927 (0.0332)	γ_{bk}	−0.0929 (0.0269)
β_{ly}	0.5170 (0.0900)	γ_{xk}	−0.9108 (0.1408)
β_{lx}	−0.6366 (0.2907)	α_{mm}	−2.7376 (1.1356)
γ_{bb}	0.0069 (0.0037)	β_{mt}	−0.4327 (0.0622)
γ_{xx}	0.2142 (0.0474)	β_{mb}	0.1803 (0.0366)
γ_{yt}	−0.0455 (0.0124)	β_{μ}	0.5602 (0.0850)
γ_{yx}	−0.0920 (0.0173)	β_{mx}	−0.7136 (0.2938)
γ_{tx}	−0.0835 (0.0291)	β_{mk}	5.4533 (0.8129)
β_{lk}	5.5396 (0.8021)		
Log-likelihood: 249.058			

Note: [a]in parentheses, asymptotic standard errors adjusted for heteroscedasticity

Table B3 reports the evolution of the main indicators derived from the estimates: (i) profitability ($py/c_t(w,r,y,k,t)$), (ii) market power ($p/c_m(w,y,k,t)$), (iii) returns to scale ($1/\epsilon_{cy}$), (iv) short-run returns to scale ($(1-\epsilon_{ck})\epsilon_{cy}$), and (v) capacity utilization ($1-\epsilon_{ck}$).

Finally, it should be noted that the estimates presented here are part of a wider project on the structure and the evolution of the Italian economy in the twentieth century. In particular, it is envisaged that future research will provide improved estimates by (i) completing the model adding an Euler equation for investment, (ii) allowing for a fully specified demand equation, (iii) isolating the role of energy products in factor demand.

[54] 95 per cent critical values are reported in the fourth column of the table.

Table B3. *Main indicators*

Year	*Profitability*	*Market power*	*Returns to scale*	*Short-run returns to scale*	*Capacity utilization*
1894	1.575	1.462	2.149	1.077	2.315
1895	1.758	1.794	2.127	0.980	2.083
1896	1.797	1.812	2.106	0.991	2.088
1897	1.715	1.942	2.089	0.883	1.845
1898	1.807	2.180	2.047	0.829	1.697
1899	1.880	2.217	1.952	0.848	1.655
1900	1.862	2.243	1.827	0.830	1.517
1901	1.890	2.277	1.726	0.830	1.433
1902	1.565	2.370	1.685	0.660	1.113
1903	1.738	2.464	1.572	0.705	1.108
1904	1.736	2.397	1.505	0.724	1.090
1905	1.535	2.104	1.384	0.729	1.009
1906	1.688	1.963	1.265	0.860	1.088
1907	1.529	1.711	1.124	0.894	1.005
1908	1.601	1.678	1.078	0.954	1.028
1909	1.420	1.660	1.009	0.855	0.863
1910	1.536	1.827	1.021	0.841	0.858
1911	1.387	1.800	1.004	0.771	0.773
1912	1.562	1.781	0.999	0.877	0.876
1913	1.537	1.741	1.006	0.883	0.888
1914	1.463	1.943	1.098	0.753	0.827
1915	1.488	2.014	1.033	0.739	0.763
1916	1.902	1.890	0.896	1.006	0.901
1917	1.645	1.530	0.760	1.075	0.817
1918	1.648	1.676	0.626	0.983	0.615
1919	1.458	1.759	0.678	0.829	0.562
1920	1.336	1.772	0.675	0.754	0.509
1921	1.577	2.362	0.716	0.668	0.478
1922	1.385	2.027	0.760	0.683	0.520
1923	1.432	1.689	0.839	0.848	0.712
1924	1.390	1.488	0.945	0.934	0.883
1925	1.634	1.324	0.933	1.234	1.151
1926	1.630	1.362	0.932	1.197	1.115
1927	1.491	1.474	1.010	1.011	1.022
1928	1.212	1.324	1.008	0.916	0.923
1929	1.420	1.288	1.050	1.102	1.158
1930	1.569	1.478	1.194	1.062	1.268
1931	1.380	1.773	1.419	0.778	1.105
1932	1.473	1.923	1.606	0.766	1.231
1933	1.283	1.841	1.734	0.697	1.208
1934	1.526	1.713	1.868	0.891	1.664
1935	1.651	1.448	1.818	1.140	2.073
1936	1.804	1.432	1.937	1.260	2.440
1937	2.015	1.325	1.938	1.521	2.947
1938	2.067	1.400	2.052	1.477	3.030
1939	1.921	1.297	2.027	1.480	3.000
1940	1.688	1.287	2.149	1.311	2.817
1941	2.149	1.337	2.322	1.607	3.732
1942	2.128	1.519	2.477	1.401	3.469
1943	2.256	1.870	2.665	1.206	3.215
1944	2.328	2.226	3.003	1.046	3.140
1945	1.681	3.444	3.743	0.488	1.827
1946	1.904	1.843	1.995	1.033	2.061
1947	1.520	1.096	1.784	1.387	2.474

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