

**BUSINESS FLUCTUATIONS IN ITALY, 1861-1913:
THE NEW EVIDENCE**

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ABSTRACT

Band-pass filters and structural time series models are applied to the new estimates of Italy's national income from 1861 to 1913. These indicate a strong four-year cycle, derived from the agricultural sector, which curiously (and perhaps spuriously) vanishes after 30 years. Agriculture seems marked by a further cycle of some 12-15 years, and also by a long wave related to the sector's terms of trade. Industry displays a marked Kuznets cycle, which dominates trend GDP. Growth significantly accelerated in the pre-war years, without however implying the deep-structure discontinuity of the historical literature.

Keywords: trend-cycle decompositions, post-Unification Italy

1. Introduction

Italy's national historical accounts were reconstructed just over a half-century ago by Istat (the Istituto Centrale di Statistica) and Ornello Vitali (the statistician of the "Ancona Group" organized by Giorgio Fuà). The Istat-Vitali estimates for the decades between Unification (1861) and World War I have long been considered seriously distorted; but such reconstructions are enormously labor-intensive, and a preliminary set of alternative set of estimates has appeared only a few months ago. These new estimates combine the constant-price value added series for agriculture estimated by Giovanni Federico with the corresponding series for industry and the services estimated by the coauthor of the present piece; they point to higher and above all much steadier long-term growth.¹ This paper examines business fluctuations in post-Unification Italy in the light of these new estimates. Section 2 considers the short-term business cycle, and section 3 the longer-term fluctuations in GDP; a brief conclusion summarizes the main empirical results, and the research agenda to which they point.

The business cycle in the new GDP series is identified through alternative decompositions; these yield very similar results, which are correspondingly robust. Post-Unification Italy was largely agricultural, and the short-term cycle in GDP derived overwhelmingly from the movements of agricultural production. The measured cyclical deviations were unusually moderate over the quarter-century before the war; but this comparative stability is not clearly confirmed by the available historical data, and it may be a statistical artifact.

Over the longer term trend growth appears to have been above average in the 1880s, and even more so after the turn of the century; alternative decompositions again yield very similar results, and these fluctuations too appear to be robustly identified. The agricultural series displays a further cycle of some twelve to fifteen years, and an even longer fluctuation apparently related to the sector's terms of trade; but these movements are relatively mild. The measured fluctuations of the services sector are even milder, and the major longer-term movements in GDP paralleled those in industrial output. The significant turn-of-the century acceleration of GDP growth is tied to the rising industrial production of durables; it appears to reflect a sustained upswing in the investment cycle induced by the varying supply of foreign capital, and does not point to a break in the deep structure of the economy.

2. The business cycle

The business cycle over time

The new GDP series is illustrated in Figure 1.² Figure 2 presents the business cycle identified through two alternative decompositions (of log GDP). One uses a Baxter-King (1999) band-pass filter that admits periodic components between 2 and 8 years, and a moving

¹The original estimates appeared in Istat (1957) and Fuà (1969); Fenoaltea (2005) presents the new estimates, and compares them to their predecessors.

²GDP at market prices includes net indirect business taxes; GDP at factor cost does not. The conventional measure "of GDP" is the former, and that is the series analyzed here; but the two series are very close. Population growth was very steady, at least between census benchmarks, and essentially unknown at higher frequencies; the extant per-capita series are in essence rescaled and retrended versions of the corresponding aggregates, with no independent variation (Fenoaltea, 1988, 2005).

average of order 3, as is standard when dealing with annual macroeconomic data. The other relies on the general structural time series model with uncorrelated components described in Harvey and Jaeger (1993) and extensively applied to historical time series by Crafts and Mills (1996, and references therein).³

These alternative approaches to the identification of the business cycle reflect very different statistical methodologies; but in the present case they yield results that are very similar (and similar to those obtained through alternative filters).⁴ The cycle which they identify is essentially one and the same, and appears to be robustly based in the GDP series itself.

The business-cycle chronology that emerges from these series is presented in Table 1, col. 1.⁵ All turning points are identified by a *p* (peak) or a *t* (trough). A bold-face *MP* or *MT* identifies a major peak or trough, defined as a turning point that deviates from the series' own trend by no less than *s*, the standard deviation of the cyclical deviations themselves. A bold-face *p* or *t* identifies a minor but still significant turning point, with a cyclical deviation under *s*, but with a deviation from either the previous or the succeeding turning point no smaller than *s*; a "plus" highlights those that are borderline major. Parentheses indicate a cyclical deviation close to that of the neighboring peak or trough; square brackets appear in the initial and final years, to signal local extreme values that are not of course turning points.

The new GDP series is characterized by a sharp, roughly quadriennial cycle until about 1890; subsequently, its cyclical variations are much reduced, and on the present definitions major peaks and troughs do not recur.⁶ The contrast is evident in Figure 3, which presents the kernel density estimates of the (band-pass) cyclical deviations of GDP over the full span from 1861 to 1913, and the sub-periods 1861-1890 and 1891-1913.⁷

Figure 4, analogous to Figure 3; it compares the post-Unification (1861-1913) experience represented by the new series at 1911 prices with the interwar (1919-1939) and postwar (1950-90) experience represented by the Rossi-Sorgato-Toniolo series at 1938 and at 1985 prices, respectively (Rossi, Sorgato, Toniolo, 1993). Over its full span the post-Unification economy appears more stable than the inter-war economy, and no more unstable than the post-war economy; but the measured amplitude of the business cycle is extremely sensitive to the precise methods used to generate the time-series estimates (Romer, 1986), and over these three periods the GDP series are not homogeneous.

Only the post-World War II figures are derived from current, broadly-based national

³Neither decomposition requires a prior verification of the unit-root properties of the series under investigation (Baxter-King, 1999, Appendix A; Harvey, 1997). The structural time series model is estimated using STAMP 6.2 (Koopman, Harvey, Doornik, and Shephard, 2000).

⁴These alternative filters are the fixed-length symmetric Christiano-Fitzgerald (1999) filter, very similar in spirit and structure to that of Baxter and King, and the full-sample asymmetric Christiano-Fitzgerald (2003) filter with time-varying data-sensitive weights. These aspects of the weighting structure are captured by the structural time-series model. A very similar cycle (apart from the end-points) is also obtained through a Nadaraya-Watson non-parametric regression with Gaussian kernel and the corresponding Silverman band-width.

⁵Table 1 is based on the Baxter-King filter alone: since it has recently been applied to the Istat-Vitali estimates of Italian GDP (as amended, from 1890, by Rossi, Sorgato, and Toniolo, 1993) by Delli Gatti, Gallegati, and Gallegati (2005), the chronology presented here directly illustrates the differences in the time series that are being analyzed, without clouding the comparison with a change in technique.

⁶Over the full half-century the cycle period estimated by the structural model is 4.56 years.

⁷These were generated with an Epanechnikov kernel and a band-width proportional to the sample size raised to the power $-.2$.

accounts; the pre-World War I and interwar series are estimates derived from limited historical data, and reflect very different approaches. The interwar series is a very partial revision of the original Istat-Vitali estimates (Bardini, Carreras, and Lains, 1995), obtained with the traditional methodology of the pioneers: a small number of series is taken to represent a much larger whole, in effect overstating cyclical variations by assuming perfect positive correlations even where these were more plausibly limited or even negative (Fenoaltea, 2003).

The new series for the decades to World War I avoid Scylla, but in the present, preliminary version sail close to Charybdis. Their immediate aim was to remove the gross errors displayed over the medium and long term by the extant Istat-Vitali series and their subsequent derivatives; and this much they appear to have achieved. But the aggregate series for industry and for the services both include provisional elements that simply interpolate a small handful of census benchmarks, and do not yet incorporate any short-term movements at all (Fenoaltea, 2003, 2005). The agricultural aggregate too is excessively stable. Federico's component series are normally simple averages of separate production-side and consumption-side estimates calculated for ten major products. The consumption-side estimates model consumption as a function of wages and deflated current prices, and deduct net imports to estimate production; depending on the openness of the market, therefore, supply shocks show up either in prices and consumption, or in net imports. The production-side estimates assume supply curves that shift steadily with technical progress, and movements along these curves that are a function of lagged relative prices, with elasticities that reflect the competing uses of the available land; but in these preliminary estimates, the deviations between planned and actual output are simply neglected (Federico, 2003).

Figure 4 cannot therefore be taken at face value, for the series for the three sub-periods are not directly comparable. Allowing for their relative cyclical sensitivity, all Figure 4 actually suggests is that the pre-World War I economy was *less* stable than the post-World War II economy. The relative volatility of the interwar economy cannot be ascertained at all: as measured it was the highest, but its measure alone is biased upwards.

Figure 3 is of course derived from the new series alone, and free of such problems; the sharp difference in volatility across the sub-periods 1861-1890 and 1891-1913 cannot simply be dismissed, and warrants further investigation.

The sectoral origins of the business cycle

The immediate sources of the business cycle are here explored by applying the Baxter-King filter to the new series for agriculture, industry, and the services, here illustrated in Figure 5.⁸ In this context, the computational simplicity of this decomposition facilitates the interpretation of the results: their statistical roots are perfectly transparent, and the aggregate trend and cycle are simple sums of those obtained for its components.⁹

The resulting chronology is transcribed in Table 1, cols. 2 - 4; all three sectors display

⁸GDP is estimated at market prices, and contains a fourth series, for indirect business taxes. This last is a very minor component of the total, and the only element of the new estimates borrowed from the Istat-Vitali corpus (Fenoaltea, 2005); it will here be ignored.

⁹With the standard parameters used here, the weights that generate the cyclical variable c_t have a very simple structure: approximately .77 to the current observation x_t , and -.20, -.14, and -.05, respectively, to those 1, 2, and 3 years removed; and this is equivalent to calculating c_t as the deviation of x_t from a trend y_t calculated as a straightforward seven-year moving average with weights equal to .23 on the current observation and .20, .14, and .05, respectively, on its neighbors. The corresponding algorithm of the structural time series model is much more complex (Proietti, 2002), and does not lend itself to straightforward disaggregation; as noted below, the results agree with those presented here.

major peaks and troughs, as here defined with reference to each series' own variability, especially over the first three decades of the period at hand. But the different sectors were not equally variable, nor equally large; as is apparent from Figures 6 and 7, which compare the cycles in GDP and in the three major sectors, there are sharp differences in their relative contribution to the cycle in GDP.

Figure 6 presents the cycle series separately, but they are all expressed as percentages of trend GDP; the vertical scale differs by an order of magnitude between the upper graphs, for GDP and agriculture, and the lower graphs, for industry and services. The sector graphs include reference lines that indicate a constant range of variation with respect to the sector's own calculated trend; that range is set at (plus or minus) 2 percent in the case of agriculture, and just 1 percent in that of industry and the services. These lines converge as the sector's share of GDP declines and a given percentage of GDP equals an ever larger percentage of the sector itself, and obviously diverge in the opposite case.

The three sectors differed significantly in their relative variability. The percentage deviations from the sector's own trend (measured in Figure 6 with respect to the dotted reference lines) were clearly greatest in agriculture, much reduced in industry, and least in the services: agriculture deviated from its trend by more than 2 percent, industry by less than 2 percent but more than 1 percent, the services by well under 1 percent. Agriculture was at once the largest sector, and the most variable: in their impact on GDP, its fluctuations were an order of magnitude greater than those of industry or of the services. The services in particular had a minimal impact, especially in a causal sense: within that sector, by construction, large components are virtually devoid of cyclical movements, and the parts that do vary respond to the changes in commodity production (Fenoaltea, 2005).

Figure 7 superimposes the different series illustrated separately in Figure 6: it is immediately apparent that the business cycle of the new GDP series is essentially that of its agricultural component. The post-1890 reduction in the amplitude of the GDP cycle coincides with a reduction of the co-variation of the sector cycles (Table 2), but that covariation seems to have exacerbated the GDP cycle only in the 1860s, and again at the late-1880s peak; the other swings in GDP up to 1890 were virtually the agricultural cycle alone, with a negligible net contribution from the other sectors.¹⁰

The post-1890 reduction in the variability of GDP seems correspondingly to have derived primarily from the reduction in the variability of agricultural production, which similarly varies much less than before: the 2-percent-of-trend dotted line was regularly crossed between 1861 and 1891, but from then on it would be reached again only at the very end of the period at hand, in 1907 and again in 1910 (Figure 6).

Is the relative stability of the pre-war years a figment of the data?

It is of course hardly surprising that in a largely agricultural economy the cycle in GDP should have been, to a first approximation, the cycle of the agricultural sector. A progressive reduction in the volatility of GDP as the more stable sectors became relatively larger, or as the diffusion of new techniques made agriculture itself less sensitive to natural shocks, would be similarly plausible; but the observed reduction in volatility is very sudden, and within agriculture itself. Its statistical roots cannot be investigated directly, however, for the

¹⁰The analogous figure obtained from the structural time series model returns this result in even stronger terms. The agricultural trend and cycle are virtually identical to their Baxter-King equivalents, and the GDP cycle is all but exhausted by the agricultural cycle, with a negligible contribution from industry and the services. In both decompositions the only exception is in the early years, where a significant residual is due to a sharp fluctuation in indirect business taxes (Figure 1).

component elements of the Federico series have not been published, and the available description of his sources and methods is very terse (Federico, 2003).

Over the short term, as noted, the movements of the new series reflect the consumption-side evidence from changes in prices and trade flows, but not (yet) any direct production-side testimony on the relative abundance of each harvest. From this perspective the new series is a mirror-image of the agricultural statistics generated at the time: these apparently got the longer-term movements wildly wrong--and transmitted their errors even to their distant progeny (Fenoaltea, 2005)--but they clearly incorporated the perceived short-term variations in the harvest.

Annual series for wheat, corn, and wine, beginning in 1884, were published by the Direzione generale della statistica (1915). In 1911, according to Federico (2000), these three products accounted for some two fifths of agriculture's GSP (8.06 billion lire): wine alone represented about one fifth (1.71 billion) and wheat almost another sixth (1.23 billion), with corn far behind (.25 billion). Figure 8 presents the (Baxter-King) cycles in these historical series, and compares them to the corresponding cycle in the Federico series. The wheat series points to relatively constant variability (the 1897 catastrophe apart), and the (minor) corn series tends if anything to vary more where the Federico series varies less. The wine series alone displays less cyclical variation over its central span than at the beginning and the end, as the new aggregate does; and while wine was the most important of the measured crops it is relatively *sui generis*, and less likely than the others to be correlated with omitted items.

Little further evidence speaks to the point.¹¹ Before the public sector took on the burden of monitoring the economy, the study of its fluctuations relied on whatever statistics had been generated for other purposes; and one of the more useful real indicators was provided by the data on railroad traffic. The time series for freight-car vehicle-kilometers incorporated in the new service-sector estimates is illustrated in Figure 9: over the early years it seems to reflect little more than the initial construction of the national network, but from about 1875 it too displays apparently meaningful cyclical variations. The cycle identified by the Baxter-King filter appears in Figure 10: it is quite regular and roughly quadriennial from the mid-1870s to about 1890, and somewhat less regular--and partly abated--from then on. This indicator too must be interpreted with caution, however, for the traffic data available for the end of the period at hand suggest that some three-quarters of railway shipments consisted, in roughly equal parts, of coal alone, agricultural products (largely grain, and not much wine), and construction materials. With the exception of these last, the railways seemed engaged very largely in the distribution of bulk imports; most domestic agricultural goods seem to have been consumed locally, and moved by traditional means (Fenoaltea, 1983).¹²

The very limited evidence that can now be examined thus suggests a cautious evaluation. There are scattered indications that the cyclical variations of the post-Unification economy may indeed have been somewhat milder after 1890 than before, but the sharp

¹¹The mean temperature and total precipitation series in Istat (1958) shed little light on current conditions. Over most of the 1890s the temperature data are altogether lacking. The available local series are not highly intercorrelated--Italy is notoriously a land of multiple local climates--and there is no visible correlation with the calculated agricultural cycle. This too is unsurprising, as the seasonal distribution of precipitation matters as much as its annual total, and a given amount of precipitation has very different effects if it takes the form of large hailstones rather than of a gentle rain.

¹²The cyclical movements of railway freight traffic seem to corroborate this evidence: from 1875 on the railway freight cycle shows a negative correlation with the GDP cycle (-.46), but a weak positive partial correlation with the industrial cycle (.25), presumably from coal traffic, and a stronger negative partial correlation with the agricultural cycle (-.62), presumably from the opposite cycle in compensating imports.

stabilization that the present estimates derive from the preliminary agricultural series must be verified by further research.

3. Longer-term movements

GDP and major-sector trends over time

In much of the current literature "the business cycle" is in a predetermined, relatively high frequency range; everything else that is not mere noise is "trend." The trend thus absorbs a good deal of the original series' residual (low-frequency) variation: it is a "local" trend, a "flexible" trend (e.g., Zarnowitz and Ozyildirim, 2002). In the older literature there was no such thing: the "trend" which served to identify cyclical deviations was in the nature of a rigid rod--possibly in tension or compression--and by definition it could not snake around. By the same token, that literature spoke not of "the" business cycle, but of Juglars and Kitchins, Kuznets and Kondratieffs, Dungeons and Dragons. Its richness was there, not in the eventless "trend."

To historians, the fluctuations of the local, flexible "trend" are more baby than bathwater, and no less interesting than "the cycle." Moreover, with annual macroeconomic data the "trend" generated by the fixed-length symmetric filters is a construct they should find very familiar: it is a seven-year moving average, of the sort traditionally used to smooth series and bring out their longer-term variations--improved by a triangular weight structure that has individual observations enter and leave the moving average with a whisper instead of a bang.¹³ The equivalent construct in the general structural model is more complex, and noisier: in logs, the trend level equals its own past value plus a slope coefficient plus a random disturbance, with the slope coefficient itself equal to its own past value plus a random disturbance.¹⁴

Figure 11 presents the trend in GDP and in the three major sectors identified by the same alternative decompositions used above to identify the business cycle. The band-pass trends are somewhat smoother than the structural trends, but in every case the two are so close as to be almost indistinguishable (from each other, and also from those obtained by alternative filters): once again, they appear robustly rooted in the series themselves. All four trends manifest clear long cycles; these are highlighted in Figure 12, which illustrates the annual growth rates of the trend series, with their (band-pass) means as a benchmark.

To an extent, once again, these figures bring out features already suggested by the basic series themselves (Figures 1 and 5). Industry in particular clearly displays the Kuznets-cycle swing, with above-average growth rates from the late 1870s to the later 1880s and again after the mid-1890s, and also, by pre-1900 standards, in the early 1870s. This swing has been already identified and examined in its own right (Fenoaltea, 1988, 2003); it here appears to have

¹³Above, note 9. This simple weighting scheme is specific to the permissive band (with the minimal lower bound of 2 years), and the low order of the moving average. If one keeps the latter at 3 but raises the lower bound, the reference "trend" is obtained with negative weights on the immediate neighbors of the current observation; these de-stabilize a positively autocorrelated time series, and render the trend "noisier". If one increases the order of the moving average, in calculating the "trend" negative weights appear at the tails; with a positively autocorrelated time series these tend to offset the neighboring positive weights, so that the moving average is effectively shortened and the resulting "trend" is again more flexible. See Harvey and Trimbur (2003).

¹⁴The trend can be smoothed by setting the variance of the trend-level disturbance equal to zero, but this restriction has not here been imposed.

been transmitted from industry to the services, and to have been the dominant long-term fluctuation of GDP as well.

The more intriguing results pertain--again--to agriculture. The trends rise in a series of clear medium-term oscillations, which in the original series are altogether masked by the short cycle which has here been removed (Figure 11). Figure 12 suggests that the peaks or troughs of the trend growth rate cycle are some twelve to fifteen years apart.

It is worth noting not only that the hills appear at regular intervals, but that they change shape over time. Over the middle decades the hills are relatively peaky, in the 1860s and 1900s they are altogether fatter: the trend growth rate was above its long-term average in most years before 1870 and again after 1900, but only comparatively rarely between those dates. The relative deviations of the band-pass trend from its log-linear OLS interpolator (Figure 13) tell the same story in another way: the local maxima and minima both decline from the 1860s into the early 1890s, and then both reach unprecedented highs. This long cycle was not strong enough to be obvious to the eye in the trend itself (let alone the underlying series), but it is particularly seductive: it closely follows the Kondratieff cycle in commodity prices, which is essentially a cycle in the relative price of agricultural goods (Lewis, 1978).

The first decade of the twentieth century was, in Italy, a period of unprecedented prosperity: to use the language of a much earlier literature the new estimates point to the happy conjunction of the Kuznets-cycle upswing in industry and the Kondratieff-cycle upswing in agriculture.

The turn-of-the-century break in GDP trend growth

Much of the literature on the economic growth of the Italian economy to the First World War has been concerned with the rostowian "take-off" in the run-up to the war. The early consensus to that effect was buttressed by the Istat-Vitali series, which showed a sharp acceleration at the end of the century (Gerschenkron, 1955, 1968; Istat, 1957; Romeo, 1959). Historians have come to doubt such a sharp break, and most now prefer to describe a drawn-out, difficult take-off in a series of "waves," but econometricians using the older time series continue to speak of a take-off in the early 1900s (Bonelli, 1978, Cafagna, 1983a, 1983b; Delli Gatti, Gallegati, and Gallegati, 2005).¹⁵ The new GDP series lacks any obvious discontinuity; but it too grows faster in the 1900s than in the preceding decades, and its acceleration may well be significant.¹⁶

A simple Chow-style test for a break at an unknown date regresses the annual growth rate of GDP on a constant and a time dummy that passes at some date from zero to one, and tests for the significance of the coefficient on the dummy. Figure 14 presents the QLR test results obtained by letting the break date run (almost) from end to end; the no-break null is clearly rejected. The test statistic points to a break in 1900, with the mean growth rate nearly doubling from 1.34 percent per year to 2.57 percent.¹⁷

¹⁵Federico (1994) and Zamagni (1993) misread the Bonelli and Cafagna interpretations, and fail to see that these are still entirely in the stages-of-growth tradition: their analysis essentially replicates that of Romeo (1959), but with each stage much extended over time (Fenoaltea, 2004).

¹⁶The sharp end-of-the-century break that characterized the Istat series and their various modifications was clearly spurious, and seems due essentially to an interpolation between the badly underestimated agricultural output estimates of the late 1890s and the much higher figures obtained for the 1900s by the new statistical service (Fenoaltea, 2005).

¹⁷The regressions use the Newey-West standard errors; the (asymptotic) critical values are derived from Andrews (2003), with 15 percent trimming.

A more subtle indication emerges from within the structural time-series model. Harvey (1997) recommends *not* imposing an *a priori* break, on the grounds that the more general model is sufficiently flexible to capture a trend acceleration if one is indeed present in the data. In the present case the trend acceleration is brought out by the year-to-year growth rates of trend GDP in Figure 12, and even more directly by the plot of the trend's slope coefficient alone in Figure 15: in both graphs the relevant growth rate breaks out of its previous range of variation around the turn of the century, and is perceptibly higher in the 1900s than before.

If the model is reestimated allowing a discontinuous change in the trend's slope coefficient in 1900, a perceptible discontinuity emerges; interestingly, the estimated variance of the slope coefficient falls to zero, and the calculated trend is a random walk. Statistically, the model with the break performs marginally better (Appendix 1), but the trend and cycle which it yields are all but indistinguishable from those obtained above: with or without a break in the trend slope coefficient the decomposition of the GDP series is essentially one and the same.¹⁸

The new GDP series scale down the turn-of-the century increase in the economy's growth rate, especially in per-capita terms (Fenoaltea, 2005); but they do not negate it. In the long decade to the war, the economy grew significantly faster than before.

Did the economy "take off" in the early twentieth century?

The statistical evidence points to unprecedented trend growth in the early 1900s. A "take-off" involves much more than that: it refers back to the stages-of-growth approach, and denotes the transition to sustained growth following the creation of the necessary "pre-conditions." A "take-off" is thus tied to a structural change in the economy that generates the previously missing capacity to take advantage of (already present) opportunities: in Gerschenkron's famous analysis, for example, the creation of the mixed banks provided the entrepreneurial-managerial talent that Italy had lacked (Gerschenkron, 1955). The rise in the growth rate is here a mere signal, it does not itself, in any meaningful sense, define the "take-off."¹⁹

In the case at hand the supernormal growth of the early 1900s seems to have different roots altogether. To a large extent, it can be traced to a simple composition effect: the agricultural sector was initially much the largest, but its mean growth rate was much the lowest (Figures 5 and 12); as time went by the faster-growing sectors represented an ever-larger share of the aggregate. From this perspective the accelerated growth of the aggregate emerges from an unchanging underlying structure: as Gerschenkron himself had pointed out, it is *within* the aggregate that one must seek the evidence of a take-off.²⁰

The transition to modern economic growth is conventionally associated with industrialization, and no one ever suggested that the locus of the Italian "take-off" was the agricultural sector.²¹ But within agriculture, for what it may be worth, year-to-year trend

¹⁸The estimated trends are always within a fraction of a percentage point of each other, and the calculated cycles differ only in 1861-62 and in the immediate neighborhood of the break itself.

¹⁹Gerschenkron himself identified the industrial "take-off" from growth rates alone, but only because he was so sure of its presence that he searched only for its timing and likely causes.

²⁰Gerschenkron (1962), where the point is aimed at Rostow. This simple perspective is not of course the only one; but as argued below it here seems appropriate.

²¹There is however a long literature, from Romeo (1959) to Bonelli (1978) and Cafagna (1983a, 1983b), on the agricultural roots of Italy's industrial growth, in the specific sense that agriculture provided the necessary "original accumulation."

growth rates were no greater after 1900 than before (Figure 12). Longer-term growth *did* accelerate, because the proportion of years with above-average growth was higher than in the immediately preceding decades. That proportion was not however greater than in an even earlier period: as noted above these movements point to the varying opportunities created by the long cycle in the sector's terms of trade, and not to a one-time improvement in the ability to take advantage of them.

The critical sector is the industrial sector: in the historiography, which speaks of the *industrial* "take-off" in the pre-war years, and in the new series, where it is industry that directly and (through the services) indirectly dominates the trend fluctuations, and the post-1900 acceleration, of GDP (Figure 12).

Industry displays a long swing with a strong upswing in the early 1900s, and a steadily accelerating trend. But industry is itself an aggregate, and reproduces within itself the sub-aggregate compositional changes noted above for GDP. The foodstuffs industry, closely tied to agriculture, was initially much the largest, but grew relatively slowly; its weight declined over time, and the trend acceleration of total industry again emerges arithmetically from the much steadier trends of its components (Fenoaltea, 2003).

The industrial upswing of the early 1900s was itself, like the earlier, milder upswings, a surge in the production of durables, induced by an investment boom and specifically a construction boom. The entire investment cycle was by no means peculiar to Italy: it was largely shared by the overseas countries, and seems traceable to the long swing in British capital exports (Fenoaltea, 1988). In the early 1900s British capital exports surged far beyond their previous maxima; in Italy borrowing rates fell far below their previous minima, and finance-sensitive construction experienced an unprecedented boom (shared by its suppliers in the manufacturing sector). From the Italian point of view it was not a "take-off" but a real business cycle: industrial output and GDP surged when investment was exceptionally productive, because the resource cost of external funds was exceptionally low.

To this line of argument there is of course a counter. One can argue that the sector- and sub-sector-level analysis is misleading, and gets the counterfactual wrong. In this alternative perspective the growth rate of the aggregate is not simply the (inevitably accelerated) sum of the given growth rates of its components, for the game is played at the aggregate level. The evidence of the "take-off" is in the very acceleration of GDP (or aggregate industry): had the economy (or industry) *not* become capable of growing faster than before, the faster-growing sectors would not have maintained their own growth rates, but would have been forced to decelerate by the constraint on overall growth.

This counter is entirely in the spirit of the stages-of-growth approach, which sees the various national economies as constrained by the local (natural and human) resource base. But there is a counter to the counter, suggested by Gerschenkron's own hypothesis that Italy's "take-off" was due to the importation of the German mixed banks (Gerschenkron, 1955). We tend to think in terms of national economies, because general histories are national, and our data sources are too; but in a broader perspective Italy was simply a region of the trans-national European economy (Pollard, 1981). Italy freely imported or exported capital, labor, and know-how: how much was produced in Italy was determined not by how much Italians were capable of producing, but by how much the trans-national economy chose to produce within Italy's borders. We need growth theory to understand world (or "Western") development, and the stage approach is a growth theory; but the development of the small part of the (Western) world we call Italy seems better understood through location theory.

It would take a book to do this point justice, and it cannot be further developed here; but enough has perhaps been said to establish both that the new series allow one to see a significant acceleration of GDP growth in the early 1900s, and that they do not, for all that, support the

still-popular stage approach centered on a "take-off."

4. Conclusion

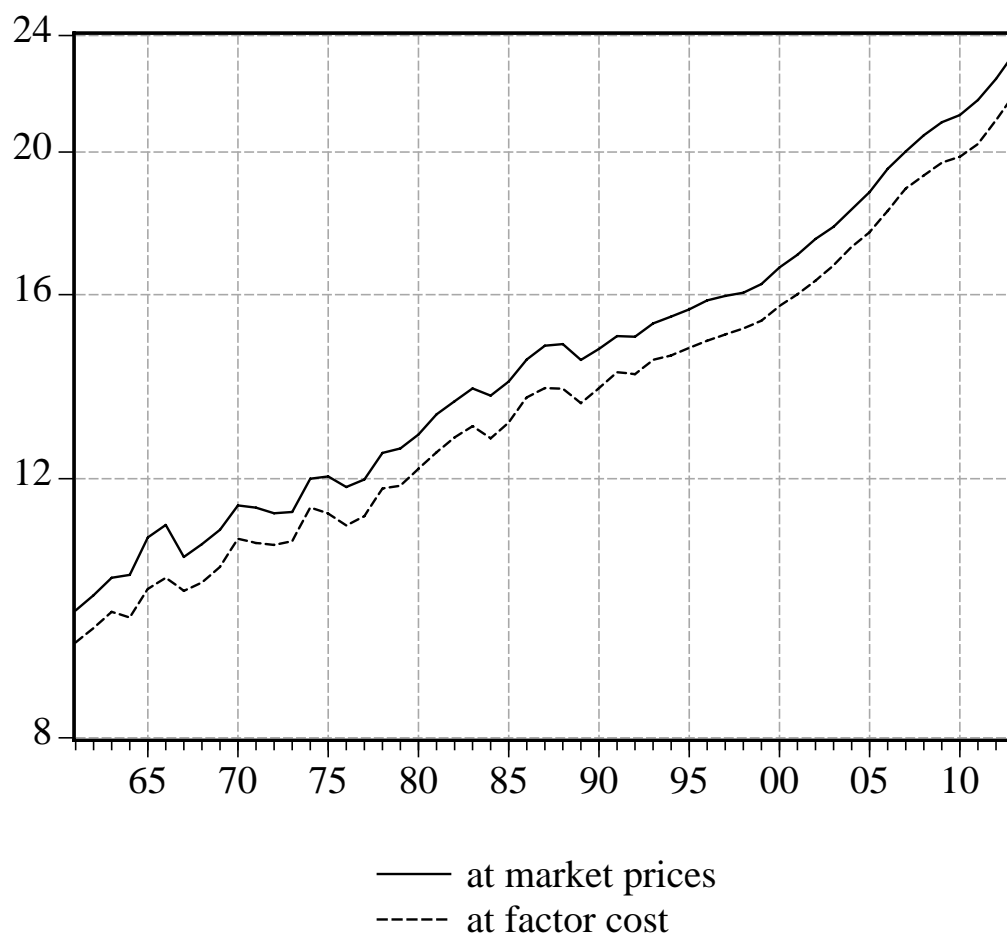
Italy's national historical accounts have recently been revised, and the new series are substantially different from the old.

The decomposition of these series' fluctuations suggests that the (high-frequency) "business cycle" was essentially agricultural. A clear four-to-five-year cycle is evident until about 1890; after that date the short-term variability of agricultural production, and of GDP, is sharply lower than before. This "passing of the business cycle" is only weakly confirmed by the available independent evidence, and, pending further research, must be considered suspect.

Over the longer term GDP and the services appear to reflect the long swing in industry, already noted in the literature. The more novel results again pertain to agriculture, where the calculated trend follows a clear cycle with a periodicity of about a dozen years. Nor is that all: trend growth was generally below-average between ca. 1870 and the end of the century, and above-average in the 1860s and again after 1900; this suggests that Italian agriculture in fact responded to the world-wide Kondratieff cycle in the agricultural terms of trade.

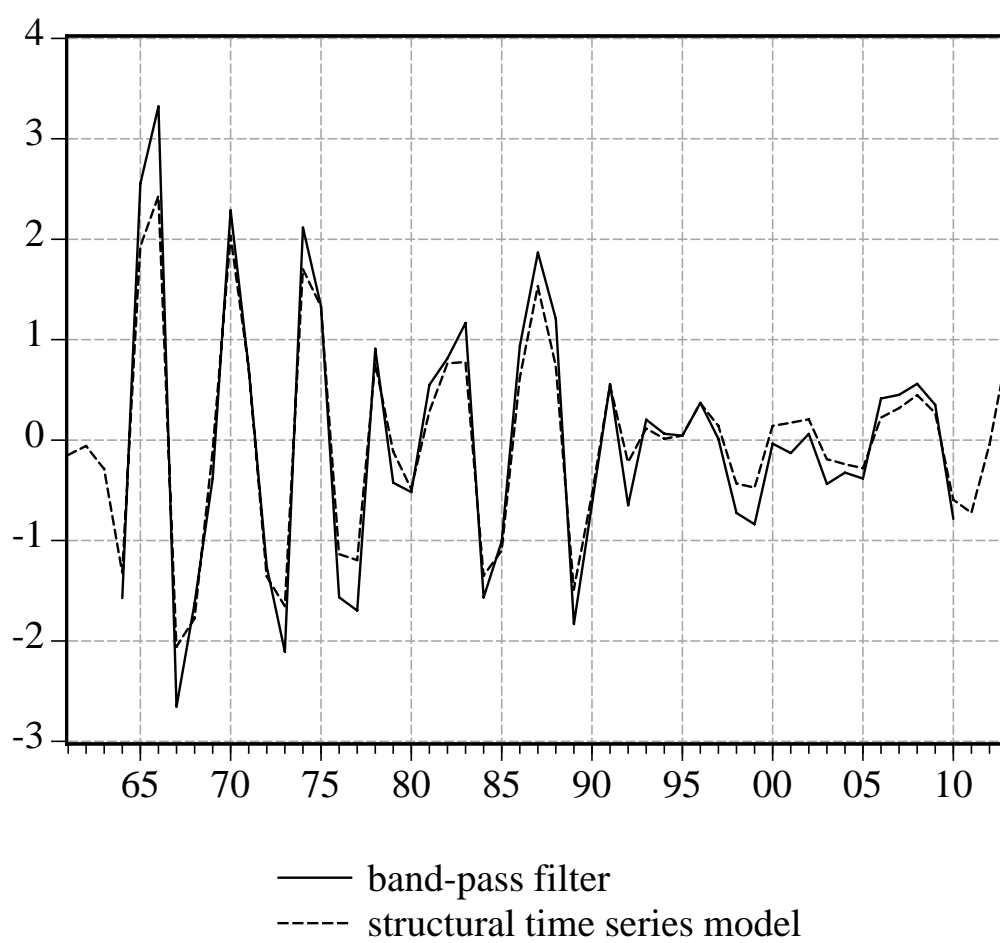
The new GDP series lacks the obvious turn-of-the-century discontinuity of its predecessors, but it too points to significantly faster growth after 1900 than before. The statistical break does not however imply a "take-off," in the sense of a change in structure that overcomes prior constraints on growth itself: the pre-war acceleration appears to have reflected a sustained upswing in the investment cycle, due to the unprecedented cheapness of foreign capital, and it was not peculiar to Italy.

Figure 1
Gross domestic product
(billion lire at 1911 prices)



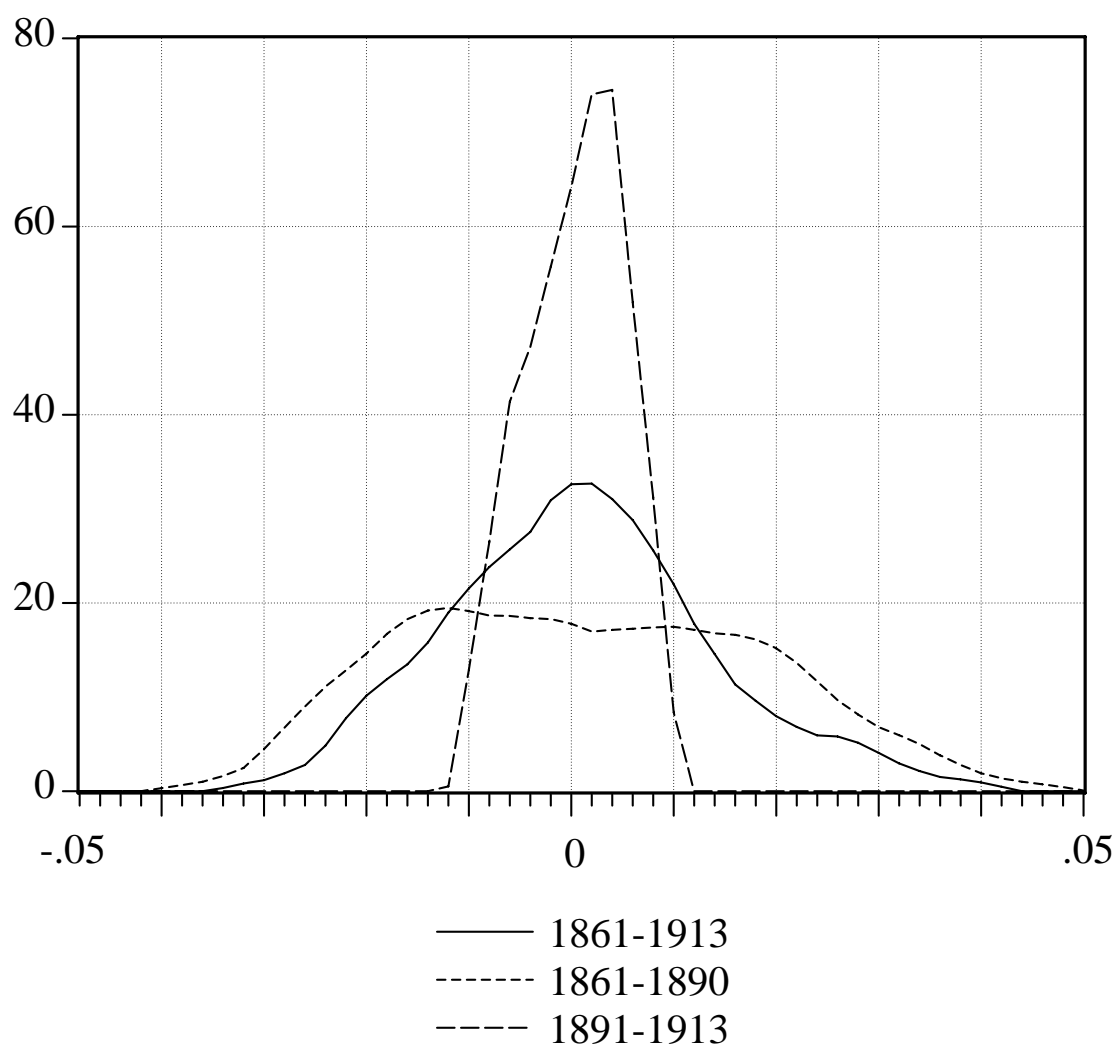
Source: Fenoaltea (2005)

Figure 2
Business-cycle fluctuations: alternative estimates
(percentage deviations from trend)



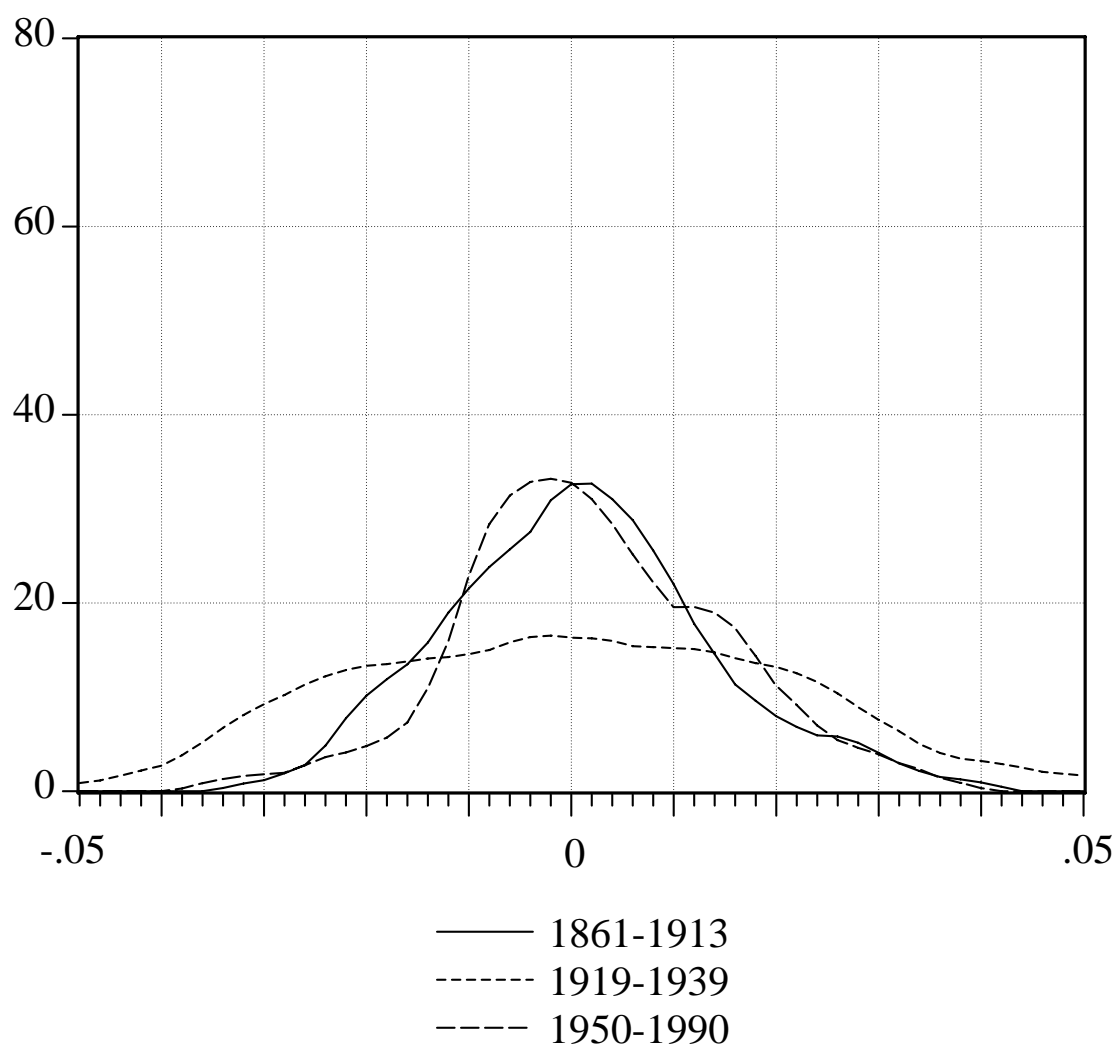
Source: see text.

Figure 3
Band-pass filter cycles: kernel density estimates, 1861-1913



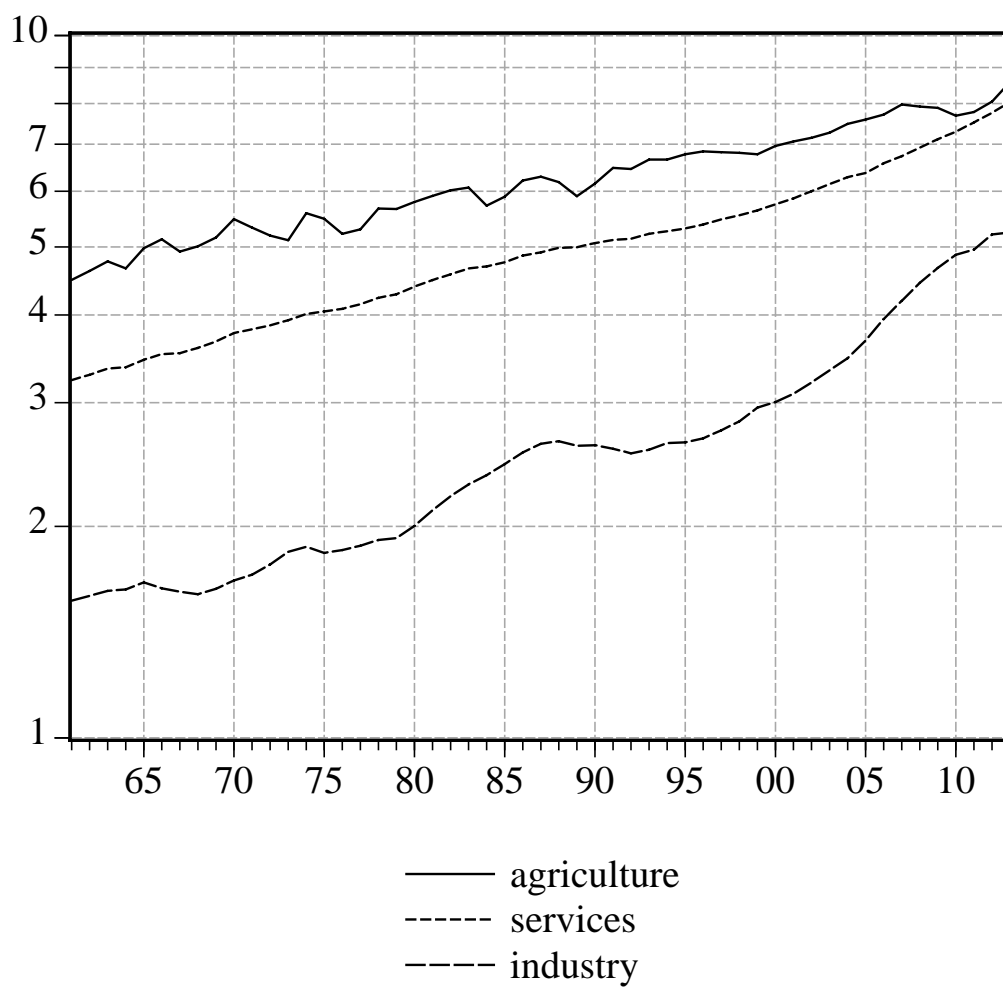
Source: see text.

Figure 4
Band-pass filter cycles: kernel density estimates, 1861-1980



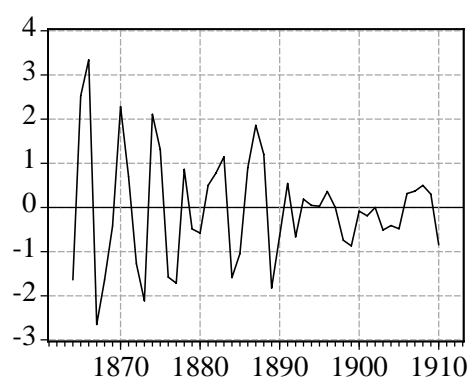
Source: see text.

Figure 5
Value added, by major sector
(billion lire at 1911 prices)

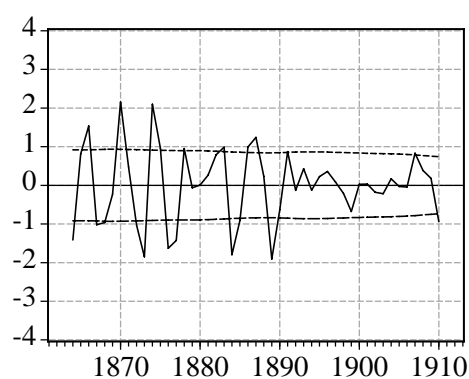


Source: Fenoaltea (2005)

Figure 6
Band-pass filter cycles in the major sectors
(deviations from trend as percentages of trend GDP)



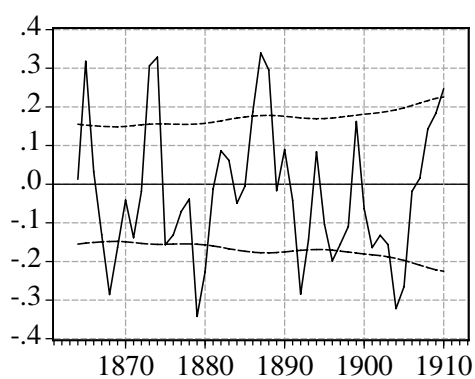
— GDP



— agriculture

---- +2 percent from sector trend

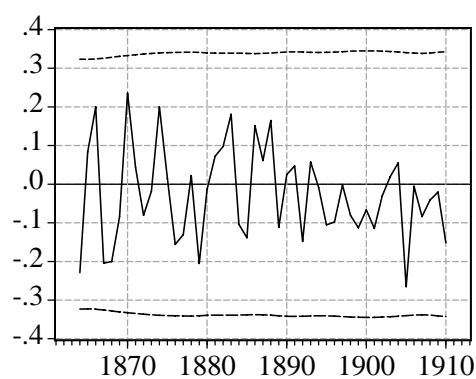
---- -2 percent from sector trend



— industry

---- +1 percent from sector trend

---- -1 percent from sector trend



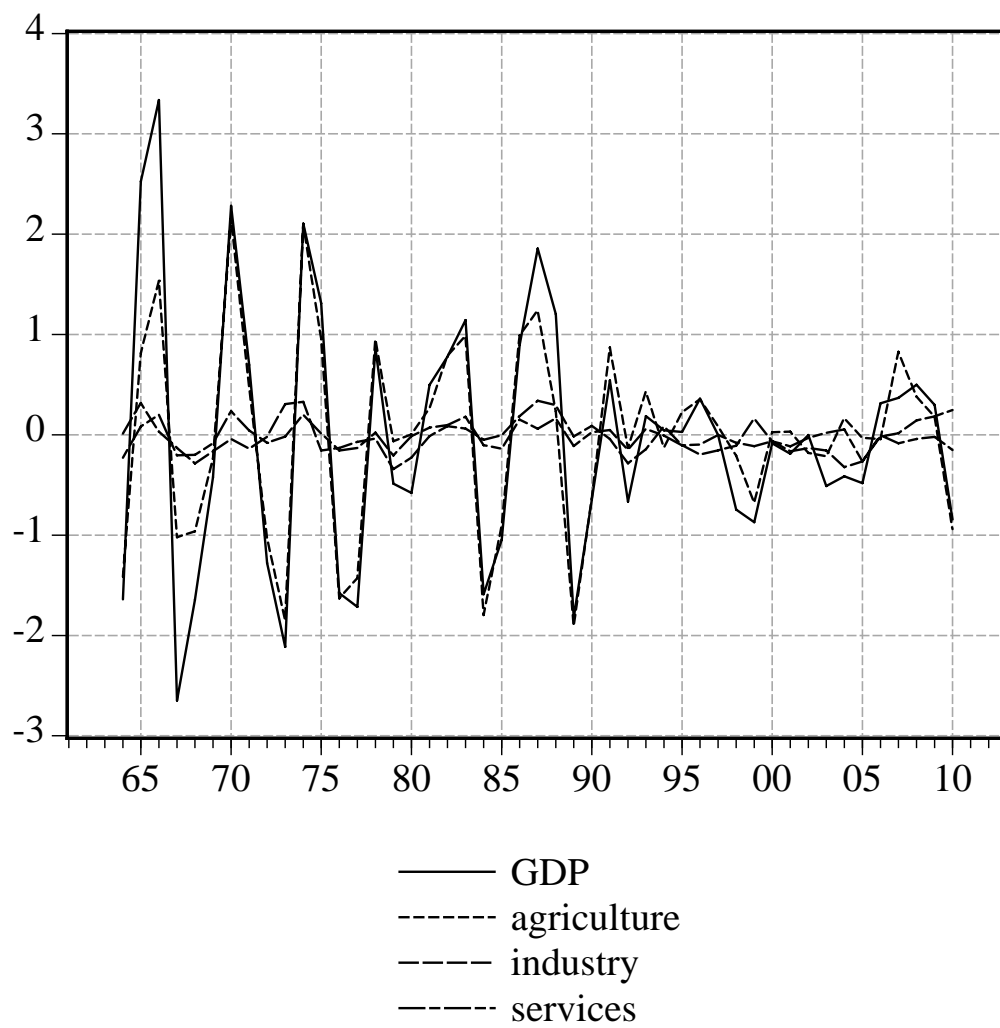
— services

---- +1 percent from sector trend

---- -1 percent from sector trend

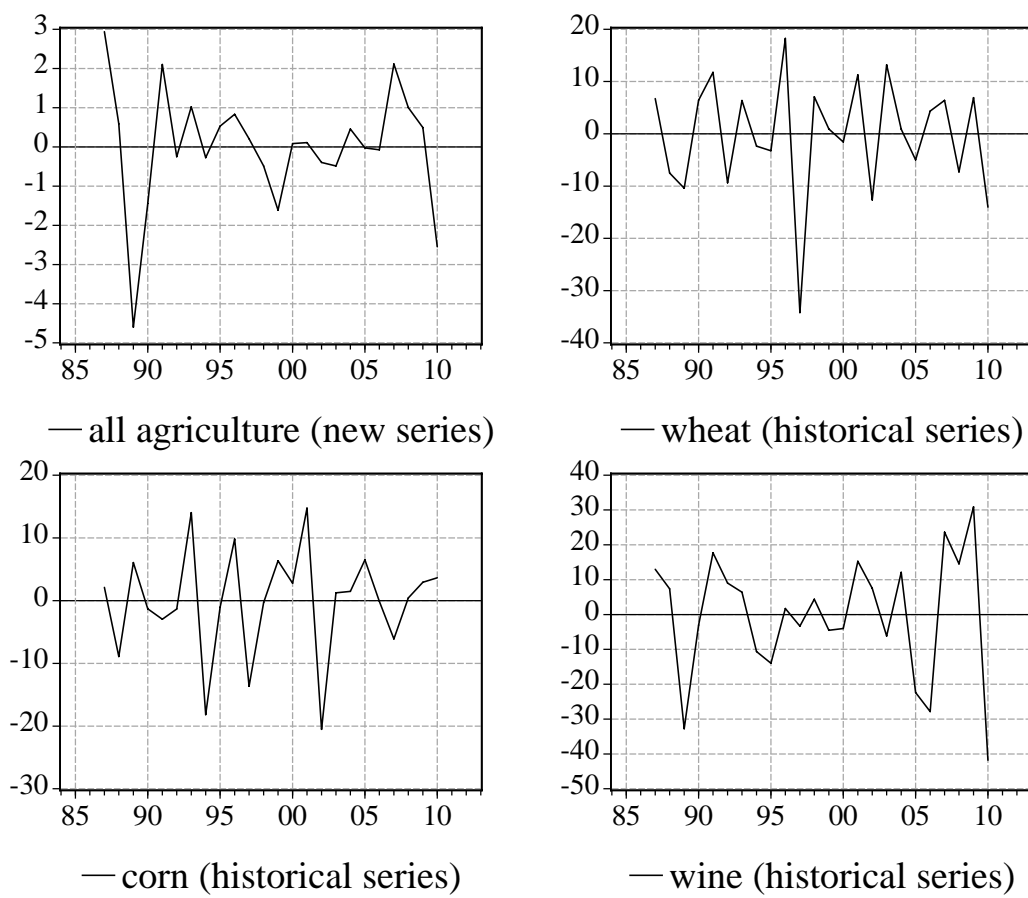
Source: see text.

Figure 7
Band-pass filter cycles
(deviations from trend as percentages of trend GDP)



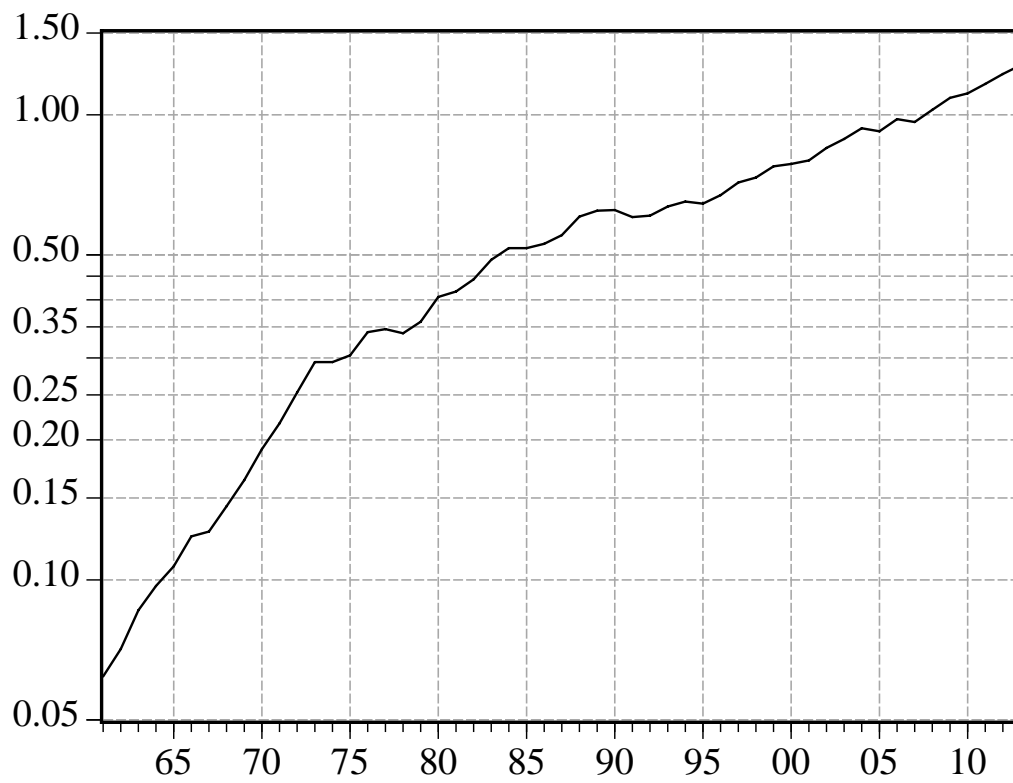
Source: see text.

Figure 8
 Band-pass filter cycles in the agricultural series
 (percentage deviations from trend)



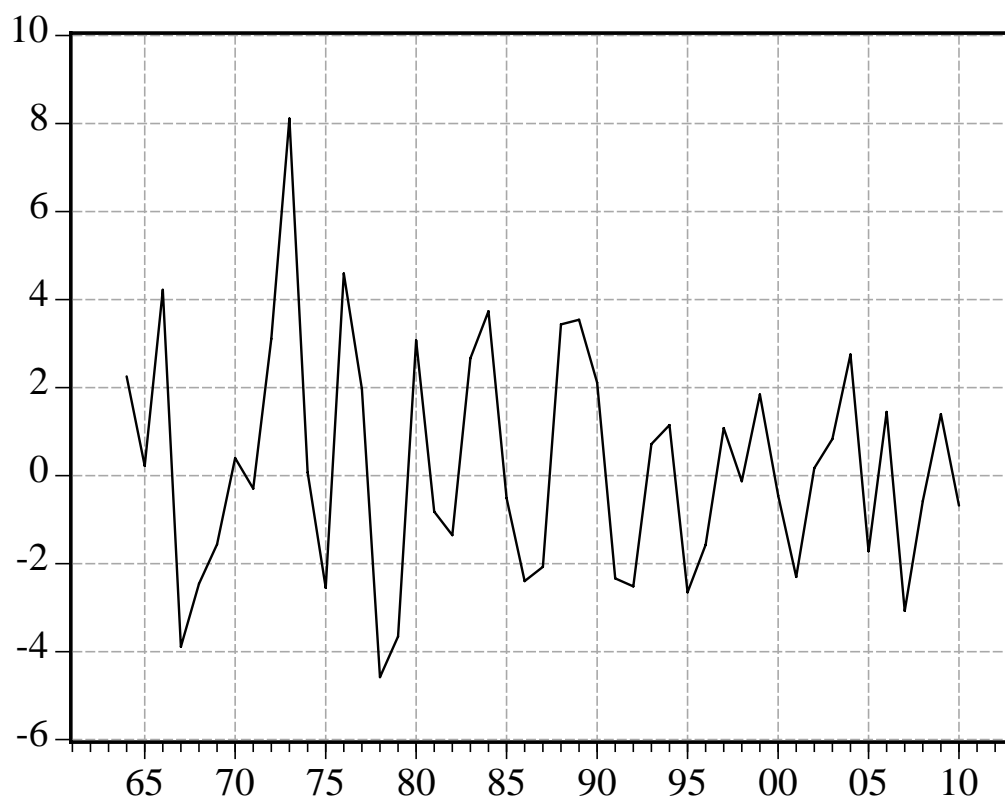
Source: see text.

Figure 9
Railway freight-car vehicle-kilometers
(billions)



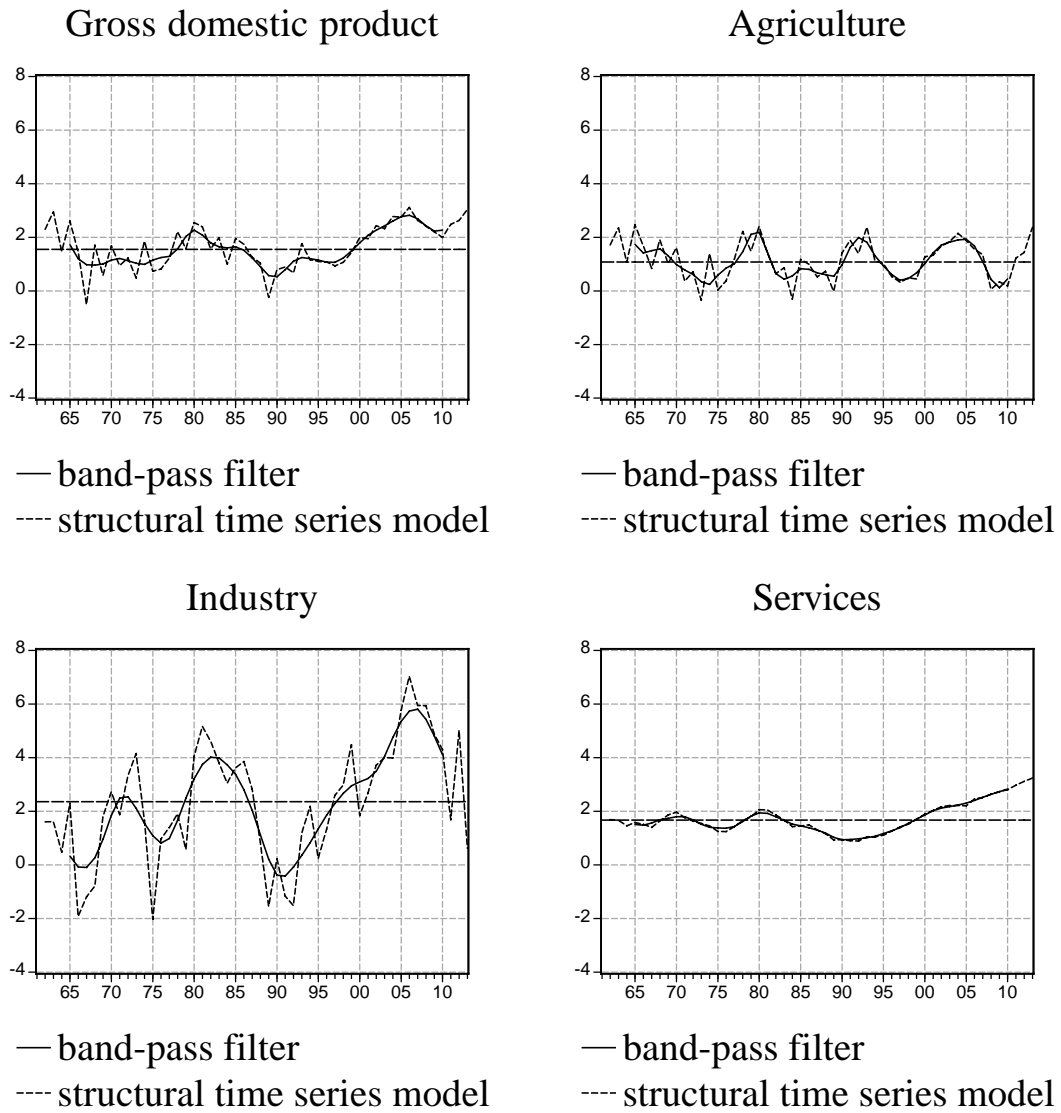
Source: see text.

Figure 10
Band-pass filter cycles: railway freight-car vehicle-kilometers
(percentage deviations from trend)



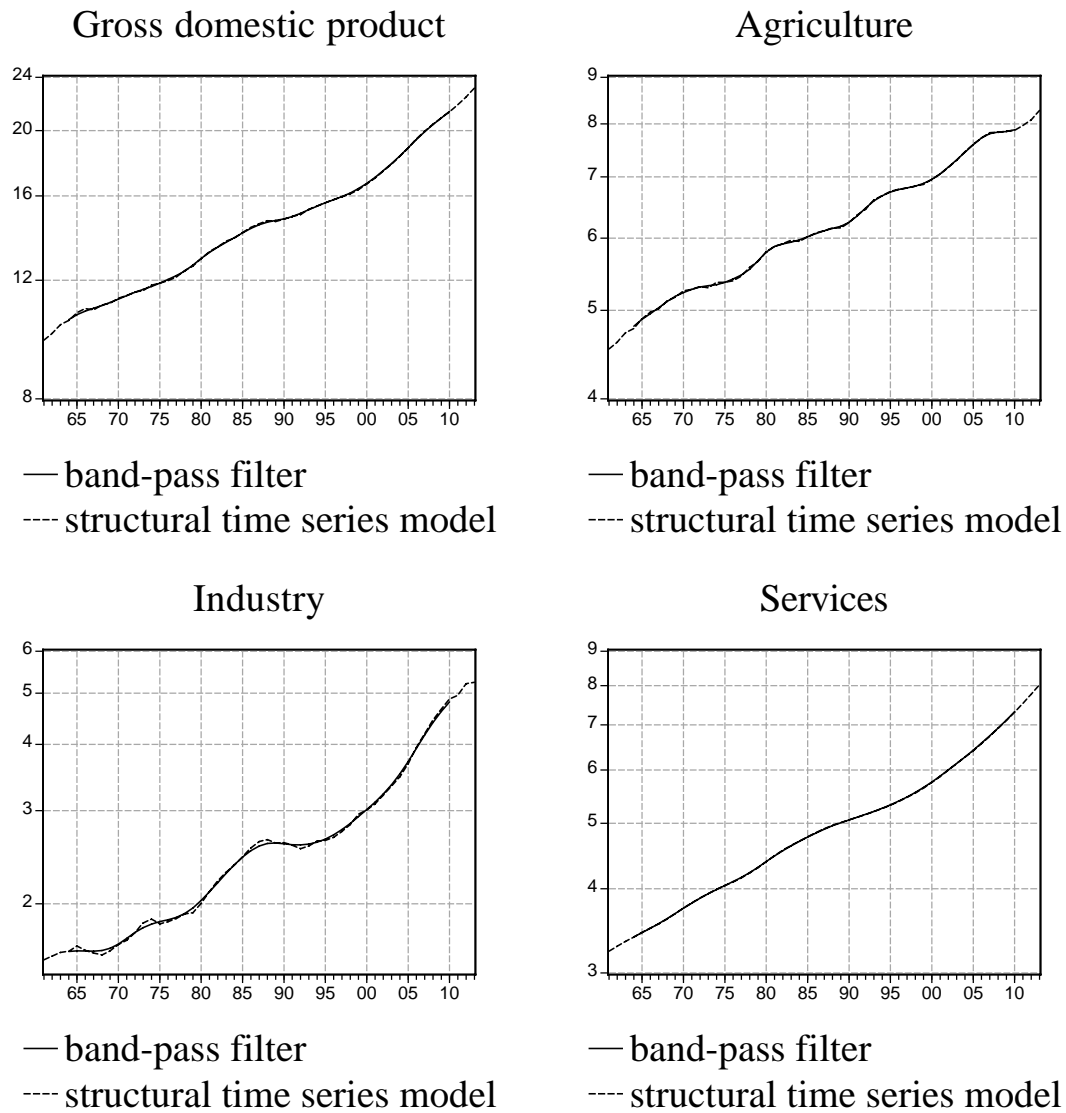
Source: see text.

Figure 12
Year-to-year trend growth rates: alternative estimates
(percent)



Source: see text.

Figure 11
GDP and sector trends: alternative estimates
(billion lire at 1911 prices)



Source: see text.

Figure 13
Band-pass filter agricultural trend:
percentage deviations from log-linear interpolator

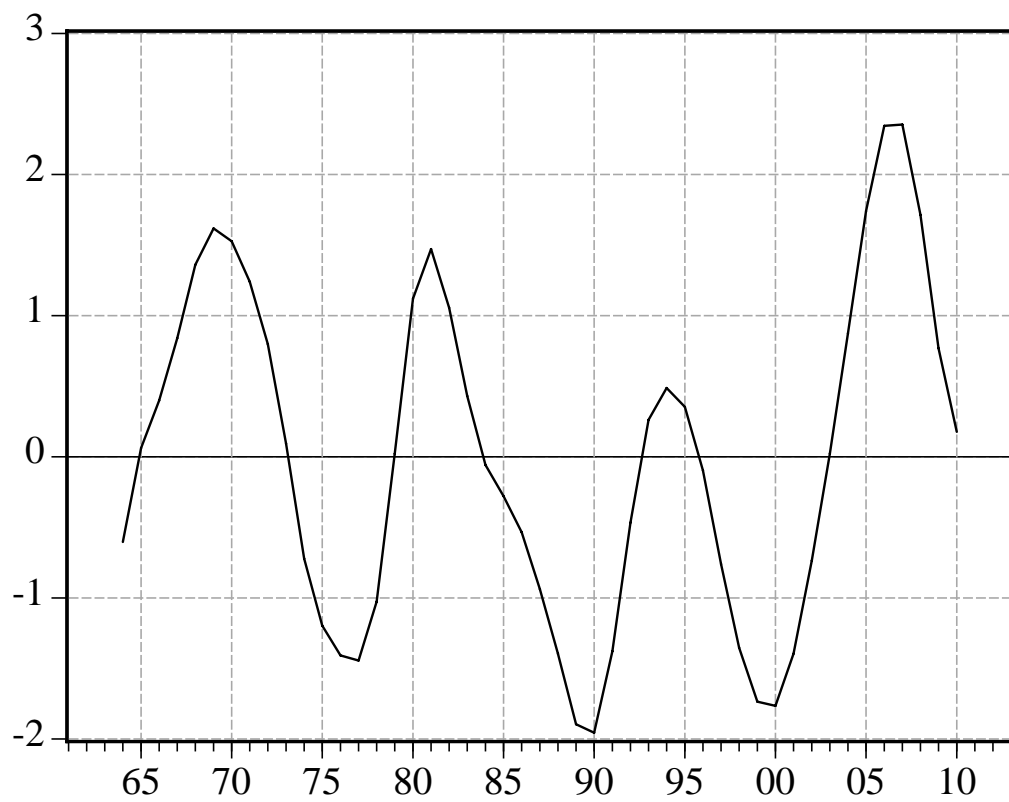
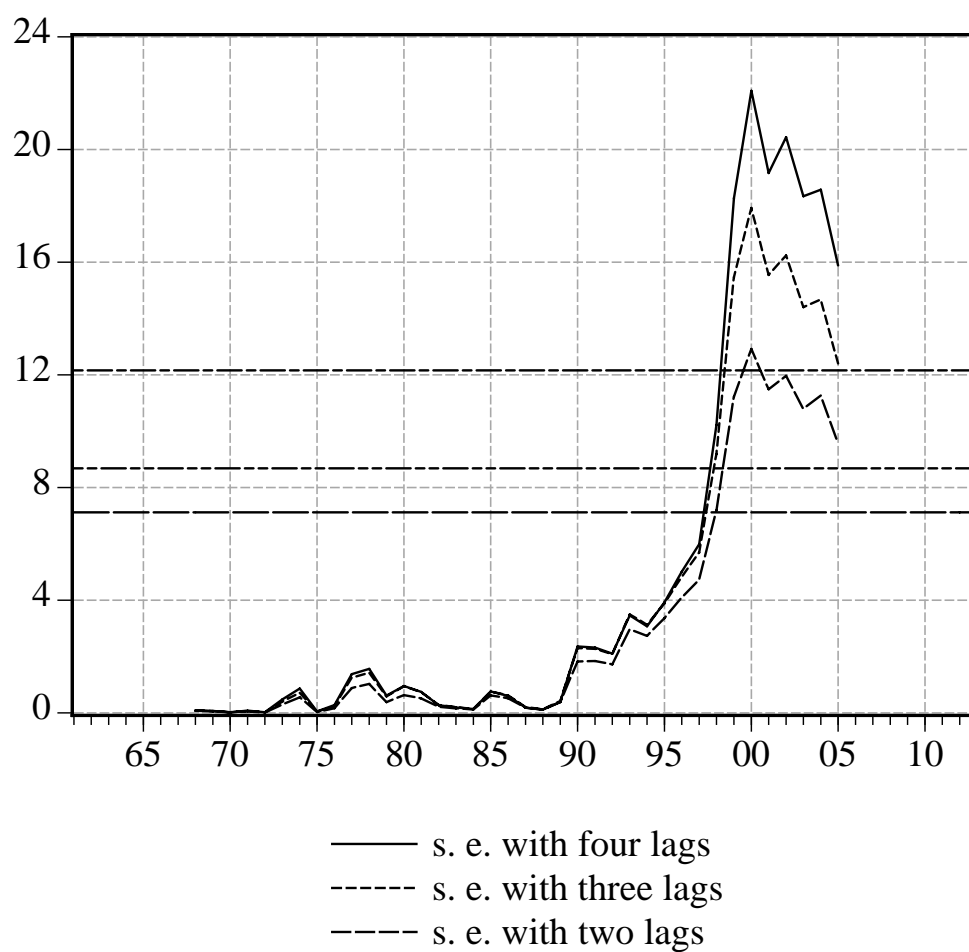


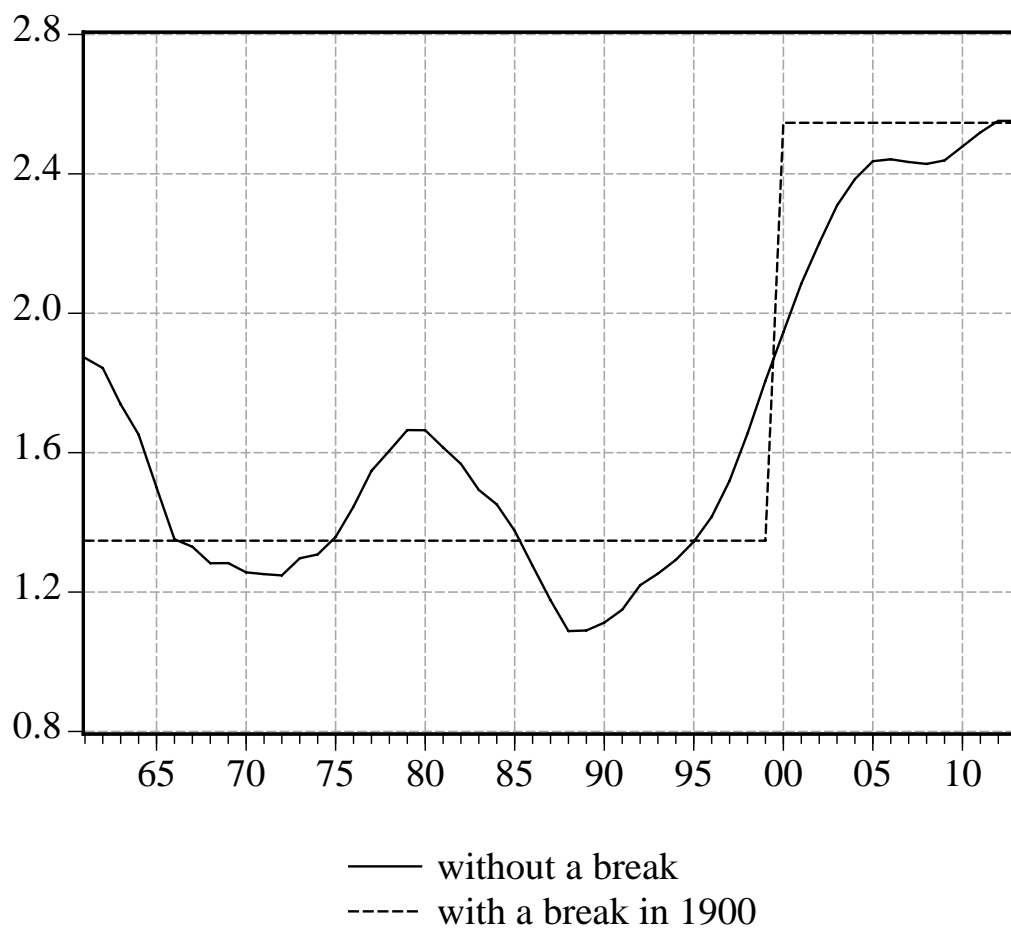
Figure 14
GDP series: QLR test statistics for structural break
(with alternative Newey-West standard errors)



The horizontal lines indicate the 1%, 5%, and 10% critical values.

Source: see text.

Figure 15
Structural time series model: estimated trend slope coefficient
(annual percentage growth)



Source: see text.

Table 1
Band-pass filter cycles: turning points

	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	new series					new series			
year	agr.	ind.	ser.	GDP	year	agr.	ind.	ser.	GDP
1864	[T]	[t]	[T]	[T]					
1865		P		[P]	1890		P	(p)	
1866	P		P	P	1891	p+		P	P
1867	T		T	T	1892	t	T	T	t
1868	(T)	T	(T)		1893	p		P	p
1869					1894	t	P		(t)
1870	P	p	P	P	1895			t	t
1871		t			1896	P	T	(t)	p
1872			t		1897			p	
1873	T	(P)		T	1898				
1874	P	P	P	P	1899	t	p+	t	t
1875		t+			1900	p		p	p
1876	T		T	(T)	1901		t	t	t
1877	(T)		(T)	T	1902		p		p
1878	p+	p	p	p	1903	t			t
1879	t	T	T	(t)	1904	p	T	P	p
1880	(t)			t	1905			T	t
1881					1906	t		P	
1882		P			1907	p+		t	P
1883	P		P	p	1908				
1884	T	t	(T)	T	1909			P	
1885			T		1910	[T]	[P]	[T]	[t]
1886	(P)		P						
1887	P	P	t	P					
1888		(P)	P						
1889	T	t	t	T					

Key:

cols. 1 - 4:

MP, MT: major turning point, at least one standard deviation from trend.

p, t: significant turning point, following or preceding a one-standard-deviation or larger improvement or deterioration.

p+, t+: significant, near-major turning point.

p, t: other turning point

(P), (T), (p), (t): deviation close to that of neighboring major or significant turning point.

Source: see text.

Table 2
Band-pass filter cycles: simple correlations

1864-1891

	Agr.	Ind.	Ser.	GDP
Agr.	1.00			
Ind.	.28	1.00		
Ser.	.82	.57	1.00	
GDP	.93	.42	.86	1.00

1892-1910

	Agr.	Ind.	Ser.	GDP
Agr.	1.00			
Ind.	-.29	1.00		
Ser.	.28	.01	1.00	
GDP	.78	.11	.39	1.00

Full sample

	Agr.	Ind.	Ser.	GDP
Agr.	1.00			
Ind.	.17	1.00		
Ser.	.72	.45	1.00	
GDP	.92	.35	.78	1.00

Source: see text.

Appendix 1

In the notation of Harvey and Jaeger (1993), the structural model

$$y_t = \mu_t + \psi_t + \epsilon_t$$

linearly decomposes log GDP (y_t) into the sum of a trend (μ_t), a cycle (ψ_t) and an irregular component (ϵ_t); here, $t = 1861, 1862, \dots, 1913$.

The model estimated here is the general local linear trend model,

$$\begin{aligned}\mu_t &= \mu_{t-1} + \beta_{t-1} + \eta_t \\ \beta_t &= \beta_{t-1} + \zeta_t\end{aligned}$$

where the trend level μ_t equals the sum of its previous value, the rate of growth β_{t-1} , and a noise term (η_t). The growth coefficient β_t is modelled as a random walk.

The stochastic model for the cycle is formulated as a linear combination of sines and cosines:

$$\begin{bmatrix} \psi_t \\ \psi_t^* \end{bmatrix} = \rho \begin{bmatrix} \cos(\lambda_c) & \sin(\lambda_c) \\ -\sin(\lambda_c) & \cos(\lambda_c) \end{bmatrix} \begin{bmatrix} \psi_{t-1} \\ \psi_{t-1}^* \end{bmatrix} + \begin{bmatrix} \kappa_t \\ \kappa_t^* \end{bmatrix}$$

where ρ is a damping factor ($0 \leq \rho \leq 1$) and λ_c is the frequency of the cycle expressed in radians ($0 \leq \lambda_c \leq \pi$).

The error terms $\epsilon_t \sim NID(0, \sigma_\epsilon^2)$, $\eta_t \sim NID(0, \sigma_\eta^2)$, $\zeta_t \sim NID(0, \sigma_\zeta^2)$, $\kappa_t \sim NID(0, \sigma_\kappa^2)$, and $\kappa_t^* \sim NID(0, \sigma_{\kappa^*}^2)$ are mutually independent.

The ML estimates obtained with STAMP 6.2 are:

Estimates	Model 1	Model 2
$\hat{\sigma}_\epsilon$	0.00000	0.00000
$\hat{\sigma}_\eta$	0.00919	0.00936
$\hat{\sigma}_\zeta$	0.00240	0.00000
$\hat{\sigma}_\kappa$	0.00680	0.00717
$\hat{\rho}$	0.79504	0.78097
$\hat{\lambda}_c$	1.37843	1.35752
$2\hat{\lambda}_c/\hat{\rho}$	4.55822	4.62844
$\hat{\sigma}_\psi$	0.01122	0.01148
$\hat{\sigma}$	0.01668	0.01507
R_D^2	0.16880	0.32116
$\ln L$	206.719	204.053
$Q(11)$	4.22310	6.97700
(p-value)	(0.6465)	(0.3230)

Model 1 is the general trend plus cycle model; Model 2 is the same model, with a slope intervention in 1900. $Q(11)$ is the Box-Ljung statistic, based on the first 11 residual autocorrelations. The p-values in parentheses are from a χ^2 with 6 degrees of freedom. The log likelihood function $\ln L$ is evaluated at the parameter estimates. $2\lambda/\rho$ is the period evaluated in years. σ is the prediction error standard deviation. R_D^2 is the coefficient of determination with respect to the first differences of log GDP.

REFERENCES

- Andrews, D. A., 2003. Test for parameter instability and structural change with unknown change point: a corrigendum. *Econometrica* 71, 395-397.
- Bardini, C., Carreras, A., Lains, P., 1995. The national accounts for Italy, Spain and Portugal. *Scandinavian Economic History Review* 43, 115-147.
- Baxter, M., King, R. G., 1999. Measuring business cycles: approximate band-pass filters for economic time series. *Review of Economics and Statistics* 81, 575-593.
- Bonelli, F., 1978. Il capitalismo italiano. Linee generali di interpretazione. In: Romano R., Vivanti, C. (Eds.), *Storia d'Italia. Annali*, 1. Dal feudalesimo al capitalismo. Einaudi, Turin, pp. 1193-1255.
- Cafagna, L., 1983a. Protoindustria o transizione in bilico? (A proposito della prima onda dell'industrializzazione italiana). *Quaderni storici* 54, 971-984.
- Cafagna, L., 1983b. La formazione del sistema industriale: ricerche empiriche e modelli di crescita. *Quaderni della Fondazione G. G. Feltrinelli* 25, 27-38.
- Christiano, L. J., and Fitzgerald, T. J., 1999. The band pass filter. NBER Working Paper No. W7257.
- Christiano, L. J., and T. J. Fitzgerald, 2003. The band pass filter. *International Economic Review* 44, 435-465.
- Crafts, N. F. R., and Mills, T. C. (1996). Modelling trends in economic history. *The Statistician* 45, 153-159.
- Delli Gatti, D., Gallegati, M., Gallegati, M., 2005. On the nature and causes of business fluctuations in Italy, 1861-2000. *Explorations in Economic History* 42, 81-100.
- Dirstat (Direzione generale della statistica), 1915. *Annuario statistico italiano 1914*. Bertero, Rome.
- Federico, G., 1994. Introduction. In: Federico, G., Ed., *The Economic Development of Italy since 1870*. Edward Elgar, Aldershot, pp. xi-xliii.
- Federico, G., 2000. Una stima del valore aggiunto dell'agricoltura italiana. In: Rey, G. M. (Ed.), *I conti economici dell'Italia. Vol. 3***. Il valore aggiunto per gli anni 1891, 1938, e 1951. Laterza, Rome-Bari, pp. 3-112.
- Federico, G., 2003. Le nuove stime della produzione agricola italiana, 1860-1910: primi risultati e implicazioni. *Rivista di storia economica* 19, 357-381.
- Fenoaltea, S. 1983. Italy. In: O'Brien, P. K. [Ed.], *Railways and the Economic Development of Western Europe*. Macmillan, London, pp. 49-120.
- Fenoaltea, S., 1988. International resource flows and construction movements in the Atlantic

- economy: the Kuznets cycle in Italy, 1861-1913. *Journal of Economic History* 48, 605-638.
- Fenoaltea, S., 2003. Notes on the rate of industrial growth in Italy, 1861-1913. *Journal of Economic History* 63, 695-735.
- Fenoaltea, S., 2004. Contro tre pregiudizi. *Rivista di storia economica* 20, 87-106.
- Fenoaltea, S., 2005. The growth of the Italian economy, 1861-1913: preliminary second-generation estimates. *European Review of Economic History* 9, 273-312.
- Fuà G. (Ed.), 1969. *Lo sviluppo economico in Italia*, vol. 3. Franco Angeli, Milan.
- Gerschenkron, A., 1955. Notes on the rate of industrial growth in Italy, 1881-1913. *Journal of Economic History* 15, 360-375.
- Gerschenkron, 1962. *Economic Backwardness in Hoistorical Perspective*. Belknap, Cambridge MA.
- Harvey, A. C., 1997. Trends, Cycles and Autoregressions. *Economic Journal* 107, 192-201.
- Harvey, A. C., and Jaeger, A., 1993. Detrending, stylized facts and the business cycle. *Journal of Applied Econometrics* 8, 231-247.
- Harvey, A. C. and T. M. Trimbur, 2003. General model-based filters for extracting cycles and trends in economic time series. *Review of Economics and Statistics* 85, 244-255.
- Istat (Istituto centrale di statistica), 1957. Indagine statistica sullo sviluppo del reddito nazionale dell'Italia dal 1861 al 1956, *Annali di statistica*, serie VIII, vol. 9. Istat, Rome.
- Istat (Istituto centrale di statistica), 1958. *Sommario di statistiche storiche italiane, 1861-1955*. Istat, Rome.
- Koopman, S.J., Harvey, A. C., Doornik, J.A. and Shephard, N., 2000. *STAMP 6.2: Structural Time Series Analysis, Modeller and Predictor*. Timberlake Consultants, London.
- Lewis, W. A., 1978. *Growth and Fluctuations, 1870-1913*. Allen and Unwin, London.
- Pollard, S., 1981. *Peaceful Conquest: The Industrialization of Europe, 1870-1970*. Oxford University Press, Oxford.
- Proietti T., 2002. Forecasting with structural time series models. In Clements, M., and Hendry, D. (Eds.), *A Companion to Economic Forecasting*. Blackwell, Oxford.
- Romeo, R., 1959. *Risorgimento e capitalismo*. Laterza, Bari.
- Romer, C. D., 1986. Is the stabilization of the postwar economy a figment of the data? *American Economic Review* 76, 314-34.
- Rossi, N., Sorgato, A., Toniolo, G., 1993. I conti economici italiani: una ricostruzione statistica, 1890-1990. *Rivista di storia economica* 10, 1-47.

Zamagni, V., 1993. The Economic History of Italy, 1860-1990: Recovery after Decline. Clarendon Press, Oxford.

Zarnowitz, V., Ozyildirim, A., 2002. Time-series decomposition and measurement of business cycles, trends and growth cycles. NBER Working Paper No. W8736.