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Ciccarelli, Carlo and Fenoaltea, Stefano and Proietti, Tommaso

Università di Roma "Tor Vergata"

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THE COMOVEMENTS OF CONSTRUCTION IN ITALY'S REGIONS, 1861-1913

Carlo Ciccarelli[a], Stefano Fenoaltea[a,*], Tommaso Proietti[a]

[a]*Facoltà di Economia, Università di Roma "Tor Vergata," via Columbia 2, 00133 Roma, Italy*

Abstract

This paper examines the comovements of construction in Italy's regions from 1861 to 1913. The dynamic correlations of the series' deviation cycles decline in the case of buildings, remain very low in that of railways, and tend to decline in that of other infrastructure; the total-construction correlations instead peak in the 1870s, and again after 1900. Long-term comovements are examined by tracking the dispersion of the first differences of the measured trends. Increasing dispersion is obtained in the construction of buildings and of non-rail infrastructure; railway construction displayed a dramatic decline in dispersion, which dominates the aggregate.

Key words: construction, regions, post-Unification Italy, trends, cycles, comovements

* Corresponding author. Tel: 011-39-06-7259-5907.
Email addresses: `carlo.ciccarelli@uniroma2.it` (Carlo Ciccarelli),
`stefano.fenoaltea@uniroma2.it` (Stefano Fenoaltea),
`tommaso.proietti@uniroma2.it` (Tommaso Proietti).

1 Introduction

There is a growing literature that uses the relatively rich data available for the recent past to investigate the comovements of production activities among the different components of a broader geographic unit. While sub-national production series for the more distant past are comparatively rare, post-Unification Italy is something of a happy exception, and a growing corpus of constant-price regional production series is now available.

This paper examines the comovements of new construction in Italy's regions from Unification to World War I. For a combination of reasons, this sector provides a particularly interesting case study. Technically, construction activity is highly unstable, because it is a stock-adjusting flow, and sensitive as perhaps no other to strictly local developments, because its products are immobile. Historically, in the Italian case construction movements appear as a major determinant of the path of aggregate output (Ciccarelli and Fenoaltea, 2007); and they are documented by a comparative abundance of what are, in context, high-frequency regional data.

For reasons of space, the object of the present examination is limited. On the one hand, it considers only aggregate (new) construction and its three immediate subaggregates, which are here building construction, railway construction, and other (social-overhead) construction; the underlying, more specific categories are occasionally recalled, but not systematically examined. On the other, it considers only the sixteen regions themselves, and ignores the three traditional macro-areas that group the regions of the North-West, of the Center and North-East, and of the South and major islands.

The regional total and component series are here filtered to extract their trends and deviation cycles. Short-term comovements are investigated by calculating dynamic correlations of the deviation cycles. The building-cycle correlations are initially high but decline sharply, while the railway-cycle correlations are consistently very low; the other-construction-cycle correlations tend to lie between the preceding two, and moderately decline. All three tend to display local peaks when the corresponding national series was particularly volatile. The total-construction-cycle correlations reflect both these correlations within its components, and the correlations between the (national) components themselves; as the latter peak sharply in the early 1870s and again after the turn of the century, so do the regional total-construction-cycle correlations.

Longer-term comovements are investigated by examining the distribution of the first differences in the regional series' calculated trends, with the latter scaled to give each region an equal weight. Here too, building and other non-railway construction display growing dispersion. The dispersion of railway construction instead dramatically declined; and that of total regional construction followed a similar path, simply because railway construction was much the most variable, and most idiosyncratic, component of the regional aggregate.

2 The data

Italy's heritage of historical data is not particularly rich; the national series themselves are often estimated through indirect indicators, and for many industries the annual estimates of regional production rely perforce on the interpolation of a small number of benchmark regional shares (e.g., Fenoaltea, 2003a, 2004). In the case of construction activity, for the reasons noted, the fall-back assumption that regional shares evolved relatively slowly would be hard to defend; fortunately, it can here be avoided, for the empirical evidence is relatively rich.

Railway construction proper was recorded in great detail, and only a few subsidiary components of the present aggregate, like the initial construction of horse tramways, must be extrapolated from a handful of point estimates. Other public works were documented by the annual expenditure figures in public budgets; these naturally omit privately-financed social-overhead construction, but the more significant of these relate to the infrastructure of the utilities, which also left an abundant documentary trace. The construction of buildings, too, was widely documented by the annual assessment figures generated by the tax on buildings; but this data-base is incomplete, and the corresponding aggregate series are less sturdy than the others.[1] This wealth of relatively high-frequency information allows the calculation of regional series directly from local data.

The series analyzed here are the recently compiled regional estimates of 1911-price value added in new construction.[2] These are illustrated, in index form

[1] The most serious gap in the data stems from the relatively late introduction of the tax on buildings. Over the series' initial decade, building construction could be estimated, for a few regions, from alternative local evidence (the municipal tax on construction materials); for the other regions, the backward extrapolation relies on a common index, and local deviations could not be incorporated. Moreover, rural structures were exempt from that tax, as they entered the base for the land tax; the ratio of taxed to untaxed construction is estimated on the basis of the census evidence on the changes in the distribution of the corresponding populations.

[2] See Ciccarelli and Fenoaltea (2008a, 2008b). These estimates include the maintenance component of construction activity, but for a combination of reasons the latter is here ignored. Maintenance is a stock-related flow, rather than a stock-adjusting flow: it is intrinsically of little relevance to the study of construction *movements*. Moreover, in the present context, large components of both the new-construction

and on a common scale, in Figure 1; the indices of total, non-railway, and building construction for each region are the 1911-price series divided by the same scalar–the region's average total new construction at 1911 prices–so the railway and other social-overhead components appear as vertical differences. Regional paths differ widely, and do not simply reproduce the analogous national paths illustrated, to the same scale, in Figure 2.

3 Short-term comovements: method

The short-term comovements of the estimated series are evaluated by examining their cyclical deviations from the underlying (flexible) trend. The regional series y_{it}, $t = 1, \ldots, n$, $i = 1, \ldots, N$, are decomposed simply as

$$y_{it} = \mu_{it} + \psi_{it} \tag{1}$$

where μ_{it} is the trend, and ψ_{it} is the deviation cycle. Here, these components are estimated by the LHP filter (Leser 1961, Hodrick and Prescott, 1997) with a smoothness parameter that is set equal to the value suggested by Ravn and Uhlig (2002) for annual data, so that the corresponding trend filter can be interpreted as a low-pass filter with a cut-off period of 10-12 years. As a result, the component ψ_{it} will retain to a great extent the fluctuations in the series that have a periodicity smaller than 12 years.[3]

As is well known, and much discussed, at the end of the sample the LHP-filtered components are of questionable reliability (Orphanides and Van Norden, 2002). In principle, the LHP estimates could be adapted to the characteristics of the present series using the techniques reviewed in Proietti (2008); however, Wallis (1974) has proved that the dynamic relationship between filtered time series is least distorted if the same (possibly suboptimal) filter is applied to all the series.

In a tradition that goes back at least to Kuznets (1928), the concordance of the regional cycles is here evaluated by the average ($\bar{r}_t$) of the $N(N+1)/2$ pairwise dynamic correlation coefficients $r_{ij,t}$ between the cyclical components. With i and j denoting the region and t time,

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and maintenance series are obtained by deflating regional expenditure series by the available *national* deflator. In the case of new construction, the region-specific variation in expenditure far outweighs the common variation in the deflator; in the case of maintenance, to the contrary, the expenditure series are trend-dominated, and the deflated series display largely common movements introduced by the common deflator.

[3] For a thorough treatment of the selection of the smoothing parameters for the LHP filter at different observation frequencies see Maravall and del Rio (2007).

$$\bar{r}_t = \frac{2}{N(N+1)} \sum_{i=1}^{N} \sum_{j=i}^{N} r_{ij,t}, \qquad \text{with } i \neq j. \tag{2}$$

The dynamic correlation coefficient between the two time series ψ_i and ψ_j at time t is defined as

$$r_{ij,t} = \frac{m_t(\psi_{it}\psi_{jt}) - m_t(\psi_{it})m_t(\psi_{jt})}{\sqrt{m_t(\psi_{it}^2) - (m_t(\psi_{it}))^2}\sqrt{m_t(\psi_{jt}^2) - (m_t(\psi_{jt}))^2}} \tag{3}$$

where $m_t(\cdot)$ denotes a kernel function, i.e., a set of non-negative weights symmetric around time t non-increasing in the distance from time t, and summing up to one. Expression (3) computes a local correlation coefficient with a greater weight on the observations in the neighborhood of time t, as defined by the bandwidth of the kernel.[4]

In practice, this nonparametric concordance statistic requires selecting a kernel $m_t(\cdot)$ and a bandwidth. The recent literature proposes a family of estimators, with varying weights on the observations (Proietti, 2008). Here, the kernel is allowed to adapt automatically at the boundaries of the sample space, and the bandwidth is related to the time horizon at which the correlation is computed. Specifically, the running means are estimated using a two-sided exponentially-weighted moving average (EWMA) with weights determined by a smoothing parameter (λ) related to the cut-off period p and the signal-to-noise ratio. The actual computation of $m_t(q_t)$, where q_t is alternatively $\psi_{it}, \psi_{jt}, \psi_{it}^2, \psi_{jt}^2$ and $\psi_{it}\psi_{jt}$, is performed by the Kalman filter and smoother (Durbin and Koopman, 2001) applied to the local level model $q_t = q_t^* + \varepsilon_t$ and $q_t^* = q_{t-1}^* + \eta_t$, where ϵ and η are both white noise, and λ is related to $\sigma_\eta^2/\sigma_\epsilon^2$. The filter $m_t(q_t)$ emerges as the estimate of the underlying component q_t^*. The choice of the λ parameter entails a bandwidth of 12 years.

RiskMetrics (1996) follows a semiparametric approach, computing $m_t(q_t)$ with the one-sided EWMA

$$m_t(q_t) = \lambda q_t + (1-\lambda)m_{t-1}(q_{t-1}) = \lambda \sum_{k \geq 0} (1-\lambda)^{t-k} q_{t-k} \tag{4}$$

where λ is a smoothing constant between 0 and 1; in practice, λ is set *ad hoc* at .04 and .06. The two-sided EWMA used here is a smoother as well as a filter, and it eliminates the phase shift originating from the use of a one-sided filter. Moreover, the value of the smoothing constant is here related to a particular time horizon, and not assumed *ad hoc*.

[4] The rolling correlations calculated by Kuznets (1928) select the uniform kernel for the given bandwidth. The present "dynamic correlations" are not equivalent to those in Croux *et al.* (2001), which measure cyclical concordance in the frequency domain.

Simulation envelopes for $\bar{r}_t$ are also computed, under the assumption that the true dynamic correlations are zero. A parametric model of the ARIMA class, selected with the AIC information criterion, is fitted to each regional time series. Each of these models is used to generate 10,000 independent replicate series, which are then filtered and correlated as above. The resulting envelopes allow at once for the correlations induced by the filtering to extract the cycle, for the persistence induced by the EWMA running mean filter, and for the time series persistence of the estimated series themselves.

4 Short-term comovements: results

Figure 3 illustrates the dynamic correlations obtained for the calculated (LHP) deviation cycles in total construction alone, for varying levels of the cut-off period p. As p increases, the calculated series tend to become less volatile, and the dynamic correlations tend to their static equivalent. The relationship is systematic; to highlight the correlations' medium- and long-term tendencies, the subsequent calculations are performed with a 12-year cutoff.

In the upper panels of Figures 4 - 7 the solid lines illustrate the (12-year cutoff) dynamic correlations of the LHP deviation cycles of building construction, railway construction, other (social-overhead-capital) construction, and total construction. The various dashed and dotted lines illustrate the comparable correlations of the standard BK (Baxter-King, 1999), and CF (Christiano-Fitzgerald, 2003) deviation cycles, and of the growth rates of the construction series themselves; with the limited exception detailed below, the present results appear robust to these alternatives.

The long-dashed lines in those same panels illustrate the 95% simulation envelopes. The upper and lower bands are near .10 and -.05, respectively; the median average correlations are very near zero.[5] The lower panels plot the growth rates of the corresponding national series.

The building-cycle correlations illustrated in Figure 4 display initially high levels, and a sharp downward trend that brings the later values below the upper band of the simulation envelope.[6] Since building construction is closely

[5] Virtually identical envelopes are obtained if the first steps of the simulation are simplified, and ARMA models fitted to the regions' deviation cycles are used to replicate these directly.

[6] The early correlations are in fact spuriously high (above, note 1; but this is of little consequence for the later estimates. If the calculations are repeated without the initial 11 observations, one obtains a truncated dynamic-correlation series that very quickly coincides with that illustrated here. The corresponding (LHP) static correlation equals .31.

tied to urban growth, and the prosperity of urban activities, this downward trend might be tied to the increasing differentiation and specialization of the regional economies as internal and external trade increased (Fenoaltea, 2003b). The regions' industrial structures, in particular, were initially very similar, and industry-specific shocks were regionally diffused; differentiation meant that industry-specific shocks became increasingly region-specific.

The downward trend in these correlations is in fact interrupted by local peaks, and the series' minimum values appear in the later 1890s rather than at the very end. These cyclical movements may usefully be considered together with the national growth rates in the lower panel. In general, high dynamic correlations are associated with a high *volatility* in the aggregate growth rate.[7] The local peaks in the correlations in the mid-1870s and late 1880s correspond to the sharpest short-term swings in the aggregate growth rate, the lowest overall correlations to the run of years over which the growth rate remained highly stable (and, at that, very near zero). Over the longer term, too, aggregate volatility clearly declined: the account of the correlations' cycle carries over, and provides an alternative account for their trend as well.

The observed association between regional correlation and national volatility does not identify, however, the underlying structure. One hypothesis is that local construction is subject to strictly local shocks: they tend to cumulate into a large national shock if they are (for whatever reason) highly correlated, and into a small national shock if they are uncorrelated and mutually offsetting.[8] An alternative hypothesis is that local construction is subject to a combination of strictly local (idiosyncratic) shocks, and common national shocks; the larger the latter, the more they overwhelm the former, and the higher the correlation of the local cyclical deviations. This second hypothesis dovetails better with the view that national construction movements were related to national, indeed *inter*national, financial shocks (Fenoaltea, 1988); but the first cannot here be excluded.

The railway-cycle correlations in Figure 5 are in contrast essentially trendless, and so low as to be rarely outside the simulation band.[9] That they should be so much lower than the building-cycle correlations in Figure 4 is to an extent unsurprising: compared to building projects, railway projects were far larger

[7] This is apparent to the eye, and easily confirmed; for example, one obtains a simple correlation of .83 between the (LHP) dynamic correlations in the upper panel and a three-year moving average of the absolute annual changes in the growth rates in the lower panel.

[8] While the correlations give equal importance to every region, the cumulation of local shocks naturally reflects the regions' relative weights.

[9] Growth-rate correlations are not calculated, because of the presence of null observations in the railway-construction series. The corresponding (LHP) static correlation equals .04.

and fewer, and far more subject to political decisions rather than market forces (Fenoaltea, 1983).

In fact, the railway-cycle correlations display negative runs near the beginning and again at the end. The early run seems tied to the construction of the peninsular trunks, for as the railheads advanced different regions were affected in sequence rather than simultaneously. The later run is less easily traced: railway work fell off to nothing in much of the South (Figure 1), and the construction projects elsewhere seem to have been simply out of phase.

Once again, however, the dynamic correlations seem associated with the volatility of the aggregate series. The local correlation peaks around 1880 and 1903 correspond to periods of relatively sharp variations in the aggregate's growth rate, the overall peak in 1895 to the collapse of railway construction in the depths of the end-of-the-century crisis.[10]

The other-social-overhead-cycle correlations illustrated in Figure 6 appear to fall between the preceding two, both in their levels, and in displaying a mild downward trend; this is again unsurprising, as this category covers projects that run the gamut from the largest public works (e.g., the La Spezia naval base in Liguria, the Apulian aqueduct) to very small-scale local ones related, like building construction, to urban expansion (Ciccarelli and Fenoaltea, 2008a).[11] From the mid-1880s to the mid-1890s, the low correlations obtained here with LHP deviation cycles may not be robust: a similar result is obtained with CF cycles, but the BK-cycle and growth-rate correlations display an intermediate peak.

Be that as it may, the association between the (LHP) dynamic correlations and the volatility of the national aggregate is again apparent to the eye, as both seem highest over the first quarter century, and least over the next decade and a half.[12] Over the 1860s and early '70s, on the other hand, the correlations rise with no visible increase in aggregate volatility; one surmises that the early correlations may have been reduced by the impact of the large and highly idiosyncratic Piedmontese bulge (Figure 1), tied both to the Cavour canal project and to the fortification of the new border with France.

The local peak in 1870 is also surprising–one might have expected more from the public-works collapse with the crisis of 1866–and may warrant a very

[10] The simple correlation between the (LHP) dynamic correlations in the upper panel and a three-year moving average of the absolute annual changes in the growth rates in the lower panel here equals .67.
[11] The corresponding (LHP) static correlation equals .14.
[12] Here, the simple correlation between the (LHP) dynamic correlations in the upper panel and a three-year moving average of the absolute annual changes in the growth rates in the lower panel equals .68.

specific explanation. In the now-superseded Istat/Vitali reconstruction, public works fell in 1870 to a sharp overall minimum. An investigation of this outlier traced the decline in recorded public spending to a change in accounting rules, as from fiscal 1861 to fiscal 1869 delayed spending was attributed to the year in which it was originally budgeted, and from fiscal 1871 to the year in which it actually occurred; fiscal 1870 was the truncated transition year that excluded the calendar-1870 spending attributed to fiscal 1869, under the old rules, but included no calendar-1871 spending, under the new ones. The new series allow for this change, and the outlier has disappeared (Fenoaltea, 1986); but the correction uses a simple algorithm, and it may have induced a common error in the regional series.

In the upper panel of Figure 7, the average total-construction-cycle correlations display yet another path, with a sharp peak in the early 1870s and a late plateau near that early maximum; a minor intermediate peak, in the early 1890s, is also apparent.[13] This particular path reflects of course the sector-specific correlations illustrated in Figures 4 - 6, and also, more markedly, the correlations between the sectors themselves. Figure 8 plots the average of the pairwise dynamic correlations between the (LHP) deviation cycles of *national aggregate* building construction, railway construction, and other construction; these reach a local maximum in the early 1870s, and peak at the very end, during the pre-War boom, when all three major sectors of construction followed very similar paths.

Since the average dynamic correlations across regions, and across sectors, are all transformations of the same underlying data, there is of course an exact, but complex, analytical relationship among them. Empirically, however, the total-construction-cycle correlations can be approximated by a simple weighted sum of the three interregional average correlations in the upper panels of Figures 4 - 6 and the intersectoral average correlations in Figure 8.[14]

5 Longer-term comovements

To investigate the longer-term comovements of regional construction, we examine the trends of the regional series obtained in the (LHP) decomposition

[13] The corresponding (LHP) static correlation equals .09.

[14] A simple OLS regression of the LHP total-construction-cycle correlations on these four (LHP) variables yields an R-squared of .87. The coefficients and associated Newey-West t statistics are -.07 (-1.9) for the constant and, in order, .15 (2.7), 1.28 (4.8), .24 (2.7), and .31 (8.2) for the four regressors;. An ARMA structure somewhat modifies these weights and produces a much closer fit, but such refinements are irrelevant to the point at hand.

described above; these are of course the original series, net of the deviation cycles considered in the previous section. To avoid giving a heavier weight to the larger regions, each regional trend is divided by that region's total-construction-trend average; to preserve additivity (and comparability), as in Figure 1, the total-construction average is used to scale the regional building-, rail-, and other-construction trends as well.

These scaled trend series are then differenced. The ranges and interquartile ranges of the resulting differences in total construction, and in its components, are illustrated in Figure 9. To avoid clutter, the means and medians are illustrated separately, and to a smaller scale, in Figure 10. Clearly, the means alone retain the additivity of the underlying series.

The first panels refer to buildings. Both the interquartile and overall ranges illustrated in Figure 9 are initially very narrow, and widen substantially over time. This evolution recalls the declining correlation of the corresponding deviation cycles (Figure 4). The increasing differentiation of the regions' industries, and the concomitant rise in the geographic specificity of industry-specific shocks, may clearly have separated the trends as well as the cycles. Over the longer term, too, the regions' demographics also drifted apart, as migration rose rapidly over time, and affected different regions very differently; but these developments affected trend levels more certainly than the trend differences considered here. The censuses of 1901 and 1911 point to exceptionally rapid net growth in Liguria, and an equally exceptional net *decline* in the Abruzzi. In the years around 1911 the upper limit of the present range is indeed defined by Liguria; the lower limit is set by the Abruzzi before 1911, but after that by Venetia and then Lombardy, where the vigorous pre-war boom was already coming to an end (Figure 1).

The building-trend-differences' means and medians in Figure 10 alternate positive and negative runs that correspond to the upswings, and downswings, of the national aggregate (Figure 2). The ranges in Figure 9 enrich this story. The band that defines the interquartile range naturally displays the cyclical movements of the mean and median, but the band itself remains relatively tight, and close to its central tendency. From the 1880s, however, the overall range widens, and the corresponding band moves more than the central part of the distribution. The outliers swing from one side to the other, reinforcing the overall cycle: as if when building-construction did well nationally it did somewhat better than normal practically everywhere, but spectacularly well in selected regions, and vice versa. In fact, the same regions that lead the rise appear to lead the subsequent fall: over the 1880s, for example, the building boom-and-bust was sharpest in Latium (Figure 1), and Latium duly appears as the up-side outlier in the first half of the decade, and the down-side outlier in the second.

Other construction, in the third panels, is usefully considered next to building construction, for the patterns one finds are similar. Again, the ranges become wider over time; again, the interquartile band displays cyclical movements; again, the overall cycle is reinforced as the outliers swing from one side of that band to the other. In part, as noted in connection with the deviation cycles, these similarities are unsurprising, as much of the construction in this residual is tied, like building construction, to urban growth; but there is more to be said. The early (up-side, down-side) outlier was Piedmont, where the Cavour canal and defense work seem to have shaped the trend as well as the cycle. In the 1880s and early 1890s the comparable outliers were Lombardy and Latium, where urban improvements seem to have called the tune, but around the turn of the century both the maxima and the subsequent minima reflect industrial hydroelectric construction in Umbria. After 1907 the outliers reflect work on the Apulian aqueduct: the maximum is tied to Basilicata, where the main conduit was built, until 1911, and then to Apulia itself, while Basilicata became the minimum.

Railway construction, in the second panel, behaved very differently. In the means and medians in Figure 10, the railways differ from the preceding sub-aggregates: there is an overall peak around 1880, and no sustained run of new highs in the final decade. In the ranges in Figure 9, the contrast is even greater, for instead of widening over time, these sharply narrow. Through the 1890s, the railway ranges far exceed those of buildings and other construction; by the series' end the railway ranges are the narrowest of the three components'.

Three regimes can in fact be identified, that correspond to the successive phases of railway development after Unification (Fenoaltea, 1983). In the 1860s and 1870s, when construction was devoted primarily to the peninsular and island trunks, the measured range was particularly wide, and the outliers were broadly symmetric with respect to the interquartile range (which itself narrowed to a local minimum as construction fell off in the mid-1870s). In the 1880s and 1890s, when construction shifted to thickening the network of minor lines, the range narrowed, and became asymmetric; as with non-railway construction, the outliers were predominantly above the interquartile range when the aggregate prospered, until the early 1890s, and below it when, as the century drew to its crisis-ridden end, the aggregate itself collapsed. After 1900 railway construction picked up again, but shifted from adding new lines to improving existing ones where traffic growth warranted it. The range then again narrowed; the interquartile range, which had widened again in the 1880-95 boom, did too, to the point that the quartile markers collapse around the zero line.

The fourth and final panels refer to (the differences in) total construction. The measures of central tendency in Figure 10 naturally reflect those of all three components, though these did not always move together. From 1861 through the mid-1880s the total reflects primarily the movements of building and railway construction, as other construction varied little; over the next fifteen years building construction varied relatively little, and the total moved down and then recovered as railway and other construction did; after 1900 railway construction barely moved, and the rapid rise in the total stems from the increases in building and other construction.

The ranges in Figure 9 again add to this story. The dispersion of railway construction initially far exceeded that of building and other construction, and it varied far more over time. Railway construction here overwhelmed the other two, and dominated the aggregate: the right-hand panels resemble each other much as the left-hand panels do.

This conclusion is not unexpected, for the trends smooth the original series in Figure 1. Over the longer term as in the short, at the regional level railway construction was much the most variable, and idiosyncratic, component of the total; as it fell off after the turn of the century, so did the dispersion of the paths of the regional totals.

6 Conclusion

This paper examines the comovements of construction in Italy's regions over the half-century from Unification to the World War.

Short-term comovements are measured by the dynamic correlations of the series' deviation cycles. The building-construction correlations decline over time from high levels to near zero; this increasing dispersion is consistent with the increasing differentiation of the regions' urban/industrial economy. The railway-construction correlations are instead consistently very low, as one would expect: such projects were large (and largely political), and as the railway net spread down the peninsula they reached different regions at different times.

Other construction covers a mixed bag of large- and small-scale projects, and the corresponding correlations lie between the preceding. All three correlations display local peaks when the corresponding aggregate was particularly volatile, possibly because the common shocks then outweighed the idiosyncratic local ones. The path of the total-construction correlations differs from those of its components, as it peaks sharply in the early 1870s and again after the turn of the century; these peaks are due to episodes of high correlation among the three subaggregates themselves.

Long-term comovements are examined by tracking the dispersion of the first differences of the (suitably scaled) measured trends. The decline in the cyclical correlations of building and other non-railway construction is mirrored by a secular increase in the dispersion of their trend differences. Over the longer term, too, the regions' urban and (non-rail) infrastructure growth became increasingly differentiated: again because their economies did, and also in part, surely, because the surge in migration affected them very differently. The dispersion of the railway-construction trend differences instead declined dramatically; it was very high when the trunk lines were built in the 1860s and 1870s, substantially lower during the local-line construction boom of the 1880s and 1890s, and lowest of all after 1900, when construction fell essentially to the improvement of existing lines. Since at the regional level railway construction varied far more than building or other construction, and far more idiosyncratically, the dispersion of the total-construction trend differences is dominated by the railways, and it too displays a long-term decline.

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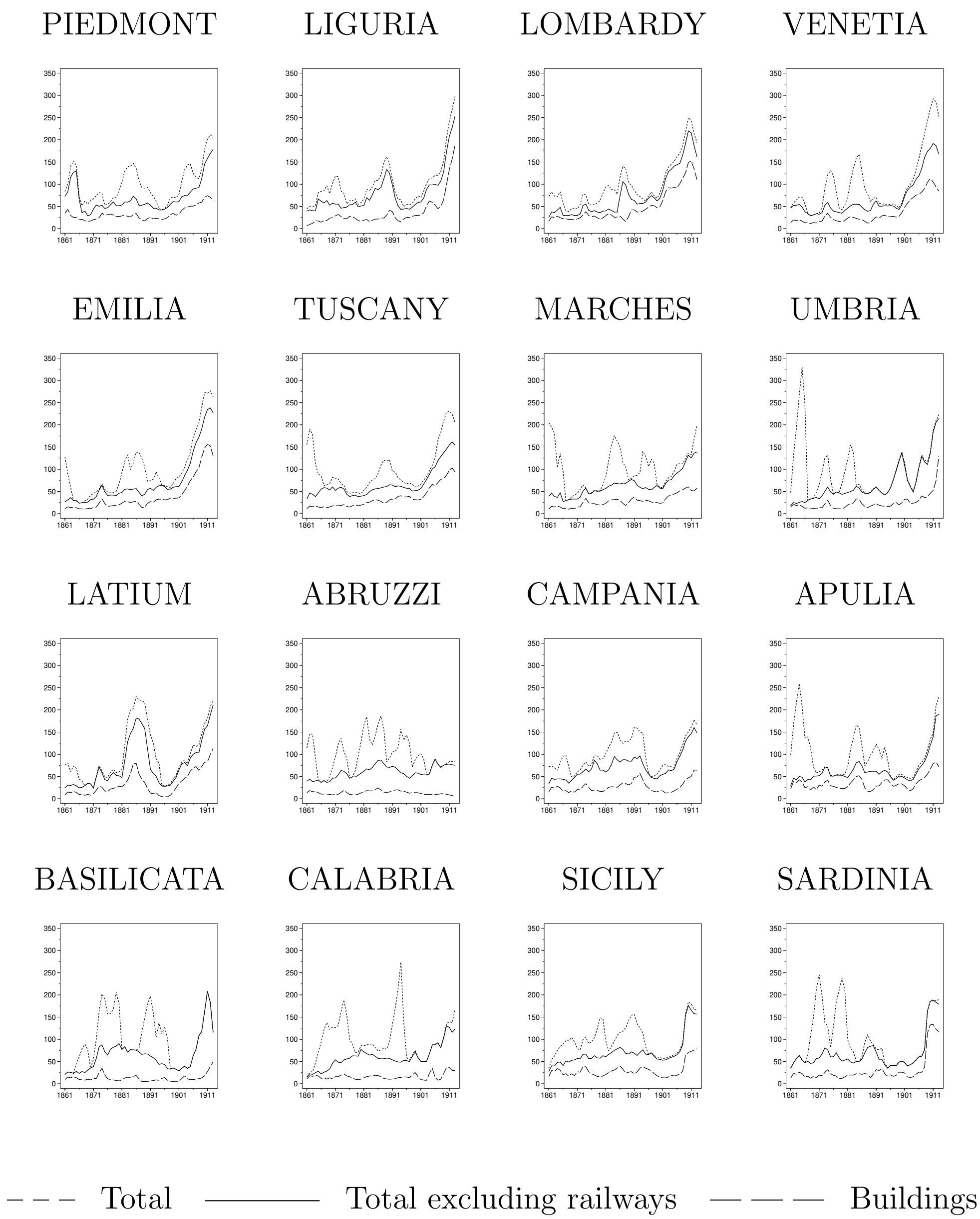
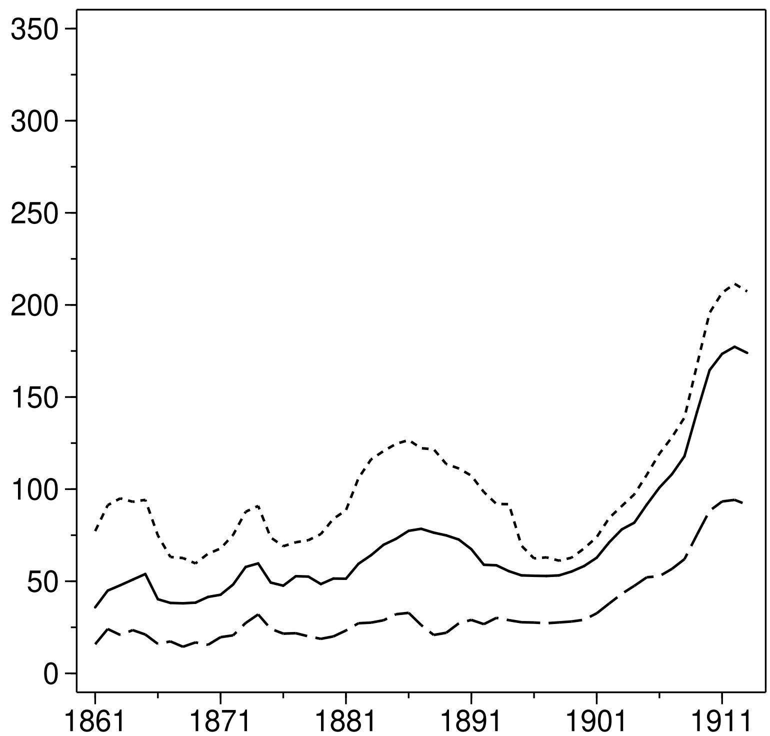
Figure 1
New construction: regional indices of value added at 1911 prices
(for each region, average total construction = 100)



Source: see text.

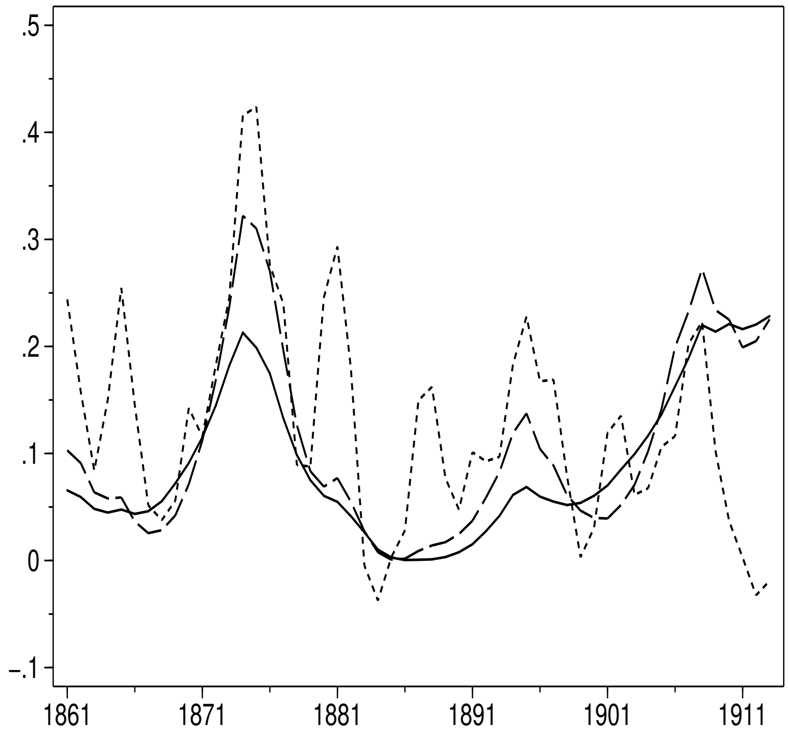
Figure 2
New construction: national indices of value added at 1911 prices
(average total construction = 100)



– – – Total ——— Total excluding railways — — — Buildings

Source: see text.

Figure 3
Average dynamic correlations, regional total-construction cycles

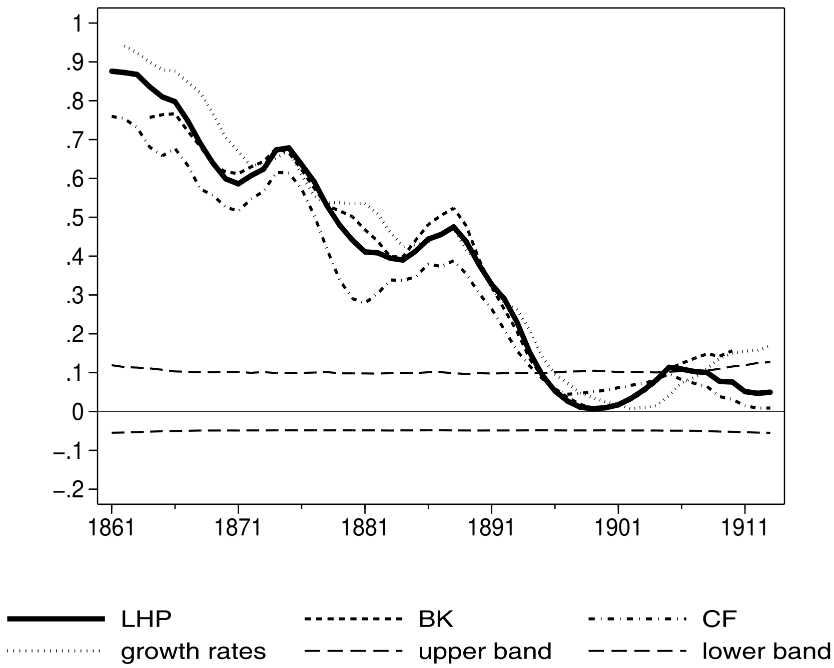


Cut-off period: – – – 2 years — — — 12 years ———— 20 years

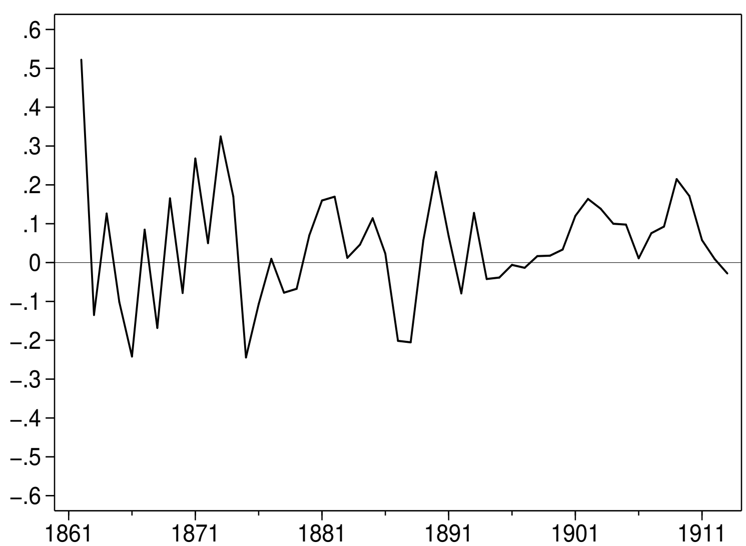
Source: see text.

Figure 4
Building-construction cycles

(a) Average dynamic correlations, regional cycles



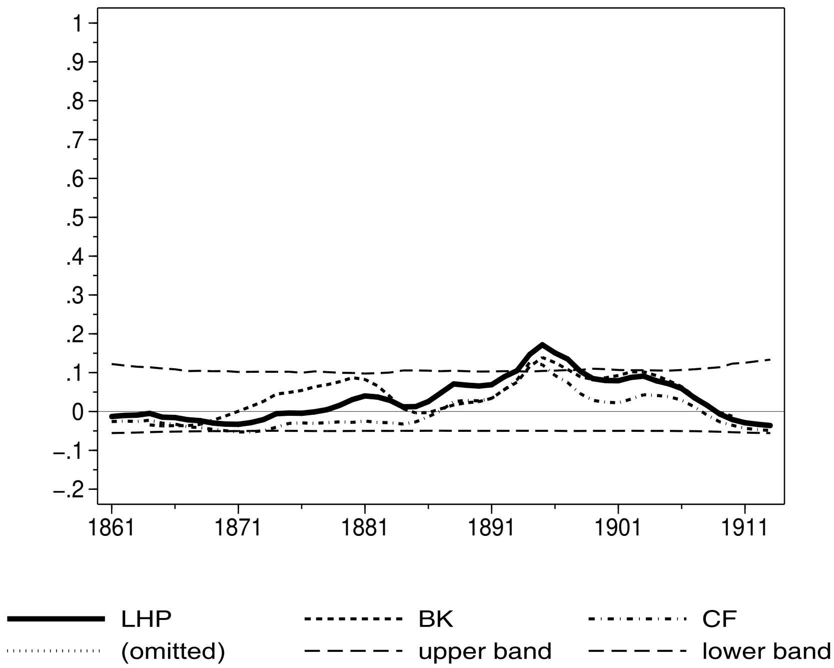
(b) Year-to-year growth rate, national series



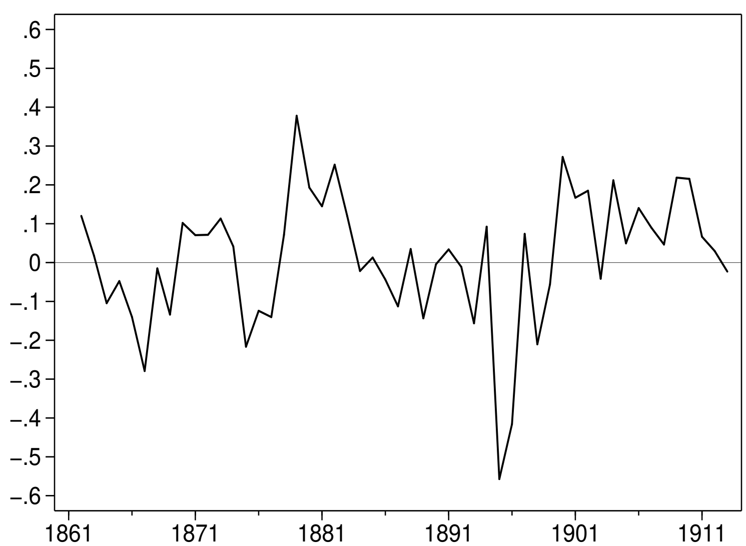
Source: see text.

Figure 5
Railway-construction cycles

(a) Average dynamic correlations, regional cycles



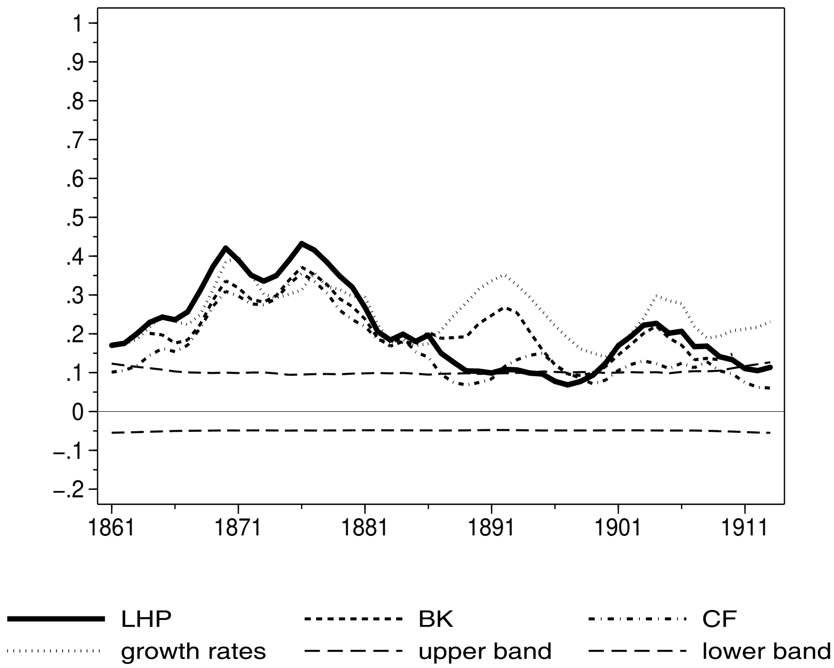
(b) Year-to-year growth rate, national series



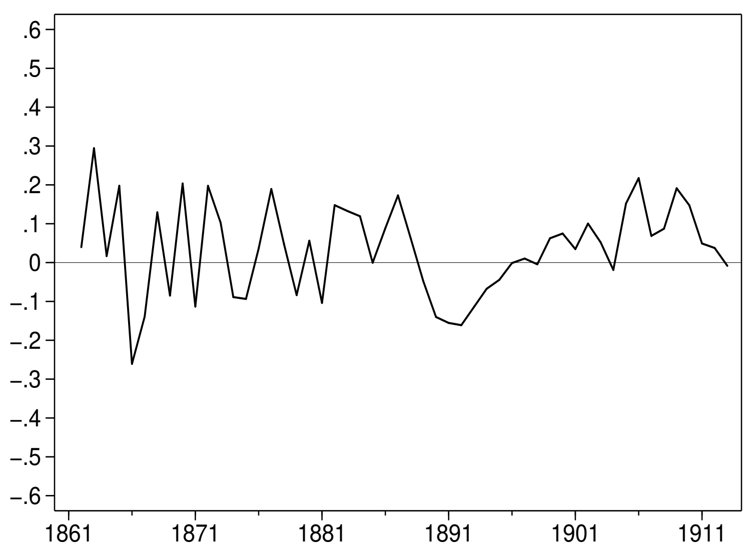
Source: see text.

Figure 6
Other-construction cycles

(a) Average dynamic correlations, regional cycles



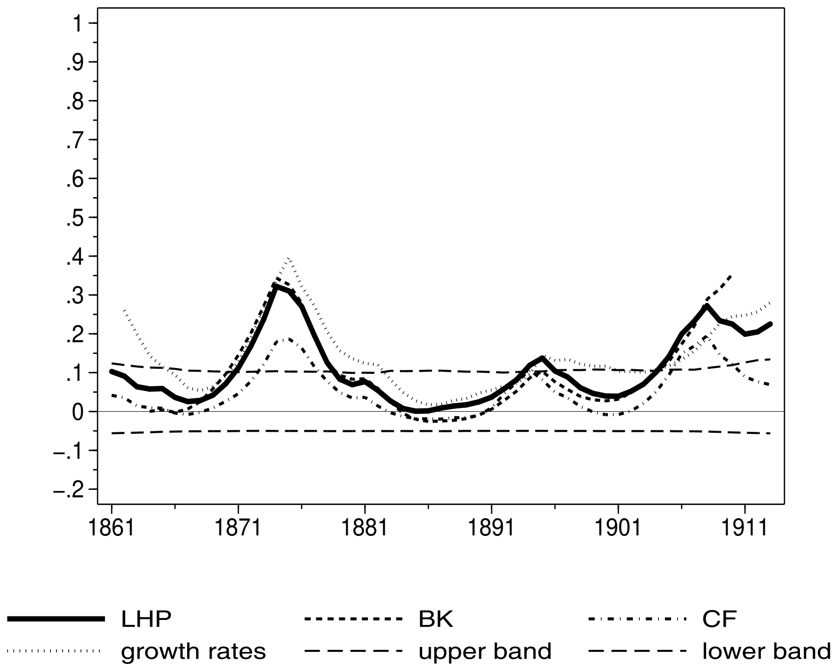
(b) Year-to-year growth rate, national series



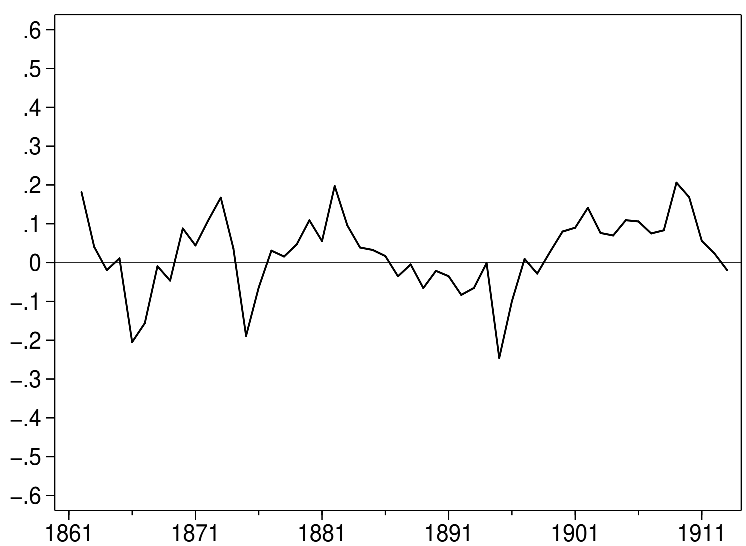
Source: see text.

Figure 7
Total-construction cycles

(a) Average dynamic correlations, regional cycles



(b) Year-to-year growth rate, national series

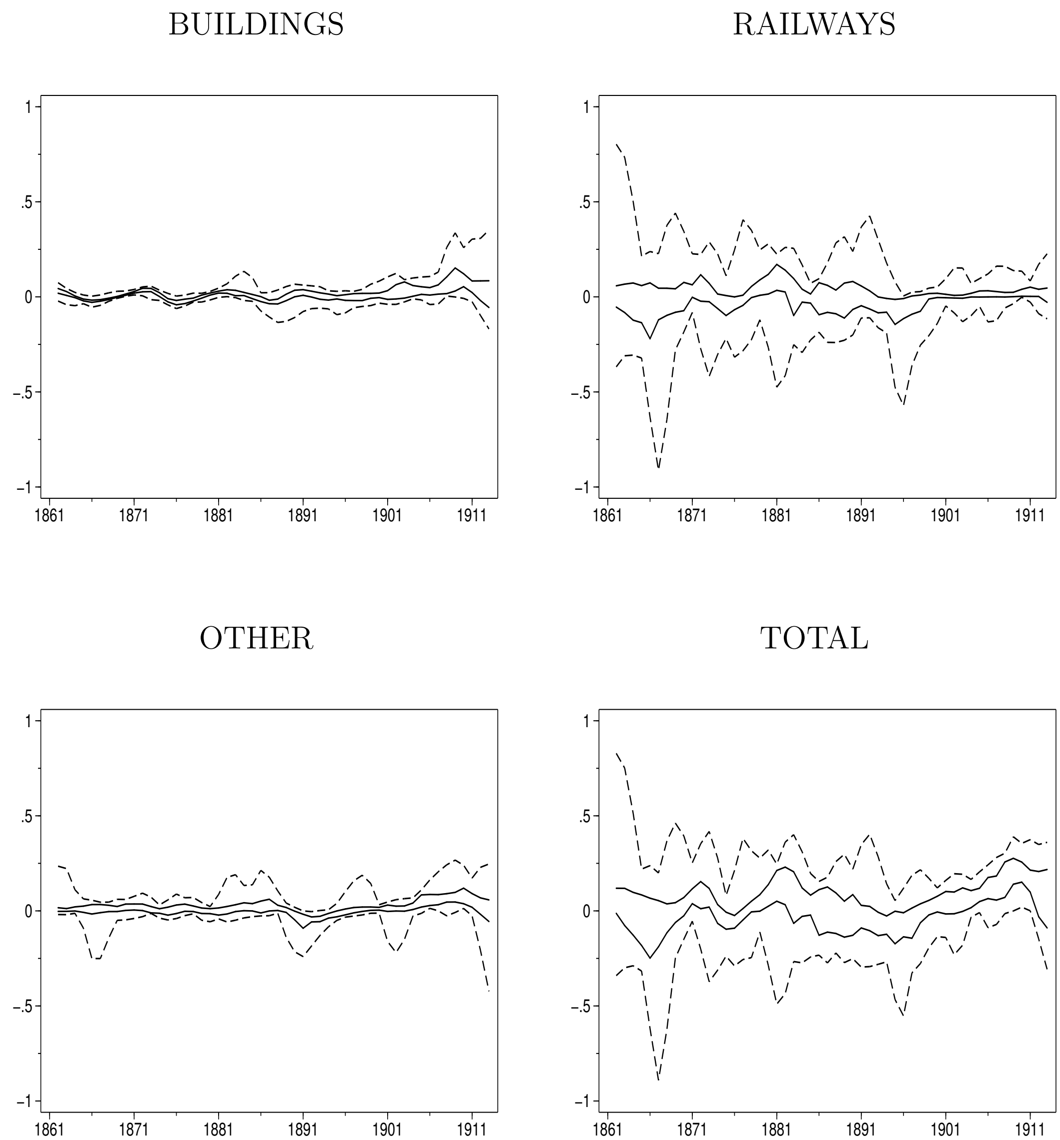


Source: see text.

Figure 8
Average dynamic correlations, national construction-sector cycles

Source: see text.

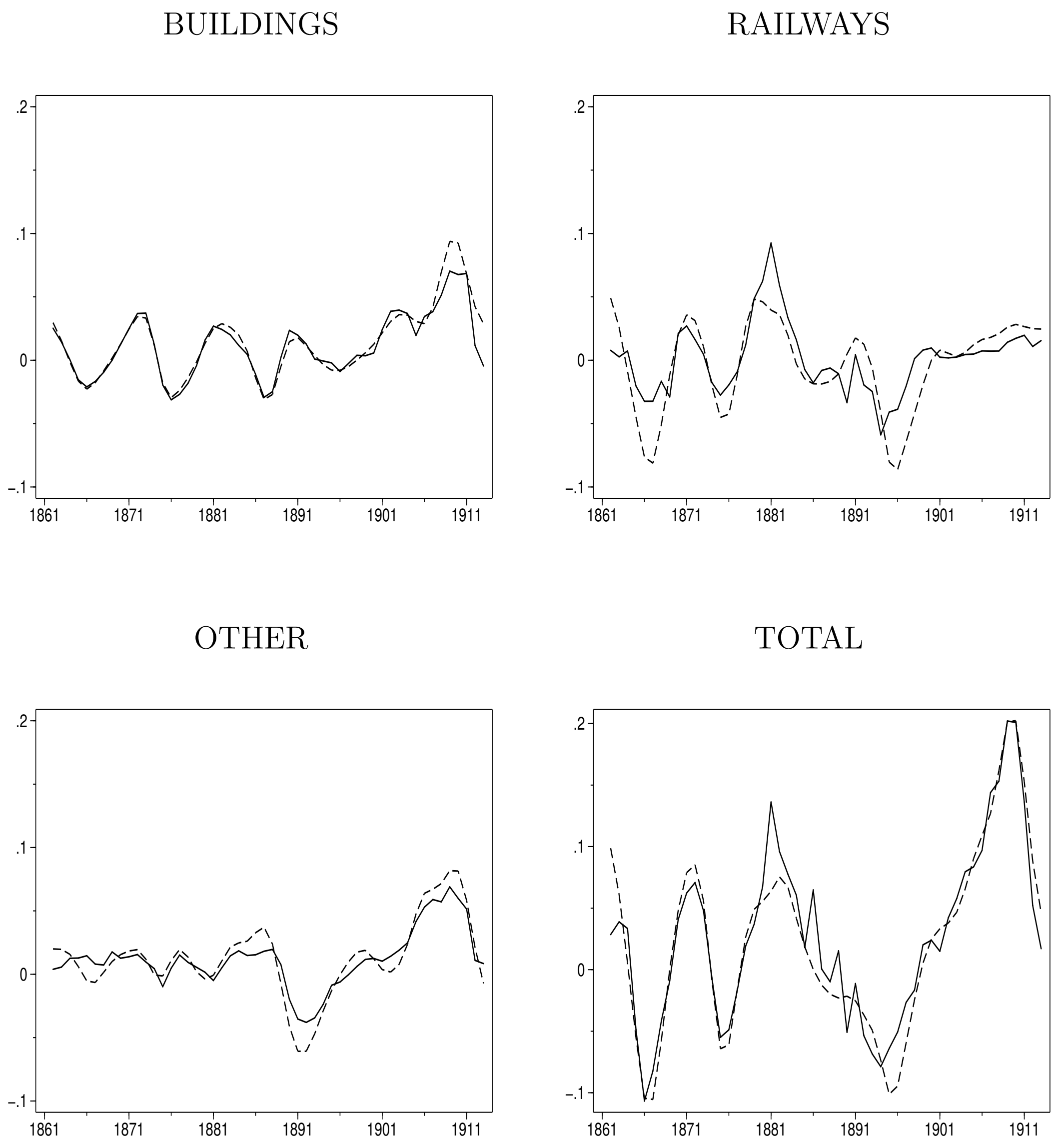
Figure 9
First differences in regional scaled trends: ranges
(for each region, average scaled total trend construction, 1861-1913 = 1.00)



Key: the dashed lines indicate the maxima and the minima, the solid lines the second and third quartiles.

Source: see text.

Figure 10
First differences in regional scaled trends: means and medians
(for each region, average scaled total trend construction, 1861-1913 =1.00)



Key: the dashed lines indicate the mean, the solid lines the medians.
Source: see text