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Macroeconomic estimates of Italy's mark-ups in the long-run, 1861-2012

Claire Giordano and Francesco Zollino*

Abstract

We explore three alternative methodologies drawn from economic history literature to compute macroeconomic total-economy estimates of Italy's mark-ups since 1861, based on the new historical national accounts presented in Baffigi (2013) and Giordano and Zollino (2015). Two key features of Italy's history stand out: a) the increase in market power under the Fascist regime and b) the strengthening of competition since 1993. We then focus on a more limited time span (1970-2012) in order to estimate sectorial mark-ups using the model developed in Bassanetti, Torrini and Zollino (2010). Employing Istat and EU-KLEMs data, we find evidence of a reduction in mark-ups after the completion of the Single Market, with an acceleration after the inception of the European Monetary Union, owing mostly to the decrease in workers' bargaining power rather than in firms' margins. Moreover, we find large heterogeneity in mark-ups across sectors, with regulated services displaying weaker competition than manufacturing and market services.

JEL Classification: E01, J50, L50
Keywords: mark-ups, completion policy, wage bargaining, growth accounting

Contents

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1 Introduction[1]

Measuring the level of competition of an economy and of its sectors has become a relevant topic in recent years, since many theoretical and empirical studies have pointed to beneficial effects of competition on economic growth (see Cohen 2010 for a survey of the literature). According to the nature of the data available and to the size of the relevant market considered, alternative measures of the degree of competition may be used. It may in fact be measured directly, on the basis of microdata, via for instance the construction of concentration indices, Lerner indices, the elasticity of profits to marginal costs (see Ciapanna 2008 for a detailed overview of these measures) or indirectly, on the basis of national accounts series, via a range of alternative methods.

In order to estimate the mark-up of prices on marginal costs of the Italian economy in the long-run we make use of the second field of indirect macroeconomic measures. In the first part of the paper, we experimentally estimate Italy's mark-ups over the past 150 years, by investigating three alternative methodologies employed in the economic history literature in order to appraise the evolution of competition in Italy during its various phases of growth, to the extent that a larger mark-up actually does imply weaker competition in the product market[2]. In particular we employ the methods described in Roeger (1995), Crafts and Mills (2005) and Morrison (1988). To our knowledge, this is the first study referred to the Italian economy which attempts to achieve this aim; it has been made possible by the recent reconstruction of new historical national account data for Italy (Baffigi 2013; Giordano and Zollino 2015). However, owing to the current unavailability of disaggregated data for the overall period since 1861, only a total economy mark-up could be estimated. Two features of Italy's economic history robustly stand out: the drop in competition under Fascism and the strengthening of competition after 1993, at least compared with the immediate post-WWII period. Strong conclusions on other sub-periods of Italy's history cannot be reached.

The three methodologies used in our historical analysis present both theoretical shortcomings and econometric issues. In the second part of the paper, we attempt to overcome both sets of drawbacks. On the one hand we adopt an extension of Roeger's (1995) model, developed in Bassanetti, Torrini, Zollino (2010), which relaxes the assumption of perfect competition in the labour market as well as that in the goods' market. On the other hand, we choose to focus on a shorter time-span, i.e the past forty years of Italy's history, for which disaggregated data are available, thereby estimating more robust total-economy, as well as sectorial, mark-ups. Evidence of a strengthening of competition after 1993 is clear-cut, also across sectors. Yet a large variation of mark-ups across sectors also stands out, confirming the relevance of sectorial analysis in the estimation of mark-ups.

The paper is structured as follows. Section 2 briefly outlines the three approaches which have been applied in the economic history literature to indirectly measure mark-ups, put forward respectively in Roeger (1995), Crafts and Mills (2005) and Morrison (1988). Section 3 describes the historical dataset used and the total economy mark-up estimation results according to the three methodologies. Section 4 describes the approach derived in Bassanetti, Torrini and Zollino

[1]The Authors wish to thank Antonio Bassanetti who contributed to the first part of the research project, an anonymous referee, our discussant Sergio de Nardis, Antonio Accetturo, Andrea Brandolini, Fabio Busetti, Nicholas Crafts, Marco Magnani, Terence Mills, Libero Monteforte, Paolo Sestito, Stefano Siviero, Gianni Toniolo for comments and suggestions on previous versions of the paper, as well as all participants of the conference *Concorrenza, mercato e crescita in Italia: il lungo periodo* held at Banca d'Italia in October 2014 and of previous internal workshops. Moreover, we are very grateful to Federico Barbiellini Amidei, Francesco Giffoni and Matteo Gomellini for sharing their data with us. The views here presented are those of the Authors and not of the Institution represented. Any errors remain sole responsability of the Authors.

[2]High mark-ups cannot be taken unconditionally as evidence of persistent rents stemming from market power. They may, for instance, reflect temporary innovation rents. In this paper, however, we consider mark-ups as an inverse proxy of competitive pressures, as in Griffith and Harrison (2004) and Thum-Thysen and Canton (2015), amongst others.

(2010), which overcomes a major shortcoming of Roeger's model (i.e. the assumption of perfect competition in the labour market). Section 5 describes our sectorial dataset, based on EU-KLEMS and Istat series, which we were able to construct for the years 1970-2012. Section 6 estimates total-economy and sectorial mark-ups, by applying the extended Roeger model to our more recent dataset. Section 7 draws our conclusions. Appendix 1 outlines the derivations underlying Hall's (1988) and Roeger's (1995) seminal models, as well as Bassanetti, Torrini and Zollino's (2010) methodology.

2 Three alternative approaches to estimating historical mark-ups

2.1 Roeger's (1995) model

Roeger's (1995) model to estimate mark-ups builds upon seminal work by Hall (1988), in turn based on a standard growth accounting exercise.

Hall's method of estimating price mark-ups on marginal costs is a rearrangement of the Solow residual, once the assumption of perfect competition on the product markets is relaxed.

The basic equation in growth accounting exercises is the following:[3]

$$\Delta q = \varepsilon_{Q,L}\Delta l + \varepsilon_{Q,M}\Delta m + \varepsilon_{Q,K}\Delta k + \Delta e \tag{1}$$

where q is the log of gross output, l is the log of labour input, m is the log of intermediate inputs, k is the log of capital input, Δe is technical progress and the parameters $\varepsilon_{Q,f}$ ($f = L$, M, K) represent output elasticities relative to labour, intermediate and capital inputs, respectively. Under the assumptions of perfect competition on both output and input markets, as well as of constant returns to scale, the output elasticities are the input shares of total output. Hall (1988) proved that with imperfect competition on the output market these elasticities are given by the product of input shares and the mark-up, so that Equation (1) can be rewritten as follows (see Appendix I for a derivation):

$$\Delta q = \mu\alpha_L\Delta l + \mu\alpha_M\Delta m + \mu\alpha_K\Delta k + \Delta e \tag{2}$$

where α_f are the input shares of output ($f = L$, M, K) and the mark-up μ is defined as the ratio of the output price over the marginal cost.

Assuming constant returns to scale, Equation (2) can be rearranged to obtain:

$$\Delta q = \mu\alpha_L\Delta l + \mu\alpha_M\Delta m + \mu(1 - \alpha_N - \alpha_M)\Delta k + \Delta e \tag{3}$$

and defining $B = 1 - \frac{1}{\mu}$, it follows that:

$$\Delta q - \alpha_L\Delta l - \alpha_M\Delta m - (1 - \alpha_L - \alpha_M)\Delta k = B(\Delta q - \Delta k) + (1 - B)\Delta e \tag{4}$$

which on the right hand side gives a decomposition of the standard Solow residual shown on the left hand side. Hall (1998) therefore shows that under imperfect competition in the product market, the Solow residual is not solely a measure of technological change, but a weighted sum of technological change and the growth rate of the capital-output ratio, where the weights are a function of the mark-up. If the mark-up were equal to 1 (i.e. perfect competition), then the Solow residual would be equal to the technological change (since B would be equal to 0). Equation 4 can be estimated in order to obtain an estimate of B and therefore of μ. However, given that the efficiency term $(1 - B)\Delta e$ is not observed, instrumental variables are required to obtain consistent estimates.

[3] Time subscripts are dropped for simplicity.

By combining primal and dual accounting methods, Roeger (1995) devised a way to cancel out the unobservable efficiency term and therefore to eliminate the need to resort to instrumental variables. He showed that the following equations holds (again see Appendix I):

$$\begin{aligned}&(\Delta q + \Delta p) - \alpha_L (\Delta l + \Delta w) - \alpha_M (\Delta m + \Delta j) - (1 - \alpha_L - \alpha_M)(\Delta k + \Delta r) \\ &= B[(\Delta q + \Delta p) - (\Delta k + \Delta r)]\end{aligned} \tag{5}$$

where $(\Delta q + \Delta p)$, $(\Delta l + \Delta w)$, $(\Delta m + \Delta j)$ and $(\Delta k + \Delta r)$ represent, respectively, the growth rate of nominal output and inputs compensation (p, w, j, r being the logs of output and input prices). The term on the left hand side can be defined as the nominal Solow residual (NSR), which only depends on the changes in the (observable) nominal revenue-capital ratio. In other terms, the NSR is a function of the mark-up and the difference between nominal output growth and nominal capital cost growth.

The appeal of Equation 5 is that it can be estimated via Ordinary Least Squares (OLS), and the mark-up easily derived as $\hat{\mu} = \frac{1}{1-\hat{B}}$. Moreover, once a suitable user cost of capital r is computed, it only includes nominal variables and it is not affected by possible biases in the measurement of input and output deflators[4]. However, aside perfect competition on the output market, the model preserves the remaining restrictive assumptions underlying a growth accounting exercise (constant returns to scale, perfect competition on the input market, full flexibility of inputs). Moreover, the main empirical drawback, as shown in Section 3.2, is that it does not provide a time series of mark-ups, but rather an average measure.

2.2 Crafts and Mills' (2005) methodology

Crafts and Mills (2005) rely on the definition of the mark-up as a function of the inverse demand elasticity, as derived from a standard firm's profit maximization problem:

$$M = \frac{p_Y}{MC} = \frac{1}{(1 + \varepsilon_P Y)} \tag{6}$$

In order to estimate the elasticity ε_P, they regress p_Y on Y:

$$p_{Y,t} = b_0 + b_1 Y_t + u_t \tag{7}$$

As a result,

$$\hat{b}_1 = \frac{\Delta p_Y}{\Delta Y} \tag{8}$$

and ε_P may be derived as a function of the estimated coefficient:

$$\hat{\varepsilon}_{PY} = \frac{\frac{\Delta p_Y}{p_Y}}{\frac{\Delta Y}{Y}} = \hat{b}_1 \frac{Y}{P} \tag{9}$$

Crafts and Mills (2005) estimated Equation 7 for both the United Kingdom and West Germany over the period 1954–1996, using real gross output (Y) and wholesale prices (p_Y) data. In order to correctly identify their model as a demand equation, they employed $\Delta p_{Y,t-1}$, $\Delta p_{Y,t-2}$, ΔY_{t-1} and ΔY_{t-2} as instrumental variables and ran a two-stage least squares (2SLS) procedure.

The advantage of this methodology is that it does not require the restrictive assumptions on which Roeger's (1995) model is based. However, as will later become clear in Section 3.2, it presents numerous empirical issues, which cannot be entirely overcome in the case of the Italian data.

[4] As we shall see, this issue is particularly relevant in the case of long-run data for Italy, in particular in the 1951-81 period.

2.3 Morrison's (1988) model

Morrison (1988) intended to relax the restrictive assumptions underpinning a standard growth accounting exercise. This model, in its version employed by Rossi and Toniolo (1992; 1993; 1996) and by Crafts and Mills (2005), considers a representative firm which maximises profits under non-constant returns to scale and with semi-fixed inputs[5]. The short-term equilibrium of the firm's technology is described by the variable cost function: $c_v = c_v(w, y, k, t)$, where w is the price vector of flexible inputs, y is the output, k is the vector of semi-fixed factors of production, t is the technology. The application of Shephard's lemma to this cost function determines the demand equation for the variable inputs: $x = \frac{\Delta c_v(w,y,k,t)}{\Delta w}$. Assuming a Generalized Leontief variable cost function with two flexible inputs (labour and imports), one quasi-fixed input (private net capital stock) and two exogeneous arguments (private investment; public capital stock), the empirical counterpart to this demand equation is the following system of two equations:

$$\begin{aligned} x_l/Y = {} & \alpha_{ll} + \alpha_{lm}(w_m/w_l)^{0.5} + \beta_{ly}Y^{0.5} + \beta_{lt}t^{0.5} + \beta_{lb}b^{0.5} + \beta_{lx}x^{0.5} + \beta_{lk}(k/Y)^{0.5} + \\ & + \gamma_{yy}Y + \gamma_{tt}t + \gamma_{bb}b + \gamma_{xx}x \\ & + \gamma_{yt}(Yt)^{0.5} + \gamma_{yb}(Yb)^{0.5}\gamma_{yx}(Yx)^{0.5} + \gamma_{tb}(tb)^{0.5} + \gamma_{yk}k^{0.5} + \\ & + \gamma_{tk}(tk/Y)^{0.5} + \gamma_{bk}(bk/Y)^{0.5} + \gamma_{xk}(xk/Y)^{0.5} + \gamma_{kk}(k/Y) \end{aligned} \tag{10}$$

and

$$\begin{aligned} x_m/Y = {} & \alpha_{mm} + \alpha_{ml}(w_l/w_m)^{0.5} + \beta_{my}Y^{0.5} + \beta_{mt}t^{0.5} + \beta_{mb}b^{0.5} + \beta_{mx}x^{0.5} + \beta_{mk}(k/Y)^{0.5} + \\ & + \gamma_{yy}Y + \gamma_{tt}t + \gamma_{xx}x + \gamma_{bb}b + \\ & + \gamma_{yt}(Yt)^{0.5} + \gamma_{yb}(Yb)^{0.5} + \gamma_{tb}(tb)^{0.5}t\gamma_{tx}(tx)^{0.5} + \gamma_{yk}k^{0.5} + \\ & + \gamma_{tk}(tk/Y)^{0.5} + \gamma_{bk}(bk/Y)^{0.5}\gamma_{xk}(xk/Y)^{0.5} + \gamma_{kk}(k/Y) \end{aligned} \tag{11}$$

where x_l is the labour input, x_m represents imports, Y is the total supply defined as the sum of the total economy value added at factor costs and of imports, b is investment in private capital stock k, x is the stock of public infrastructure capital and t is technology, proxied by a linear trend in Crafts and Mills (2005).

The marginal cost is given by:

$$\begin{aligned} MC = \frac{\Delta C}{\Delta Y} = {} & \{\alpha_{ll}w_l + \alpha_{mm}w_m + (\alpha_{lm} + \alpha_{ml})(w_l w_m)^{0.5} + (\beta_{lt}w_l + \beta_{mt}w_m)t^{0.5} + \\ & + (\beta_{lb}w_l + \beta_{mb}w_m)b^{0.5} + (\beta_{lx}w_l + \beta_{mx}w_m)x^{0.5} + (\beta_{ly}w_l + \beta_{my}w_m)Y^{0.5} + \\ & + (w_l + w_m)[\gamma_{yy}Y + \gamma_{ll}l + \gamma_{bb}b + \gamma_{xx}x + \gamma_{yt}(Yt)^{0.5} + \gamma_{yb}(Yb)^{0.5} + \gamma_{yx}(Yx)^{0.5} + \\ & + \gamma tb(tb)^{0.5} + \gamma tx(tx)^{0.5} + \gamma bx(bx)^{0.5}]\} + \\ & + 0.5Y^{0.5}(\beta_{ly}w_l + \beta_{my}w_m) + (w_l + w_m)[\gamma_{yy}Y + \frac{1}{2}\gamma_{yt}(Yt)^{0.5} + \\ & + \frac{1}{2}\gamma_{yb}(bY)^{0.5} + \frac{1}{2}\gamma_{yb}(bY)^{0.5} + \frac{1}{2}\gamma_{xy}(xY)^{0.5}] + 0.5(\beta_{lx}w_l + \beta_{mx}w_m)(\frac{k}{Y})^{0.5} + \\ & + 0.5(w_l + w_m)[\gamma_{yk}(\frac{k}{Y})^{0.5} + \gamma tk(\frac{k}{Y})^{0.5} + \gamma bk(\frac{bk}{Y})^{0.5} + \gamma xk(\frac{xk}{Y})^{0.5}] + \\ & + 0.5(w_l + w_m)\gamma_{yk}k \end{aligned} \tag{12}$$

[5]Formal derivations of this model may be found in Rossi and Toniolo (1993) and Crafts and Mills (2005), to which we refer.

The mark-up is thereby measured as the ratio of the total supply deflator to the marginal cost computed as in Equation 12.

Whereas this model overcomes the restrictive assumptions retained in Roeger's (1995) approach, similarly to Crafts and Mills (2005) its empirical implementation with Italian data, as shown in the next section, is not straightforward.

3 Our 1861-2011 dataset and total-economy mark-up estimates

3.1 The data

In order to produce estimates of mark-ups in Italy in the long-run according to the three described methods, a large historical dataset is required. Demand and supply-side national account aggregates, both at current and constant prices, are provided in Baffigi (2013) for the period 1861-2011. However, whereas the supply-side estimates are available for eleven sectors, the demand-side ones are available only for the total economy. The absence of a sectorial breakdown for many series therefore hindered us from computing sectorial mark-ups.

With respect to inputs, 1861–2012 capital and labour series, as well as wage and user costs of capital data, are provided in Giordano and Zollino (2015). The labour input series are available for ten sectors of the economy[6]. The current and constant, net and gross, capital stock series, since they are built using Baffigi's (2013) investment data, refer only to the total economy[7].

As well as employing the 150 year-long series, constant price data were also broken down into the original six sub-periods, delimitated by benchmark years, the so-called *piloni*[8], for which specific price deflators exist: 1861-1911; 1911-1938; 1938-1951; 1951-1970; 1970-1992; 1992-2011. These sub-periods also roughly coincide with the different historical phases of Italy's long-run development. Owing to missing and poor quality data for the World War Two years, as well as the highly exceptional circumstances of war periods, the observations referring to the two World Wars were discarded. Crafts and Mills' (2005) method also required a number of additional series, other than national account data, which we describe in the relevant sub-section.

3.2 Our estimation results

Our Roeger estimates. Owing to the absence of long-run series on intermediate inputs and gross production, we had to adapt Equation 5 in the following manner:

$$\begin{aligned}&(\Delta v + \Delta d) - \alpha_L (\Delta l + \Delta w) - (1 - \alpha_N)(\Delta k + \Delta r) \\ &= B[(\Delta v + \Delta d) - (\Delta k + \Delta r)]\end{aligned} \tag{13}$$

where $(\Delta v + \Delta d)$ represents the growth rate of nominal value added v[9].

Our mark-up estimates employing the Roeger approach, run on data net of the housing sector, are presented in Table 1.[10] According to Wald tests, the estimated mark-up proved to be significantly different than 1. However, over the 150 years of Italy's unified history appreciable

[6]The sectors coincide with the supply-side national account ones in Baffigi (2013), with the exception of the housing sector which by definition has no workers.

[7]Sources and methodological details are documented in Giordano and Zollino (2015). The series provided are a revision, extension and refinement of those used in Broadberry, Giordano and Zollino (2011; 2013).

[8]See Baffigi (2013) for details.

[9]Roeger's (1995) original model was also estimated on value added data, which however is known to induce an upward bias in mark-up estimation (see for example Norrbin, 1993; Griffith and Harrison, 2004). This issue will be tackled by us in Section 6.

[10]Nominal output is measured at factor costs, thereby avoiding potential upward biases stemming from the inclusion of production taxes and subsidies (see Oliveira Martins, Scarpetta and Pilat 1996a; Torrini 2016). All details and regression diagnostics of our estimation results, which for the sake of brevity are omitted in the whole of this section, are available upon request.

Table 1: Italy's total economy mark-up estimated via Roeger's (1995) methodology

Years	**Mark-up estimates**
1861–1911	2.06
1861–1897	2.66
1898–1914	1.37
1911–1950	2.06
1920–1938	2.01
1951–1970	2.37
1971–2011	1.82
1971–1992	1.76
1993–2011	2.01

Sources: Our estimates.

variation in the total economy mark-up arises. In particular, in the three decades after the country's political unification, the level of competition was at a historical low; the estimated mark-up was then halved during the so-called Giolitti era, when monopolistic pressures were alleviated in many sectors and when external trade was liberalised (see James and O'Rourke, 2013). Competition weakened once again under the Fascist regime; due to the limited numerosity of the sample, it is not however possible, via the Roeger method, to separate the 1920s, a more liberal phase, from the 1930s, when specific anti-competition industrial policies were introduced[11]. In the two decades following WWII, the estimated mark-up was still very high, whereas it dropped in the most recent 1971–2011 period. However, standing to the results presented in Table 1, competition was stronger in the Seventies and Eighties relative to the past twenty years[12]. Our results for short sub-periods are however strongly conditioned by the small numerosity of the sample, issue which will be overcome for the most recent period by employing sectorially disaggregated data in Section 6.

Our Crafts and Mills estimates. Also in the computation of the Crafts and Mills' (2005) model, some data adjustments were made necessary in order to adapt it to the Italian case. Instead of employing gross output and wholesale prices, we had to rely on the existing data on total value added and its relative price deflator. However, we were able to net out both the housing sector and government services from the total economy in order to focus on the productive private sector[13]. Furthermore, the model specification used for United Kingdom and West Germany by Crafts and Mills (2005), presented in Equation 7, including the listed instrumental variables, turned out to be too parsimonious in the Italian case, since it was not sufficient to identify the equation as a demand function[14].

We therefore modified the specification of Equation 7 to better adapt to the Italian case

[11]See Giordano and Giugliano (2015) which documents how the competition policy shift during the Fascist regime did indeed affect the degree of market power, measured via sectorial concentration indices. See also Giordano, Piga and Trovato (2014) on the same period.

[12]A similar result is found in Griffith and Harrison (2004), who estimate business economy mark-ups over value added in 1980–2002 for a selection of EU countries in an equivalent framework to Roeger's (1995). Their estimate of Italy's mark-up shows an increasing trend as of the early Eighties, peaking in the last years of their sample (the early 2000s). In particular, Italy's business sector mark-up rises from 1.3 to 1.5 in the twenty years considered, proving to be the highest of their 13-country sample over the entire time-span.

[13]The latter refinement was not possible when implementing Roeger's methodology since the available capital stock data taken from Giordano and Zollino (2015) includes the contribution of the government sector.

[14]Under the original Crafts-Mills' specification, our estimated coefficient $\hat{b}_1$ of Equation 7 was in fact positive, even when we replaced Y with domestic demand and p_Y with its corresponding deflator.

over its various phases. In particular, we estimated the following equation (in first differences, due to the non-stationary properties of the original series, issue to which we will later return):

$$\Delta p_{Y,t} = b_0 + b_1 \Delta Y_t + b_2 \Delta e_t + b_3 \Delta c_t + b_4 \Delta M2_t + b_5 \Delta n_t + v_t \tag{14}$$

where e_t is the lire(euro-lire)-UK sterling pound exchange rate; c_t is the price of coal until 1951 and the price of oil thereafter; $M2_t$ is the M2 monetary supply and n_t is the net emigration rate (emigrants net of return migrants on total resident population in Italy).

In particular, we derived the exchange rate series by splicing Ciocca and Ulizzi's (1990) 1861–1979 series, with the *Ufficio Italiano Cambi* series for 1918–1998 and with the official European Central Bank rates for the remaining period. The price of coal was taken from Bardini (1998) for the 1870–1914 period and then spliced with the series in Rey (1991) for the subsequent years. Oil prices as of 1957 are sourced from the International Monetary Fund. The M2 series was also the result of a reconciliation of various series: elaborations on De Mattia (1990)[15] for the 1861–1913 period were spliced with Ufficio ricerche storiche della Banca d'Italia (1996) for 1890–1936, Garofalo and Colonna (1998) for 1936–1965 and Banca d'Italia (2005) for 1948–1998. The net emigration rate is taken from Giffoni and Gomellini (2015).

The choice of our control variables, suggested by economic theory, was strongly conditioned by data availability. Our instrumental variables were also similarly constrained. As well as the four instruments chosen by Crafts and Mills (2005), mentioned in Section 2.2 we also employed ΔX_{t-1}, ΔX_{t-2} and ΔFM_{t-1}, where X is the series of Italy's exports (taken from Baffigi 2013) and FM is the series of UK imports (taken from Feinstein 1972) until 1911 and the series of US imports (taken from US Census Bureau various years) thereafter. In the XIX century the United Kingdom was in fact the leader country in the Western world, until it was overtaken by the United States at the beginning of the following century (Broadberry, Giordano and Zollino 2013).

We implemented Crafts and Mills' (2005) methodology on four sub-periods of Italy's unified history, excluding World War years (i.e. 1861–1914, 1920–1939, 1951–1970 and 1970–2011). Our regressions were estimated via 2SLS. For each sub-period the best model specification was chosen. Only for the most recent years all variables were used; for the previous sub-periods more parsimonious specifications were employed, owing to data availability and to historical reasons[16].

The model allows us to estimate one coefficient $\hat{b_1}$ for each sub-period; the variation of the mark-up time series is therefore derived entirely by the $\frac{Y}{P}$ component of $\varepsilon_{\hat{PY}}$, as defined in Equation 9. Three main issues arise when estimating the inverse demand elasticity on the basis of Italian data. First, our variables of interest are I(1), whereas the data used by Crafts and Mills (2005) are stationary. We dealt with the non-stationary nature of our data by running our regressions on first differences. Secondly, the coefficient $\hat{b_1}$ of our equation is never significant, not even for the most recent years, although correctly signed[17]. Different specifications were attempted, yet the non-significance issue always remained. Finally, for the years 1951–1985 the ratio $\frac{Y}{P}$ computed on Baffigi (2013)'s data is exceptionally high, thereby pushing up the estimated mark-up to unrealistic levels[18]. The twenty-five problematic years have thus been excluded from this analysis.

Table 2 presents sub-period averages of Italy's price-cost margins according to Crafts and Mills (2005) methodology. Overall results point to a low price-cost margin in the decades

[15]We are grateful to Federico Barbiellini Amidei for these elaborations.

[16]For instance, the net migration rate was only available for the last fifteen years of the first sub-period, hence the variable was dropped in this case. Furthermore, as previously mentioned, the definition of the price of energy inputs and of the leader country's imports changed over time.

[17]Unfortunately, Crafts and Mills (2005) do not report regression diagnostics in their paper, so we do not know if they faced a similar problem for Germany and the United Kingdom.

[18]On average the resulting mark-up was around 2.60, which in the Crafts and Mills' (2005) framework is inplausibly high.

Table 2: Italy's total economy mark-up estimated via Crafts and Mills' (2005) methodology

Years	**Mark-up estimates**
1861–1911	1.08
1861–1897	*1.07*
1898–1914	*1.11*
1920–1938	1.27
1985–2011	1.49
1985–1992	*1.58*
1993–2011	*1.45*

Sources: Our estimates.

Table 3: Total economy mark-ups for Italy, the United Kingdom and West Germany

Years	**Italy**	**United Kingdom**	**West Germany**
1980–1989	1.63	1.15	1.06
1990–1996	1.47	1.10	1.07
1974–1996	1.53	1.21	1.07

Note: For Italy the sub-periods considered are: 1985–1989; 1990–1996; 1985–1996.
Sources: Our estimates for Italy; Crafts and Mills (2005) for the U.K. and Germany.

following Italy's unification, with no significant effect of the rise to power of Giovanni Giolitti. Competition weakened during the Fascist era. In particular, in the 1930s the estimated mark-up was significantly higher than that of the 1920s, confirming other recent quantitative research on the period (Giordano and Giugliano 2015). Competition appears to be weak also during the most recent decades, although the estimated mark-up is set on a downward trend, with a strengthening of competitive pressures after 1993.

These mark-up levels are comparable with those referring to the United Kingdom and to West Germany, reported in Crafts and Mills (2005). Table 3 therefore compares the Italian experience to the British and German ones for overlapping years. Italy's mark-up is higher than that measured in the other two economies, yet its reduction from the 1980s to the 1990s is larger than the fall documented in the British case (the German price-cost margin is instead stable over the years considered).

Our Morrison estimates. Finally, we attempted to implement Morrison's (1988) methodology. Unfortunately, new data for public capital, consistent with Baffigi (2013) and Giordano and Zollino (2015), are not available, whereas they were provided by Rossi, Sorgato and Toniolo (1993), the main reference for Italy's historical national accounts until the most recent statistical reconstructions. For consistency reasons, we estimated Equations 10 and 11 on the latter data, which however only cover the period 1911–1990[19]. Another serious issue, present in Rossi, Sorgato and Toniolo (1993) series, and explicitly not tackled by Rossi and Toniolo (1992;

[19]We also dropped the beginning-of-the-sample years, until 1920, as they led to implausibly high mark-ups (and we thank our referee for pointing this out to us). Not all required price data are made available in Rossi, Sorgato and Toniolo (1993). For the missing series we resorted to Giordano and Zollino (2015). We were therefore not able to exactly reproduce the mark-up estimates reported in Rossi and Toniolo (1993), also owing to various semplifications adopted in our model and estimation procedure (e.g. a smaller number of variable inputs; a simpler modelling of technology).

Table 4: Italy's total economy mark-up estimated via Morrison's (1988) methodology

Years	**Mark-up estimates**
1920–1938	2.56
1951–1970	2.73
1971–1990	2.40

Sources: Our estimates.

1993; 1996), is the non-stationary nature of the data. Although the latter problem may be dealt with by taking first differences (as done by us when implementing Crafts and Mills' model), the theoretical implication of deriving Equation 12 in growth rates, ratherthan in levels, is not trivial. As in Rossi and Toniolo, we do not deal with this statistical issue in the implementation of the Morrison method, although we are aware that it could affect our results.

The system of level equations presented in Section 2.3 is therefore estimated as a SUR model via Zellner's iterated FGLS estimator. The advantage of Morrison's (1988) method, relative to the previous two, is that it provides a yearly historical series of mark-ups; averages over sub-periods are provided in Table 4. The estimated mark-ups are quite stable over time, presenting an appreciable reduction only as of the 1970s.

A wrap-up of our estimation results. In order to better appraise comparatively our results, Figure 1 plots the three estimated mark-up series in a single chart[20]. Mark-up levels are very different across methodologies, although the magnitudes are consistent with estimates obtained with similar methods in other studies (Crafts and Mills 2005; Rossi and Toniolo 1992, 1993 and 1996). The developments in the estimated mark-ups are also dissimilar across methods in some sub-periods. To state a relevant example, whereas the Giolitti regime shift stands out as having reduced the degree of market power with Roeger's (1995) methodology, the Crafts and Mills' (2005) approach points to a substantial stability of price-cost margins over the entire first half century of Italy's unified history, thereby not reflecting any impact of the liberalization measures introduced at the beginning of the XX century. It must be recalled however that the estimate obtained employing Crafts and Mills' (2005) method is driven by the broad stability of the inverse demand elasticity in 1861-1914, in turn dependent on the correct measurement of price deflators in those years. As developments in deflators in Italy have resulted problematic also in other sub-periods (for example, in 1951-1985), the mark-up estimates obtained by using Roeger's (1995) approach, also since they signal such a decisive drop, are probably the most reliable for the pre-WWI period, therefore suggesting increased overall competition during the Giolitti era.

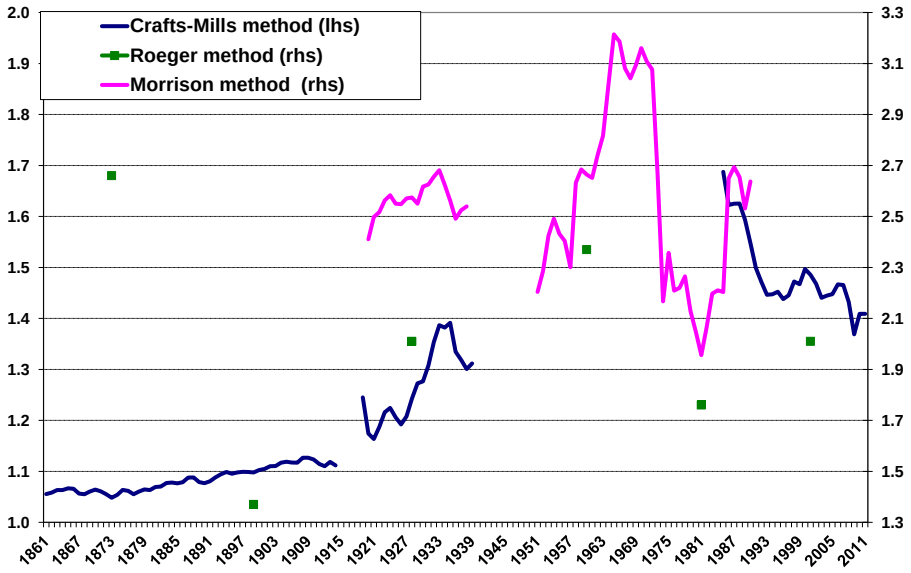
Two key features of Italy's history are instead confirmed by all three models: *a)* market power during the Fascist era increased relative to the pre-WWI period, in particular in the 1930s; and *b)* competition after 1993 was stronger compared with that recorded in the 1951–1970 period[21].

All three methodologies present numerous data and computation-related issues when applied to Italy in the long-run. To sum them up, Roeger's method only provides sub-period average estimates and is affected by the small number of observations. Furthermore, it is here implemented on value added data when gross output series would be required. Crafts and Mills' approach in turn presents numerous econometric issues, and leads to rather implausible results

[20] In the case of Roeger's (1995) methodology an average point estimate is shown, in the middle of the sub-period considered.

[21] The developments of the 1970s and 1980s are instead not clear according to the different approaches used.

Figure 1: Italy's total mark-up estimated via three alternative methods



Sources: Our estimates.

in the 1950–1985 period. Finally, Morrison's methodology, the most data-demanding of the three, can only be implemented on the old version of Italy's historical national accounts (Rossi, Sorgato and Toniolo 1993), which is known to present flaws and only covers the 1920–1990 period. Non-stationarity of the data may also affect results in this last approach.

The current availability of Italy's historical national accounts, although much improved and expanded owing to specific studies undertaken within the Bank of Italy in recent years (Baffigi 2013; Giordano and Zollino 2015), is thus still not sufficient to undertake the task of reliably estimating Italy's total economy mark-up over the whole 150 years of Italy's unified history. The two mentioned key trends, in the inter-war period and in recent years, however stand out and confirm previous findings of the received economic history literature.

Both theoretical and empirical drawbacks of the previous models may be in part overcome by limiting our analysis to the most recent period of Italy's history, for which more data exist and for which a finer industry disaggregation may be achieved, thereby leading to the measurement also of sectorial price-cost margins. This task is set out in the next Sections.

4 An extension of Roeger's (1995) model: including a control for imperfect competition in the labour market

In this section we outline the model we will use in the estimation of total-economy and sectorial mark-ups in Italy in the past 40 years, developed in Bassanetti, Torrini and Zollino (2010), referred to hereafter as BTZ. As recalled in Section 2.1 in the most recent literature two models are usually applied for mark-up estimation: the seminal one developed by Hall (1988) and Roeger (1995)'s model which provides a strategy to eliminate the unobservable technological change term in Hall's equation, that posed serious problems in its empirical implementation. Hall's model has also been extended in another direction, that is to take into account the possibility that firms and workers share rents according to the solution of an efficient bargaining model as in McDonald and Solow (1981), where firms and workers bargain over both wages and labour input (Dobbelaere, 2004; Crepon, Desplatz and Mairesse 2005). The efficient bargaining model has received new attention in the literature on the evolution of factor shares in the 1990s, as a possible explanation for the observed decline in labour shares. In an efficient bargaining model, such a decline can be related, amongst other factors such as increasing globalization, to a drop in the bargaining power of workers, possibly due to institutional changes like the privatisation of companies (Blanchard and Giavazzi 2003; Torrini 2005 and 2010; Azmat, Manning and Van Reenen 2012). When rents are shared according to this bargaining mechanism the standard model for mark-up estimation suffers from misspecification. Without appropriately controlling for rent-sharing, any decline in the share of rents which goes to workers would in fact show up as a rise in the mark-up. We consider this as a potentially large drawback of standard models when they are used to interpret mark-up dynamics over a long time-span, as is the case in this paper.

BTZ extended Roeger's (1995) model to the case of efficiency bargaining, applying the same strategy used by Dobbleaere (2004) and Crepon, Desplatz and Mairesse (2005) to extend Hall's (1988) model. Hall and Roeger's models have been briefly recalled in Section 2.1 and derived in Appendix I. In BTZ it is assumed that firms and workers, while taking the other factors of production as given, choose W and L by solving the standard efficient bargaining problem defined as follows:

$$\max_{W,L} \left(LW + (\overline{L} - L)\,\overline{W} - \overline{LW}\right)^{\phi}(R - WL)^{1-\phi} \tag{15}$$

or

$$\max_{W,L}(LW - L\overline{W})^{\phi}(R - WL)^{1-\phi}$$

where $\overline{W}$ is the reservation wage, $\overline{L}$ is the trade union membership, R is the firm's revenues; ϕ is the union's bargaining power.

The first order condition for L leads to:

$$W = R_L + \phi\frac{R - R_L L}{L} = (1-\phi)R_L + \phi\frac{R}{L} \tag{16}$$

With imperfect competition and assuming an isoelastic demand for output, we can use the following results:

$$P = Q^{-\frac{1}{\eta}}, \qquad R = PQ = Q^{1-\frac{1}{\eta}}, \qquad R_L = (1-\frac{1}{\eta})Q^{-\frac{1}{\eta}}\frac{\partial Q}{\partial L} = \frac{1}{\mu}P(Q)\frac{\partial Q}{\partial L}, \qquad \frac{L}{Q}\frac{\partial Q}{\partial L} = \varepsilon_{Q,L}$$

to rewrite Equation 16 as follows:

$$\mu = \frac{P}{\left(\overline{W}/\frac{\partial Q}{\partial L}\right)} \tag{17}$$

Accordingly, under efficient bargaining the price strategy of firms depends on the reservation wage $\overline{W}$, so that the relevant price-cost margin measuring firms' market power has to be computed with respect to the reservation wage instead of the observed wage W. This correctly measures the overall rent to be shared, which is not affected by changes in the bargaining power of unions.

Since $\frac{L}{Q}\frac{\partial Q}{\partial L} = \varepsilon_{Q,L}$, BTZ obtain:

$$\alpha_L = (1-\phi)\frac{\varepsilon_{Q,L}}{\mu} + \phi \tag{18}$$

Thus with efficient bargaining and assuming constant returns to scale, the whole set of output elasticities with respect to inputs becomes:

$$\begin{cases} \varepsilon_{Q,L} = \mu\alpha_L + \mu\frac{\phi}{1-\phi}(\alpha_L - 1) \\ \varepsilon_{Q,M} = \mu\alpha_M \\ \varepsilon_{Q,K} = [1 - \mu\alpha_M - \mu\alpha_L - \mu\frac{\phi}{1-\phi}(\alpha_L - 1)] \end{cases} \tag{19}$$

By defining $\gamma = \frac{\phi}{1-\phi}$ and substituting for these output elasticities in Equation 1, Dobbelaere (2004) obtained a modified version of Hall's equation, which encompassed the efficient bargaining hypothesis:

$$\begin{aligned} &\Delta q - \alpha_L\Delta n - \alpha_M\Delta m - (1-\alpha_L-\alpha_M)\Delta k \\ &= B(\Delta q - \Delta k) + \gamma(\alpha_L - 1)(\Delta n - \Delta k) + (1-B)\Delta e \end{aligned} \tag{20}$$

where an extra term $\gamma(\alpha_L - 1)(\Delta n - \Delta k)$ shows up relative to Equation 4. Omitting this additional term would lead to biased etimates of both B and the mark-up μ.

Following the same approach (see Appendix 1 for the derivation), BTZ modified Roeger's (1995) model to obtain:

$$\begin{aligned} &(\Delta q + \Delta p) - \alpha_L(\Delta n + \Delta w) - \alpha_M(\Delta m + \Delta j) - (1-\alpha_L-\alpha_M)(\Delta k + \Delta r) \\ &= B[(\Delta q + \Delta p) - (\Delta k + \Delta r)] + \gamma(\alpha_L - 1)[(\Delta l + \Delta w) - (\Delta k + \Delta r)] \end{aligned} \tag{21}$$

While controlling for the extra term $\gamma(\alpha_L - 1)(\Delta l - \Delta k)$, this equation can be estimated via OLS, benefiting from the advantages of the original Roeger (1995) approach.

More specifically BTZ's empirical model is given by:

$$NSR_{i,t} = \beta_0 + \beta_1 XMARK_{i,t} + \beta_2 VBARG_{i,t} + u_{i,t} \tag{22}$$

where, by dropping subscripts: $NSR = [(\Delta q + \Delta p) - \alpha_L(\Delta l + \Delta w) - \alpha_M(\Delta m + \Delta j) - (1 - \alpha_N - \alpha_M)(\Delta k + \Delta r)]$ is the nominal Solow residual; $XMARK = [(\Delta q + \Delta p) - (\Delta k + \Delta r)]$ is the nominal change of output to capital ratio, whose coefficient is linked to the mark-up through the equation $\mu = 1/(1 - \beta_1)$; $VBARG = (\alpha_L - 1)[(\Delta l + \Delta w) - (\Delta k + \Delta r)]$ is the weighted nominal change in labour to capital ratio and its coefficient gives provides us with the bargaining power of unions through $\phi = \beta_2/(1 + \beta_2)$.

In the next sections we estimated Equation 22 to obtain more robust total-economy and sectorial mark-ups for Italy since 1970.

5 Our 1970-2012 sectorial dataset

We estimated Italy's mark-ups by uniforming and splicing official Istat national account data, available for the years 1995-2012, with the November 2009 release of EU KLEMS Growth and Productivity Accounts, which provides annual statistics at industry level on hours worked, net capital stock, intermediate inputs and gross production for Italy for the 1970–2007 period. Our dataset is therefore an extended and updated version of accounts with respect to those employed in BTZ, in turn based solely on the March 2008 EU KLEMS release, that contained series until 2005[22]. Among the main revisions, the capital stocks prove regularly higher across sectors in our dataset relative to that underpinning BTZ. Our dataset covers 26 sectors of the total economy (against 15 in BTZ), considered as part of industry aggregations. In particular, we focused on manufacturing and total industry, as well as regulated services (transport and storage; post and telecommunications; financial intermediation), in which monopolies, quasi-monopolies and network effects could be largely at play, and private unregulated services. Measuring competition in services, as well as the more traditional industrial sectors, is relevant to the extent that high market power in upstream service activities can affect economic performance also in downstream industrial sectors (see Barone and Cingano 2011).

As in BTZ , the user cost of capital, which is the main statistical requirement of Roeger's (1995) framework, was estimated by multiplying the gross fixed capital formation price index by the rental rate of capital, in turn derived as the sum of the long-term real interest rate and the depreciation rate, net of the expected capital gains. In particular, the depreciation rate at time t is gauged as the contemporanous ratio of the consumption of fixed capital to the net capital stock at time t-1[23]; the expected capital gains are computed as a moving average of three terms of the gross fixed capital formation deflator growth rate.

The shares of labour and intermediate inputs on gross production were calculated as $\alpha'_L = WL/PQ$ and $\alpha'_M = JM/PQ$. Since we assume constant returns to scale, the capital share was obtained as $\alpha'_K = (1 - \alpha'_L - \alpha'_M)$.

Table 5 provides an overview of the industry-specific factor shares in relevant sub-periods. All sectors marked a decline in labour shares until 2007 that was counterbalanced by an increase in the share of intermediate inputs with a clear acceleration as of the Nineties; capital shares contracted only mildly. The literature has suggested various, complementary reasons underlying these trends, amongst which increasing globalization and the decline in workers' bargaining power, also due to privatization programmes, which was particularly intense in regulated services (Blanchard and Giavazzi 2003; Torrini 2005 and 2010; Azmat, Manning and Van Reenen 2012).

[22] Owing to the fact that they conducted an international comparison, BTZ's analysis was furthermore restricted to the 1982–2005 period. We therefore gained 18 years relative to their paper.

[23] In this manner, we overcame the restrictive assumption of arbitrarily fixing the depreciation rate across industries and over time, as done in Oliveira Martins, Scarpetta and Pilat (1996b) and Griffith and Harrison (2004), respectively at 5 and 8 per cent.

Table 5: Factor shares on industry gross production (percentage shares on current-price series)

Industries	**Labour**					**Capital**					**Intermediate inputs**				
	1970-1985	*1986-1992*	*1993-2000*	*2001-2007*	*2008-2012*	*1970-1985*	*1986-1992*	*1993-2000*	*2001-2007*	*2008-2012*	*1970-1985*	*1986-1992*	*1993-2000*	*2001-2007*	*2008-2012*
1. Agriculture, hunting, forestry and fishing	38.4	43.1	36.1	32.2	31.2	19.3	17.0	27.4	30.1	26.5	42.3	39.8	36.5	37.7	42.3
2. Mining and quarrying	15.4	14.7	12.2	12.6	13.8	64.0	57.2	55.1	44.8	41.7	20.6	28.1	32.7	42.6	44.5
3. Food, beverages and tobacco	9.4	12.0	12.5	11.9	12.4	8.9	10.9	9.3	8.6	6.9	81.8	77.1	78.2	79.5	80.7
4. Textiles, leather and footwear	30.0	24.2	20.4	18.7	19.3	9.3	12.5	11.4	9.4	7.8	60.7	63.3	68.1	71.9	72.9
5. Wood and cork;															
Pulp, paper, printing and publishing	26.5	23.1	21.1	19.7	21.4	13.5	15.2	13.1	11.0	7.8	60.1	61.7	65.8	69.3	70.9
6. Coke, refined petroleum and nuclear fuel	3.0	4.8	4.6	3.2	2.4	2.5	11.9	12.5	4.7	1.8	94.5	83.3	82.9	92.1	95.8
7. Chemicals and chemical products	20.8	17.2	15.3	13.9	13.3	13.6	15.6	15.1	12.1	10.2	65.6	67.2	69.6	74.0	76.4
8. Rubber and plastics	26.3	21.6	18.7	17.7	18.4	12.1	12.1	12.3	8.5	7.0	61.6	66.3	68.9	73.9	74.6
9. Other non-metallic minerals;															
Basic metals and fabricated metal	24.6	23.2	21.1	19.0	19.2	14.3	11.5	11.0	9.1	6.8	61.1	65.4	67.9	71.9	73.9
10. Machinery, nec	22.9	21.1	19.0	18.1	19.6	16.6	12.7	11.0	9.4	8.9	60.6	66.2	70.0	72.5	71.5
11. Electrical and optical equipment	24.4	21.1	18.9	17.7	19.1	19.4	15.6	11.1	10.4	10.4	56.3	63.4	70.0	71.9	70.5
12. Transport equipment	28.1	24.0	20.2	15.6	15.3	16.5	13.9	11.5	9.7	7.8	55.4	62.0	68.4	74.8	76.9
13. Manufacturing nec	28.2	27.0	25.0	23.9	26.1	15.5	13.3	12.1	9.3	7.7	56.3	59.7	63.0	66.8	66.2
14. Electricity, gas and water supply	21.3	23.0	16.8	12.0	10.4	4.4	22.4	22.4	19.8	19.1	74.3	54.6	60.8	68.2	70.6
15. Construction	20.3	19.5	20.4	20.7	23.7	16.9	12.1	9.9	9.8	8.0	62.9	68.4	69.7	69.5	68.4
16. Wholesale trade and commission trade;															
Retail trade; repair of household goods;															
Sale, maintenance and repair of motor vehicles	42.2	39.1	33.3	33.4	36.3	19.9	23.8	24.4	18.2	13.5	37.8	37.1	42.3	48.3	50.2
17. Hotels and restaurants	56.4	42.9	34.6	34.7	35.9	7.3	14.8	20.9	19.3	16.7	36.4	42.2	44.5	46.1	47.4
18. Transport and storage	43.3	36.5	30.2	23.9	24.2	9.2	14.1	17.4	19.1	19.4	47.5	49.4	52.5	57.0	56.4
19. Post and telecommunications	42.5	34.1	26.4	23.4	24.9	23.7	28.0	24.4	24.7	23.0	33.9	37.9	49.2	51.9	52.1
20. Financial intermediation	54.2	58.8	47.8	34.9	34.1	30.7	17.8	16.0	22.3	22.3	15.0	23.4	36.2	42.7	43.6
21. Real estate	2.3	3.3	2.9	2.9	2.8	84.8	84.7	85.7	84.1	84.4	12.8	12.0	11.4	13.0	12.8
22. Professional, scientific and technical services	20.2	28.6	27.4	28.2	33.1	35.8	27.9	27.2	23.6	19.1	44.0	43.5	45.4	48.2	47.8
23 Public administration and defence	58.5	53.8	53.0	52.9	53.6	18.1	17.0	18.6	19.8	21.6	23.4	29.3	28.4	27.3	24.8
24. Education	79.2	78.3	82.4	82.0	82.9	9.4	9.1	4.5	3.5	2.2	11.4	12.6	13.1	14.6	14.8
25. Health	49.1	53.0	53.9	51.6	48.6	11.4	9.6	10.2	10.3	10.6	39.5	37.4	36.0	38.1	40.8
26 Other community, social and personal services	57.3	51.3	41.3	40.6	42.7	10.5	15.3	20.6	17.5	16.2	32.2	33.5	38.1	41.9	41.1
3-13 Manufacturing	21.3	20.4	18.5	16.8	17.0	12.5	12.9	11.5	9.4	7.6	66.2	66.7	70.0	73.8	75.4
2-15 Total Industry	21.0	20.3	18.6	17.1	17.6	13.5	13.6	12.4	10.5	9.0	65.5	66.1	69.0	72.3	73.4
18-20 Private regulated services	46.1	41.6	33.8	26.8	27.3	19.8	19.4	19.2	21.8	21.4	34.1	39.0	47.1	51.4	51.3
16-17 +21-22+26 Private unregulated services	37.8	37.0	32.0	32.1	35.7	23.0	22.2	24.5	21.5	18.0	39.3	40.8	43.6	46.5	46.3

Sources: Our calculations on Istat and EU-KLEMS data.

In more recent years (2008-2012) the further increase in the weight of intermiedate inputs in industry was offset by the fall in the capital share. In all sectors, but in particular in private unregulated services, the labour share increased. This trend reversal in the labour share has recently been discussed by Torrini (2016), who points to the role of a compression in mark-ups, accompanied by a decline in the rate of return on capital, and the difficulty for Italian firms to be rewarded for their product quality upgrading, in turn both due to rising competitive pressures.

6 Our total-economy and sectorial mark-up estimates for the period 1970–2012

We estimated Equations 5 (Roeger's model) and 22 (BTZ's model) both via pooled OLS and via a fixed-effects model. First we concentrated on the total dataset, then we looked at the evidence for the main industries[24]. We also split the time horizon into two periods (1970–1992 and 1993–2012), which allows to test for variation in the mark-ups after the completion of the EU Single Market. Time dummies are always considered, as well as a constant. Standard errors are heteroskedasticity and autocorrelation consistent (HAC)[25]. Pooled OLS results are presented in Table 6[26].

First, we find that the standard Roeger model (left hand side columns for each sub-period in Table 6) leads to different results compared with the historical mark-up estimates presented in Table 1 in Section 3.2, obtained using the same method. This is due to various reasons. First, by exploiting the variation across sectorial data,we increase the efficiency of estimation due to the large gain in degrees of freedom. Secondly, in this section we use sectorial capital user costs rather than the total-economy user cost computed by Giordano and Zollino (2015). Thirdly, here we measure output based on gross production rather than on value added, as we need to jointly identify the mark-ups appropriated by both firms and workers: the latter data are known to lead to an over-estimation of mark-ups. Given the increasing share of intermediate inputs over time, as reported in Table 6, the upward bias in Section 3.2's estimates is larger in the most recent sub-periods. In particular, we here find that mark-ups measured as in Roeger (1995) prove lower than those computed in Section 3.2 and with a declining trend since the early Nineties (Table 6). Accordingly, the completion of the Single Market in Italy spurred an increase, not a decrease, in competitive pressures as found with aggregate data. This result is in line with evidence found by us in Section 3.2, using Crafts and Mills' (2005) approach.

As in BTZ, adding the control for the results of rent bargaining in the labour market significantly raises the estimated size of the full mark-up, namely the spread between market output prices and marginal costs of production (right hand side columns for each sub-period in Table 6). The rents appropriated by workers are controlled by the structural parameter ϕ, while those going to the firms are proxied by the difference between the joint estimates of μ and ϕ.[27] Interestingly, the decline in the full mark-up since the completion of the Single Market was driven by a reduction in rents appropriated by both firms and workers, but for the latter the loss was almost double in magnitude (from 0.25 percentage points to 0.10). It is noteworthy that after the inception of the European Monetary Union the fall in the mark-up slightly intensified,

[24] A clear advantage of Roeger's method and its extensions in estimating sectorial mark-ups is that, as it requires solely nominal variables, mark-ups for services are reliable, notwithstanding the poor statistical information on prices.

[25] Together with the inclusion of a constant, Hylleberg and Jorgensen (1998) suggest that HAC standard errors correct for some of the endogeneity owing to the fact that the mark-up computed in Roeger's (1995) framework is unlikely to be time-invariant and has the form of a constant and some i.i.d. noise.

[26] For the sake of brevity, fixed-effect results are not reproduced here, also because they are very similar to the OLS estimates. The former are available upon request.

[27] Ideally this difference should be equal to the single estimate of the mark-up on the product market, but some discrepancy may occur empirically.

Table 6. OLS estimates of structural parameters - Total dataset

Dependent variable: nominal Solow residual								
	1970-2012		1970-1992		1993-2012		1998-2012	
Estimated regressor coefficients								
X	0.25	0.35	0.27	0.39	0.21	0.27	0.19	0.25
	0.02	0.04	0.02	0.06	0.01	0.04	0.02	0.05
V		0.16		0.20		0.09		0.10
		0.06		0.08		0.05		0.06
Estimated structural parameters								
μ	1.34	1.53	1.37	1.64	1.27	1.37	1.23	1.33
Φ		0.20		0.25		0.10		0.10
Diagnostics								
R-sq.	0.62	0.64	0.62	0.64	0.63	0.65	0,57	0.59
F-stat.	11.93	14.62	10.21	11.75	11.38	24.40	12,25	21.60
Prob>F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
No. Obs.	757	757	377	377	380	380	266	266

Sources: Our estimates.

Notes: Standard errors in small print.

entirely due to the smaller rent obtained by firms.

Looking at the evidence for the main industries (Table 7), we find that in the whole period the full mark-ups (here considered only before the rent redistribution that would take place in the oligopolistic labour markets, so according to the BCZ model) are significantly higher in the regulated services than in manufacturing, where there are virtually similar to those in the other market services. The gap was dramatic in the Seventies and Eighties, but since the early Nineties the regulated services marked a swift gain in terms of competitive pressures, with the respective measure of mark-up remaining significantly higher compared to manufacturing but proving just higher than in the other market services, that on the contrary show some loss in competition (mostly due to business services). An important remark is that the declining trends of mark-ups in the regulated services correspond to a pronounced change in the pattern of rent distribution between workers and the property of firms, that was mostly public at the beginning and turned gradually private following the liberalization process started in the early Nineties. Impressively, despite the swift reduction in the spread between market output prices and marginal production costs, firms managed to obtain a drop in the bargaining power of workers (that was particularly high in previous years) and to record a strong increase in their margins on the actual labour costs, to the highest level compared with the other main groupings of industries. In other terms firms seemed to have maintained substantial market power and the result of privatizations has thereby been a reallocation of rents from wages to profits instead of a drastic increase in competition in the goods market[28].

Indeed the evidence based on the scarce long-run sectorial data available on the strength of trade unions in Italy points to a marked fall after 1993 in the financial intermediation and transport sectors, against slight increases in the trade, hotels and restaurants' branches, which would confirm our results (Figure 2).

Various caveats refer to the results provided in Tables 6 and 7. The soundness of our estimates depends on the accuracy of measurement of output and inputs, even if by working with current price variables we get rid of the potential pitfalls in deflators. However the measurement of the capital stock as well as the user costs remain controversial. Christopoulou and Vermeulen (2008) show that if capital costs are measured with error, mark-up estimates are upward biased; the bias is more severe the higher the capital shares. In addition, simultaneity bias may also affect our estimates. In order to moderate these problems, we plan to replicate our analysis by adopting a Generalised Method of Moments procedure. In the third place, our analysis in the current and previous sections hinges upon the assumption of constant returns to scale. Under returns to scale λ the coefficient B becomes $1 - \frac{\lambda}{\mu}$ (Oliveira Martins, Scarpetta and Pilat 2006b); therefore, it is not possible to disentangle the mark-up from returns to scale. Increasing returns to scale would bias our mark-up estimate downwards, wherease the opposite holds true in the case of decreasing returns. The presence of sunk costs, downward rigidities of the capital stock and labour hoarding are also likely to generate a downard bias on our mark-up estimates. Ideally total capital stock should also be netted of its sunk component, leading to a lower marginal cost and a higher mark-up. Similarly, when labour and capital do not adjust istantaneously downwards, the marginal costs would be higher than in the case of full flexibility of inputs, dampening mark-ups. As effectively summed up by Oliveira Martins, Scarpetta and Pilat (2006b), our estimates are likely to represent a lower bound for sectors operating under increasing returns to scale, large sunk costs or strong downward rigidities over the business cycle.

[28]Torrini (2005) suggests that the privatizations in these sectors brought about a change in the structure of bargaining, i.e. a shift from an efficiency bargaining framework, where firms and workers bargain over both wages and employment (MacDonald and Solow 1981), to a right to manage framework, where only wages are negotiated and firms retain the right to set the employment level unilaterally (Nickell and Andrews 1983). Dobbelare and Mairesse (2008) prove that in the latter framework the mark-up of price over marginal cost is consistent with the assumption that the labour market is perfectly competitive.

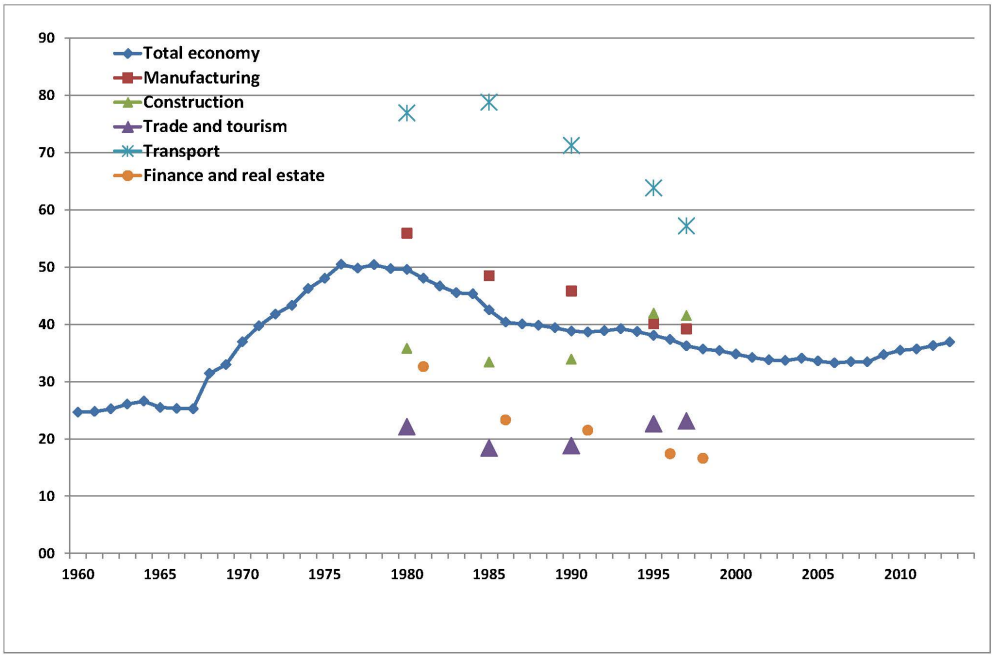
Table 7. OLS estimates of structural parameters - Main industries

	Industry			Manifacturing			Regulated services			Other market services (*)		
	1970-2012	1970-1992	1993-2012	1970-2012	1970-1992	1993-2012	1970-2012	1970-1992	1993-2012	1970-2012	1970-1992	1993-2012
Dependent variable: nominal Solow residual												
Estimated regressor coefficients												
X	0.32	0.22	0.40	0.22	0.28	0.15	0.72	0.81	0.39	0.40	0.48	0.34
	0.06	0.05	0.10	0.02	0.03	0.01	0.07	0.08	0.08	0.05	0.07	0.05
V	0.14	0.06	0.21	0.10	0.15	0.06	0.75	0.94	0.20	0.43	0.58	0.30
	0.07	0.04	0.10	0.01	0.03	0.02	0.10	0.09	0.09	0.07	0.11	0.10
Estimated structural parameters												
μ	1.47	1.29	1.66	1.28	1.39	1.18	3.60	5.26	1.64	1.67	1.92	1.52
Φ	0.16	0.07	0.27	0.11	0.17	0.06	3.00	15.67	0.25	0.75	1.38	0.42
Diagnostics												
R-sq.	0.67	0.49	0.52	0.69	0.72	0.73	0.77	0.82	0.81	0.66	0.74	0.54
F-stat.	14.09	10.40	23.51	23.43	15.99	100.00	11.70	41.59	26.59	49.69	63.11	13.50
Prob>F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
No. Obs.	440	220	220	328	160	168	120	58	60	82	42	40

Sources: Our estimates.

Notes: Standard errors in small print.

Figure 2: Shares of workers members of trade unions (percentage shares)



Sources: OECD; Ebbinghaus and Visser (2000).

7 Conclusions

This paper aimed at indirectly estimating Italy's mark-ups since 1861. A variety of methodologies was implemented in order to check the soundness of our estimation results. The main contribution to Italy's economic history is the confirmation of a hike in total-economy market power during the Fascist era, with particular reference to the 1930s. Moreover, competition after the implementation of the Single Market in the EU has shown an increase, at least relative to the post-WWII period. The current state of Italy's historical national accounts does not however allow to draw any further robust conclusion on the various stages of Italy's development path since 1861 nor to estimate sectorial mark-up estimate using macroeconomic datas. As a possible validation of the new accounts published in Baffigi (2013) and Giordano and Zollino (2015), this paper therefore suggests the need for further statistical reconstructions in the case of Italy. In particular, both a sectorial breakdown of historical investment and capital stock series and the construction of energy input, intermediate good and gross production data are necessary requirements for a fully-fledged application of the methods employed in this paper. More generally, the mentioned reconstructions are crucial to further delve into the proximate causes of Italy's long-run growth process, an attempt recently tackled by Broadberry, Giordano and Zollino (2013), yet restrained by the absence of sectorial capital input data.

Owing to these binding data limitations for the 150-year period, our paper next concentrated on the analysis of sectorial mark-ups of the Italian economy in the years between 1970 and 2012. Applying a more robust methodology which also allows to relax the assumption of perfect competition in the labour market, we found that the estimated mark-ups of prices over marginal costs are positive and statistically significant across almost all industries, implying that departures from perfect competition in the product and labour markets are the norm. Sec-

ondly, there is considerable variation of mark-ups across industries, further confirming the need to examine sectorial dynamics rather than total-economy results. We find that the completion of the Single Market in the EU channelled more competitive pressure in Italy's economy, in particular in the regulated services activities, where the workers' barganing power has collapsed. Only in the non-regulated market services the mark-up has increased since the early Nineties, mostly due to the fact that the workers' bargaining power, empirically nil in previous years, gained somewhat. This evidence may be however biased by the small number of observations available for the last twenty years in our sample. In addition to a better control for endogeneity and measurement errors a deepening of the sectorial breakdown is on the top of our agenda for future research.

8 Appendix I

Hall's standard model. The basic equation in growth accounting exercises is the following:[29]

$$\Delta q = \varepsilon_{Q,L}\Delta l + \varepsilon_{Q,M}\Delta m + \varepsilon_{Q,K}\Delta k + \Delta e \tag{A.1}$$

where q is the log of gross output, l is the log of labour input, m is the log of intermediate inputs, k is the log of capital input, Δe is technical progress and the parameters $\varepsilon_{Q,f}$ ($f = L,\ M,\ K$) represent output elasticities with respect to labour, intermediate and capital inputs. Under the assumption of perfect competition and constant returns to scale, the output elasticities are equal to the input shares of total output. Under imperfect competition, production input shares are smaller than output elasticities because the monopolist collects rents and factors are therefore remunerated below their productivity. Output elasticities are thus given by the product of input shares and the mark-up term. This can be easily seen by expressing the marginal cost in the following way:

$$MC = x = \frac{W\Delta L + R\Delta K + J\Delta M}{\Delta Q - \Delta eQ} \tag{A.2}$$

where W, R and J are, respectively, the price of labour, capital and intermediate goods. This can be rearranged in the following way:

$$\frac{\Delta Q}{Q} = \frac{WL}{xQ}\frac{\Delta L}{L} + \frac{JM}{xQ}\frac{\Delta M}{M} + \frac{RK}{xQ}\frac{\Delta K}{K} + \Delta e \tag{A.3}$$

by log-approximation:

$$\Delta q = \frac{WL}{xQ}\Delta l + \frac{JM}{xQ}\Delta m + \frac{RK}{xQ}\Delta k + \Delta e \tag{A.4}$$

Since the mark up μ is equal to P/MC (that is output price over marginal cost), we obtain:

$$\Delta q = \mu\alpha_L\Delta l + \mu\alpha_M\Delta m + \mu\alpha_K\Delta k + \Delta e \tag{A.5}$$

where α_f are the input shares of output ($f = L,\ M,\ K$).

Assuming constant returns to scale this can be rearranged as follows:

$$\Delta q = \mu\alpha_L\Delta l + \mu\alpha_M\Delta m + (1 - \alpha_N - \alpha_M)\Delta k + \Delta e \tag{A.6}$$

Redefining $B = 1 - \frac{1}{\mu}$, we obtain:

$$\Delta q - \alpha_L\Delta l - \alpha_M\Delta m - (1 - \alpha_L - \alpha_M)\Delta k = B(\Delta q - \Delta k) + (1 - B)\Delta e \tag{A.7}$$

which gives a decomposition (right hand side) of the standard Solow residual (the left hand side).

[29] Time subscripts are dropped for simplicity.

This equation can be estimated to get B and therefore μ. However, given that we do not observe the efficiency term $(1-B)\Delta e$, instrumental variables are required to obtain consistent estimates.

Roeger's standard model. Roeger (1995) combined the primal and the dual solution to the firm's programme in order to derive an expression of the Solow residual which is independent of Δe. From cost minimization, price variation can be expressed as:

$$\Delta p = \varepsilon_{Q,L}\Delta w + \varepsilon_{Q,M}\Delta j + (1-\varepsilon_{Q,L}-\varepsilon_{Q,M})\Delta r - \Delta e \tag{A.8}$$

where $\Delta w, \Delta j, \Delta r$ are, respectively, the Δ log of input prices. This can be written as:

$$\Delta p = \frac{WL}{C}\Delta w + \frac{JM}{C}\Delta j + (1-\frac{WL}{C}-\frac{JM}{C})\Delta r - \Delta e \tag{A.9}$$

where C is the total cost, WL and JM are the cost of labour and intermediate inputs. Cost shares represent both the output elasticities with respect to inputs and the cost and price elasticities with respect to the price of inputs. With perfect competition output shares and cost shares coincide; with imperfect competition cost shares can be expressed as the product of the mark-up and the output shares. For instance:

$$\alpha_L = \frac{WL}{PQ}, \quad P = \frac{1}{1-B}MC \quad \Longrightarrow \quad \frac{WL}{C} = \frac{\alpha_L}{1-B}$$

Equation (A.8) can be written:

$$\Delta p = \frac{\alpha_L}{1-B}\Delta w + \frac{\alpha_M}{1-B}\Delta j + (1-\frac{\alpha_L}{1-B}-\frac{\alpha_M}{1-B})\Delta r - \Delta e \tag{A.10}$$

Rearranging we obtain:

$$\Delta p - \alpha_L\Delta w - \alpha_M\Delta j - (1-\alpha_L-\alpha_M)\Delta r = B(\Delta p - \Delta r) - (1-B)\Delta e \tag{A.11}$$

This can be used to substitute for $(1-B)\Delta e$ in equation (7) to get:

$$[\Delta q - \alpha_L\Delta l - \alpha_M\Delta m - (1-\alpha_L-\alpha_M)\Delta k] + [\Delta p - \alpha_N\Delta w - \alpha_M\Delta j - (1-\alpha_N-\alpha_M)\Delta r] \tag{A.12}$$
$$= B[(\Delta q - \Delta k) + (\Delta p - \Delta r)]$$

This equation, conversely to Hall's one, can be estimated through OLS, with the possibility of expressing all the variables in nominal terms, once a suitable user cost of capital is computed; in fact, rearranging:

$$\begin{aligned}&(\Delta q + \Delta p) - \alpha_L(\Delta l + \Delta w) - \alpha_M(\Delta m + \Delta j) - (1-\alpha_L-\alpha_M)(\Delta k + \Delta r) \\ &= B[(\Delta q + \Delta p) - (\Delta k + \Delta r)]\end{aligned} \tag{A.13}$$

where $(\Delta q + \Delta p)$, $(\Delta l + \Delta w)$, $(\Delta m + \Delta j)$ and $(\Delta k + \Delta r)$ represent, respectively, the growth rate of nominal output and of nominal inputs compensation.

Hall and Roeger' models with efficient bargaining. As shown in the main text, by assuming that firms and workers take other factors of production as given and choose W and L by solving a standard efficient bargaining problem, the elasticities of output with respect to inputs become (under the hypothesis of constant returns to scale):

$$\begin{cases} \varepsilon_{Q,L} = \mu\alpha_L + \mu\frac{\phi}{1-\phi}(\alpha_L - 1) \\ \varepsilon_{Q,M} = \mu\alpha_M \\ \varepsilon_{Q,K} = [1 - \mu\alpha_M - \mu\alpha_L - \mu\frac{\phi}{1-\phi}(\alpha_L - 1)] \end{cases} \tag{A.16}$$

Defining $\gamma = \frac{\phi}{1-\phi}$ and using (A.16) to substitute for output elasticities in equation (A.1), we get the modified version of Hall's equation adopted by Dobbelaere (2004), Crepon, Desplatz and Mairesse (2005) and Abraham, Konings and Vanormelingen (2009):

$$\begin{aligned} &\Delta q - \alpha_L \Delta l - \alpha_M \Delta m - (1 - \alpha_L - \alpha_M)\Delta k \\ &= B(\Delta q - \Delta k) + \gamma(\alpha_L - 1)(\Delta n - \Delta k) + (1 - B)\Delta e \end{aligned} \tag{A.17}$$

In order to get a correspondingly modified Roeger model, we can now substitute (A.16) in equation (A.8), obtaining a new version of equation (A.11):

$$\begin{aligned} &\Delta p - \alpha_L \Delta w - \alpha_M \Delta j - (1 - \alpha_L - \alpha_M)\Delta r \\ &= B(\Delta p - \Delta r) + \gamma(\alpha_L - 1)(\Delta w - \Delta r) - (1 - B)\Delta e \end{aligned} \tag{A.18}$$

Finally, combining equations (A.17) and (A.18) we obtain the modified version of the Roeger's equation:

$$\begin{aligned} &[\Delta q - \alpha_L \Delta l - \alpha_M \Delta m - (1 - \alpha_L - \alpha_M)\Delta k] + [\Delta p - \alpha_L \Delta w - \alpha_M \Delta j - (1 - \alpha_L - \alpha_M)\Delta r] \\ &= B[(\Delta q - \Delta k) + (\Delta p - \Delta r)] + \gamma(\alpha_L - 1)(\Delta l - \Delta k + \Delta w - \Delta r) \end{aligned} \tag{A.19}$$

Rearranging it can be written as:

$$\begin{aligned} &(\Delta q + \Delta p) - \alpha_L(\Delta l + \Delta w) - \alpha_M(\Delta m + \Delta j) - (1 - \alpha_L - \alpha_M)(\Delta k + \Delta r) \\ &= B[(\Delta q + \Delta p) - (\Delta k + \Delta r)] + \gamma(\alpha_L - 1)[(\Delta l + \Delta w) - (\Delta k + \Delta r)] \end{aligned} \tag{A.20}$$

which is Equation 21 in the main text.

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