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## Subcontracting in the Italian industry.

Labour Division, Firm Growth and the North-South Divide

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## **1. Introduction**

During the last two decades, vertical disintegration in most industries and the globalization of intermediate goods' markets has led to significant changes in the pattern of international division of labour among manufacturing firms. These developments, together with other factors (primarily increased competition from low cost producers and exchange rate constraints precluding the introduction of a single currency) have had huge consequences for the mature industrial systems in European countries, including Italy. The peculiar features of Italian industry, i.e. small average size of firms, specialization in traditional industries, the "industrial district model" characterizing the Centre-North regions, the historical backwardness of firms in the South (the less developed part of Italy), are all characteristics that add to the problems involved and in the second half of the 1990s result in a serious productivity slowdown and significant reductions in export and market shares. This paper deals with the Italian manufacturing industry, with a particular focus on subcontracting firms, i.e. firms mostly supplying intermediate products to order (specific components and services and more complex inputs), which represent a significant portion of Italy's manufacturing sector.

What are the effects of changes in the international division of labour on the performance and growth of subcontracting firms? How can subcontracting firms successfully enter the global value chain? The answers to these questions are far from straightforward. Our working hypothesis is that the reorganization of the division of labour, in the most dynamic suppliers may have induced a change in the "nature of subcontracting": from being captive suppliers, whose activities were conducted in a monopsonistic context, the best subcontracting firms are urged to transform themselves into agents within a trans-national productive network, and enter into complementary rather than subordinate relationships with buyers. For these firms, globalization provides the chance to evolve and progress from being local to becoming global suppliers. However, this evolution cannot be taken for granted. As scholars adhering to the Global Value Chain (henceforth GVC) approach maintain, it is the position and the upgrading (rather than simply the participation) in the

global value chain pursued through innovation that yield higher returns and better growth performance to subcontracting firms. This means that subcontractors involved in only the simplest traditional manufacturing activities remain the most exposed to the increasing global competition.

In this paper we investigate the relationship between the division of labour and firm growth in the Italian manufacturing industry in the second half of the 1990s. The literature on firm growth is large, and dates back at least to Gibrat's law of proportionate growth (MANSFIELD, 1962). The novelty of our approach is its focus on organizational choice as one of the key factors in growth. More specifically, in this paper we: a) try to understand whether and how subcontracting may affect the growth dynamics of firms; b) test whether growth could be due to stronger incentives to innovate for subcontracting firms keen to move up the value chain, which would be consistent with the predictions of the GVC approach; and c) study the joint influence of subcontracting and location on growth by testing whether the growth dynamics of Southern subcontractors in particular are significantly different from those of North and Centre subcontracting firms.

The paper is organized as follows. Section 2 discusses the major determinants of the globalization of the intermediate goods markets, the new pattern of international division of labour among industrial firms, and the difficulties experienced by Italian manufacturing industry firms to adapt to the modified scenario. Section 3 describes the possible interactions between positioning and upgrading along the global value chain and propensity for innovation, and firm growth. This section relies heavily on the suggestions of GVC scholars, according to which the firm's position in the global value chain, its innovative behaviour, and the pattern of governance of the chain it feeds into, are crucial for determining its growth performance. Section 4 focuses on the empirical investigation and is organized in three subsections. The first presents the data and some descriptive statistics. We make use of the Capitalia survey of Italian manufacturing firms (for 1995-1997 and 1998-2000), which provides valuable micro-level data on a stratified sample of about 5,000 firms with at least 11 employees. The second subsection describes the estimation methods, and the third subsection presents the main results. The explanatory variables for growth used in the econometric

investigation include age, size and past growth, variables commonly used in standard econometric investigations of firm growth, and organizational variables, such as subcontracting and product innovation, proposed in the GVC approach. We also include a geographic variable, “localization”, which is particularly relevant for the case of Italy, in order to detect possible differences in the growth of Southern and Centre-Northern firms. Section 5 presents the main conclusions from this investigation.

## **2. The globalization of intermediates’ markets and the (late) involvement of Italian manufacturing industry**

The last two decades witnessed profound changes in the international division of labour among firms, which led to increasingly globalized intermediates markets.<sup>1</sup> Outsourcing and offshoring<sup>2</sup> of (stages of) production activities – mainly by (large) firms headquartered in developed countries – are major features of this evolution, for most industries resulting in global value chains.<sup>3</sup> The reasons for these changes are several and all have been widely investigated. First, the substantial reductions in trade barriers, tariffs and transportation costs favour market integration through a reduction in the costs of temporary exports/imports, thus including developing countries in international production networks as low cost producers of intermediate inputs. Second, the development and diffusion of Information and Communication Technologies (ICT) foster the spread of international outsourcing/subcontracting networks by: a) reducing the coordination costs among the agents in the network and making geographical proximity less of a constraint; and b) making the different tasks and activities that constitute the production process separable in time and space (MILGROM and ROBERTS, 1990; NORDÅS, 2004, 2005). Third, the disintegration of multinational enterprises (MNE) plays a substantial role (GEREFFI *et al.*, 2005), as subcontractors from different countries are increasingly included in these firms international production networks,<sup>4</sup> a process described by SALIOLA and ZANFEI, 2009 as “the changing nature of multinational enterprises”.<sup>5</sup> Although the involvement of independent suppliers differs across sectors and

countries, and is highly dependent on the absorptive capacity of contractors, MNE outsourcing to independent local firms seems to be increasing as shown by a wealth of evidence (e.g. NORDÅS, 2005). The increasing recourse by MNEs to local networks allows to get greater bargaining power against national governments (IETTO-GILLES, 2002), better implementation of just-in-time production procedures (e.g. the automotive industry - STURGEON *et al.*, 2008), and increased competitiveness through outsourcing to low cost suppliers (especially in the case of emerging countries; see HUMPHREY and MEMEDOVIC, 2003). Finally, improvements in the quality of contracting institutions induce producers increasingly to trust inter-firm market relationships (ANTRAS and HELPMAN, 2008) even in the presence of uncertainty, incomplete contracts and potential opportunistic behaviours, while repeated collaborations, reputation and careful “selection of players” help to reduce holdup costs and lock-in. Taken together, these factors make a spatial and functional reorganization of the division of labour even more valuable, increasing the opportunities for larger profits for both outsourcer and contractor.

The globalization of intermediate inputs (and more generally of real and financial) markets, the harsher competitive pressures being exerted by Eastern European and Asian producers (especially China), the exchange rate constraints prior to the introduction of the single European currency, and the development and spread of ICT acted as powerful shocks on Italian manufacturing firms and led to slow downs in productivity and significantly reduced export and market shares in the second half of the 1990s.<sup>6</sup>

The lack of an adequate and prompt response from Italy’s manufacturing sector to the challenges of globalization can be explained by the well known peculiarities of the industry. The historical structure of Italy’s manufacturing sector dominated by small sized firms becomes even more pronounced in the 1970s and 1980s, when a post-Fordist fragmentation of production combined with the rediscovery of the virtues of Marshallian industrial districts in the North-eastern and central parts of Italy (BECATTINI, 1978, 1979),<sup>7</sup> result in district firms becoming the most powerful drivers (MENGHINELLO, 2004) of Italian manufacturing industry performance. The

competitive advantages of this organizational model are founded on: territorially bounded high division of labour among small and medium sized specialized firms; high degree of local economic dominance of a particular industry (local specialization especially in “made in Italy” merchandise and mechanical engineering); low transaction costs based on high levels of trust and cooperation among agents; locally embedded practical and tacit knowledge; pools of specialized labour. The system fosters the development of substantial Marshallian external economies - external to the firm, but internal to the district.

Globalization comes as a major blow to this industrial district economy, and turned many traditional strengths into weaknesses. International, low-cost competition renders specialization in traditional goods no longer sustainable, while the Maastricht constraints inhibit “competitive devaluation” of the Lira, a solution often resorted to in previous decades. With the spread of ICT, codified and transmittable knowledge and information begin to supersede the tacit and informal knowledge in industrial district firms. Small size and poor endowments of human capital make adjustment to the new technological regime difficult for industrial districts’ firms<sup>8</sup>.

Difficulties are even heavier for firms localised in Southern Italy. The South of Italy is characterized by a historical lag of local manufacturing firms in terms of performance, productivity, market penetration and international openness. Several investigations (GIANNOLA and SCALERA, 1998; GUERRIERI and IAMMARINO, 2001) unambiguously confirm the persistence in the mid 1990s of a substantial gap between South and Centre-North of Italy industry. In addition, Southern manufacturing appears to be more vertically integrated because of the higher transaction costs (GIUNTA and SCALERA, 2007) and thus less able to profit from reorganization of the domestic and international division of labour.

Despite these difficulties, and with some delay, a share of Italian manufacturing firms manages to enter the global value chain. Large firms, usually assemblers/buyers located in the downstream sections of supply chains, start reducing their dependence on local suppliers by exploiting lower cost sources abroad and thus crowding out some Italian subcontractors. At the

same time, some small and medium sized firms move from subcontracting to direct sale in final markets or try to progress from local to global suppliers (CAMUFFO *et al.*, 2007). In order to face the mounting commercial pressure from low labour-cost countries and achieve better positions in the international value chain, firms exit districts in search of lower costs and engage in international outsourcing – mainly in Central-Eastern Europe, the Balkans, the Mediterranean basin and South-East Asia. International outsourcing has major consequences for borders of districts, which traditionally were highly impermeable (RULLANI, 1997). Even more important is that exits from districts change the nature of the division of labour among firms, which once was a major source of competitive advantage for industrial district firms. This explains the growing fear (CORÒ and GRANDINETTI, 1999; BRUSCO *et al.*, 1997) that international outsourcing may result in loss of local skills and technological spillovers, leading to the “dissolution” of industrial district external economies.

While general industry statistics do not capture the intensity of this phenomenon, a number of case studies (e.g. TATTARA *et al.*, 2006) and more systematic investigations (COSTA and FERRI, 2007; DAVERI and JONA-LASINIO, 2007; FALZONI and TAJOLI, 2008) provide evidence of the increasing involvement of Italian firms in the global value chain. However, this process involves the Mezzogiorno only marginally.<sup>9</sup> The UNIONCAMERE 2006 report states that in the mid 2000s some 77% of medium sized firms had at least one foreign subcontractor. But, while a fairly large number of firms (over 65% in 2000) in the Northern, Central and Eastern regions of the country make use of subcontractors outside the region and/or abroad, in Southern Italy the subcontracting network is organized mainly on a local basis, with about 2/3 of firms relying on provincial suppliers. From the point of view of subcontractors, this implies that in most cases suppliers located in the Mezzogiorno serve only a few customers in local markets, are in peripheral and weak positions in the value chain, are involved in the least profitable stages of production and have little bargaining power with clients. According to the few studies on this topic (e.g. CAMUFFO *et al.*, 2007), Centre-North firms differ in that they exploit the chances offered by



the international division of labour to reinforce their roles as specialized suppliers, while market globalization provides a strong incentive for their being more open to international markets and more active innovators. Although they may not be leaders, these firms occupy more secure and more lucrative positions in the value chain; they frequently couple subcontracting activity with production for final markets, and perform the roles of both outsourcer and subcontractor, acting as the knot joining the parts of the complex value chain network. In this paper, we investigate (Section 4) whether these kinds of firms still have gaps in their productivity or growth with respect to non-subcontracting firms, or whether their participation and role in the global value chain allow them to record productivity and growth performance that is equal to or even greater than that of other firms.

### **3. Global value chain and firm growth: the role of product innovation**

In a global scenario, as decomposition of the production process increases, commissioning firms abandon or reduce their presence at the core of manufacturing production to focus on more profitable activities (design, engineering, marketing). Consequently, the markets for intermediate goods get thicker, hold-up costs diminish, and suppliers can benefit from more intensive specialization (MCLAREN, 2000). The nature of subcontracting activities evolves, and more qualified and more specialized suppliers of intermediates emerge to serve not a single monopsonist but rather many final firms within a network of complementary relationships. Subcontracting firms are directly involved in more activities designed to offer differentiated, innovative products and services to a wider array of customers and to becoming more autonomous in the global arena. Thus, firms occupying the positions of subcontractors in the global value chain are faced with increasingly complex tasks, including the governance and policy related to their own supply networks.

The theoretical and empirical literature discusses the features and effects of outsourcing and offshoring for firms' productivity at some length<sup>10</sup> (see, e.g., OLSEN, 2006; AMITI and WEI, 2006; GÖRG et al., 2008); however, the other side of the coin, i.e. the impact of being a subcontracting firm on firm performance, has been rather overlooked. A few exceptions are

KIMURA, 2002 and RAZZOLINI and VANNONI, 2008, which deal respectively with Japanese and Italian industrial firms. Kimura concludes that subcontractors' profits are not higher than those of other firms, while Razzolini and Vannoni find that the total factor productivity of subcontractors exporting to foreign markets is lower compared to direct exporters. In both studies, that particular organizational choice seems to be subject to a "subcontracting discount".

In both studies cited above, there is no consideration of the link between the firm's organizational choice (i.e. being a subcontracting firm or selling directly to final markets) and the propensity to innovate, a link that may be crucial for at least two reasons. One originates in the relation between the effects of successful innovation on the firm's rate of growth, which based on MANSFIELD, 1962 seminal contribution, became a very popular and variously tested issue (GEROSKI *et al.*, 1997, DEL MONTE and PAPAGNI, 2003; LOOF and HESHMATT, 2006). The second is related to the firm's participation in the global chain, which provides opportunities for the development of a set of innovative subcontracting firms. This aspect constitutes the main focus of GVC, first proposed by GEREFFI, 1994 and developed in a number of contributions, such as GEREFFI and KORZENIEWICZ, 1994, KAPLINSKY, 2000,<sup>11</sup> HENDERSON *et al.*, 2002 and HUMPHREY and SCHMITZ, 2002.

According to the GVC approach, the positioning of a firm and its upgrading along the global value chain, as well as the pattern of governance of the chain it feeds into,<sup>12</sup> are crucial for determining its growth performance. GEREFFI, 1999 outlines a distinction between two types of production chains: a buyer driven commodity chain - common among labour intensive industries such as textiles and shoes - and a producer driven commodity chain - typical of industries such as automotive, electronics and civil aviation. In both chains, the key players directly carry out only the most innovation-intensive, highest return activities, both upward (design, engineering) and downward (marketing, retail). These activities yield high rents, while the simplest traditional manufacturing activities are the ones most exposed to increasing global competition. This view helps to explain some recent empirical evidence (TATTARA *et al.*, 2006) for Italy, i.e. how the

harsh competition in the textile and footwear sectors that occurred in the 1990s was selective in not negatively affecting the most dynamic small and medium sized subcontractors, but forcing many marginal producers to exit the market.

With regard to growth paths, the GVC identifies four, not mutually exclusive paths of expansion for subcontracting firms:

a) increasing their x-efficiency;

b) strengthening inter-firm connections with partners to build a more consistent and cooperative network than those of rivals;

c) improving the quality of their functions along the chain, or moving to higher quality functions (e.g. from production to design);

d) introducing new products or widening the range of products offered.

While a) and b) seem to be essential requirements for participation in the value chain, but do not warrant *per se* upgrading in the value chain or ensure against the risk of a future decline, strategies c) and d) are key to higher returns and growth. In relation to innovation in particular, GEREFFI, 1999 points out that the motivation for product innovation primarily comes from foreign buyers and global assemblers, the key players in the global value chain, who push subcontracting firms to meet their demands for more value added and more sophisticated products. Along these lines, several empirical studies (e.g. DOLAN and HUMPHREY, 2000; BAIR and GEREFFI, 2001; BAZAN and NAVAS-ALEMAN, 2004; GIULIANI *et al.*, 2005) find that integration in global value chains provides significant stimulus for product innovation - especially for firms most able to meet foreign buyers' and global assemblers' demands.

Regarding the Italian experience, the GVC provides a rationale for the functional upgrading of many subcontracting firms located in the Northern and Central regions of Italy (see, e.g., AMIGHINI and RABELLOTTI, 2003 for the Veneto region, and CORÒ and GRANDINETTI, 1999 for the Marche region), or even to changes in the specialization of some industrial district firms, moving from the production of final consumption commodities to the manufacture of

machinery and equipment employed in those same industries (DE ARCANGELIS and FERRI, 2005). HUMPHREY and SCHMITZ, 2002 would refer to this activity as inter-sectoral upgrading.

The major shortcomings of this fruitful line of analysis are that the results are usually based on case studies and/or anecdotal evidence, rather than on rigorous statistical methods, and reliable data are scarce. The investigation in the next section is intended to overcome some of these problems. Although our data do not allow us to test more broadly the ability of functional or inter-sectoral upgrading to explain subcontracting firms' growth, they do permit us to focus on the role of product innovation as a determinant of their growth in the value chain.

#### **4. The empirical investigation**

The empirical investigation has three main objectives. First, we study the relationship between subcontracting and firm growth (relative increases in sales or employees). Our working hypothesis is that subcontracting firms, when emancipated from their traditional inferior position with respect to the customer, may perform comparably to or even better than other firms. This idea is consistent with the considerations discussed above and with empirical investigations that provide evidence of significant positive relationships between subcontracting and respectively survival rates (MAZZOLA and BRUNI, 2000), rates of return ROE and ROI (INNOCENTI, 2003) or input productivity and returns (GIUNTA and SCALERA, 2007, for Central and Northern Italy firms).<sup>13</sup> Second, we test whether growth by subcontracting firms is based on the ability to innovate and upgrade in the value chain, consistent with the predictions of GVC theory. Third we evaluate possible geographic differences in the relationship between subcontracting and growth.

Alongside these main objectives we test for the relevance of the neutrality result or "Gibrat's law of proportionate growth". According to this law, firm growth rate is stochastic and, therefore, independent of size, uncorrelated to past growth and not linked to other explanatory variables. There is a large theoretical and empirical literature on Gibrat's law, at least since MANSFIELD, 1962. From the theoretical work, the most relevant criticism comes from models of firm learning

inspired by the seminal work of JOVANOVIĆ, 1982, that shows a negative relationship between the rate of firm growth, and age. Other contributions, such as SUTTON, 1997 and HART, 2000, refute the hypothesis of no serial correlation in growth rate by showing the strong persistence of growth. There are several other empirical studies along the same lines. EVANS, 1987a, 1987b for the US, and DUNNE and HUGHES, 1994 and VARIYAM and KRAYBILL, 1992 for the UK, show that there is a clear inverse relationship between growth rate and size and/or age for manufacturing and primary sector and services firms. These results are confirmed substantially by AUDRETSCH *et al.*, 1997, 1999 for Dutch firms operating in different industrial sectors, and wholesale trade, by HARHOFF *et al.*, 1998, who consider a sample of German firms, by MACPHERSON, 1996 for South Africa, and by YASUDA, 2005, who shows the existence of a strong negative correlation between growth rate and age or initial size for a sample of 14,000 Japanese manufacturing firms.

#### **4.1. The data**

Before proceeding to the econometric analysis, we highlight some features of our data and provide a short descriptive analysis of the growth performance for our sample firms. Our investigation is based on a unique dataset made available by the seventh and eighth waves of the Capitalia “Survey on manufacturing firms”, which is carried out every three years.<sup>14</sup> Capitalia collects data on a large number of variables from a stratified representative sample of around 5,000 Italian manufacturing firms with at least 11 employees. The seventh wave, covering the period 1995-1997, has 4,497 observations; the eighth wave (1998-2000 period) consists of 4,680 observations, with 1,299 firms sampled in both waves. The sample includes the whole population of large firms (at least 500 employees), while for the 11 to 499 employees class, the firms included in the sample represent, in terms of employment, about 12% of the population. The detailed questionnaire that is administered to all the firms asks about the values of a large number of organizational, structural and performance variables for the current year and in some cases for the previous one or two years. For

example, there is a question about intensity of subcontracting in the current year in terms of amount of sales to orders divided by overall sales. Also, each firm surveyed provides a 10 year time series for a selected number of balance sheet variables, which do not include additional information about subcontracting. Capitalia does not release information about non-responding firms.

Tables 1 and 2 (A panels) show the firm size distributions for classes of employees and real sales (billion Liras at year 2000 values); the B panels record annual average growth rates for employees and real sales for 1995-1997 and 1998-2000. Both tables provide separate information for:

- a) Centre-North and Mezzogiorno firms;
- b) non-subcontractors (NOSUB, firms producing exclusively for direct sale); weak subcontractors (LOSUB, i.e. up to 50% of total sales are for orders); strong subcontractors (HISUB, i.e. more than 50% of total sales are for orders); and absolute subcontractors (ONSUB, i.e. firms producing only to order);
- c) five size classes (i.e. according to the conventional European standard classification, 11-50, 51-100, 101-250, 251-500 and over 500 employees).

[Table 1 here]

[Table 2 here]

Reflecting the population size distribution of Italian manufacturing firms, our sample includes a large number of small firms. Table 1, panel A shows that over 70% of firms employ up to 50 workers, but only 8.6% have more than 250 employees. In terms of annual sales (Table 2, panel A), 56% of the sample have revenues of less than 10 billions Liras (around €5.16 million) and 88% have revenues of less than 50 billions Liras (€25.8 million). The majority of firms (about 86%) in the sample are in the Central and Northern regions of Italy with medium-large firms (more than 250 employees) making up 9.2% of the sample in the Centre-North and 4.6% in Southern Italy. The smallest firms (less than 50 employees) are more often subcontractors - in 41.4% are exclusive

subcontractors, while 39.2% never do subcontracting work. The corresponding shares for other firms are 24.9% (ONSUB) and 55.5% (NOSUB).

The B panels show that, with one exception, the sampled firms are characterized by positive (and in some cases fairly high) average growth rates. There does not seem to be a clear relationship between growth rates and firm size at this stage. In terms of geographic differences, Centre-North firms show higher growth rates of employees and sales, with the exception of non-subcontractors (NOSUB) and weak subcontractors (LOSUB). Focusing in more detail on the relationship between subcontracting intensity and growth, the evidence is mixed. To assess the statistical significance of differences among groups, we performed ANOVA tests (Table 3) on the differences, which in most cases are statistically significant. In brief, the ONSUB and HISUB groups show the highest growth rates in real sales (but not employees). More interesting is that, in almost all cases, each of the middle groups (LOSUB and HISUB) show higher growth rates of sales and employees than the extreme groups (NOSUB and ONSUB). This raises the possibility of a non-monotonic (i.e. increasing and then decreasing) relationship between growth rate and subcontracting intensity. The rows in Tables 1 and 2 show that this pattern applies to all firm sizes and to the overall group of firms in the Central and Northern regions. The exception is Southern firms where growth rates tend to decrease with subcontracting intensity.<sup>15</sup> This result is confirmed by the econometric analysis; thus, possible interpretations are postponed to section 4.3.

[Table 3 here]

## 4.2. The estimation method

We estimate the following three equations for growth in terms of both real sales and employees.

$$\Delta y_{it} = \alpha + \theta_1 y_{it-1} + \theta_2 \Delta y_{it-1} + \theta_3 AGE_{it} + \gamma_1 SUD_{it} + \gamma_2 SUB_{it} + \beta_1 AVK_{it} + \beta_2 ICT_{it} + \beta_3 INP_{it} + u_{it}, \quad (1)$$

$$\Delta y_{it} = \alpha + \theta_1 y_{it-1} + \theta_2 \Delta y_{it-1} + \theta_3 AGE_{it} + \gamma_1 SUD_{it} + \gamma_2 SUB_{it} + \beta_1 AVK_{it} + \beta_2 ICT_{it} + \beta_3 INP_{it} + \beta_4 IXS_{it} + u_{it} \quad (2)$$

and

$$\Delta y_{it} = \alpha + \theta_1 y_{it-1} + \theta_2 \Delta y_{it-1} + \theta_3 AGE_{it} + \gamma_1 SUD_{it} + \gamma_2 SUB_{it} + \gamma_3 SUB_{it}^2 + \gamma_4 SXS_{it} + \gamma_5 SXS_{it}^2 + \beta_1 AVK_{it} + \beta_2 ICT_{it} + \beta_3 INP_{it} + u_{it} \quad (3)$$

where  $i$  is the firm,  $t=1,2$  the 1998 or 2001 survey,  $y_{it}$  is the log of real sales SAL or the log of the number of employees EMP; AGE is the log of firm age (years); SOU is a dummy taking the value 1 if the firm is localized in the Southern region; SUB is subcontracting intensity; and AVK (the ratio of added value over capital) is a typical indicator of productivity. ICT and INP are two dummies, which we consider proxies for the firm's attitude to innovation; they take the value 1 if during the last three years the firm has respectively carried out ICT investments and introduced product innovation. The exact definition of these variables and the main descriptive statistics are reported in Table 4. Finally,  $\Delta y_{it}$  is the first difference  $y_{it} - y_{it-1}$ . A possible significance of parameter  $\theta_1$  indicates the dependence of growth rates on the initial value  $y_{it-1}$ , while significance of  $\theta_2$  would imply growth persistence. According to Gibrat's law, both these parameters should not be significantly different from zero.

[Table 4 here]

The interaction terms IXS and SXS respectively are the products of INP and SUB and SOU and SUB. IXS is introduced to assess the impact of innovation on the sensitivity of growth to subcontracting intensity. As shown above, within the set of subcontractors, GVC theory distinguishes a group of innovative firms able to upgrade along the value chain and to grow more than other firms. This means that the subcontracting firm should benefit substantially from innovation as it allows achievement of a better position in the value chain. For this reason, the expected sign of the IXS parameter is positive. Specification (2) allows us to make separate evaluations of the marginal effect of innovation on growth for non-subcontractors (the parameter  $\beta_3$ ) and for absolute subcontractors (the sum  $\beta_3 + \beta_4$ ).



The product  $SXS$  and the squared term in equation (3) test the hypotheses that the relationship between subcontracting intensity and firm growth is: a) structurally different for the South and the Centre-North; and b) non-linear. From (3), we can show easily that the marginal effect of subcontracting on growth rate is  $\gamma_2 + 2\gamma_3SUB$  for Centre-North and  $\gamma_2 + \gamma_4 + 2(\gamma_3 + \gamma_5)SUB$  for Mezzogiorno. This means we can test the hypothesis of geographical structural differences in the relationship between subcontracting and growth by checking the statistical significance of  $\gamma_4$  and  $\gamma_5$ , which, in turn, correspond to the differences  $(\gamma_2^S - \gamma_2^{CN})$  and  $(\gamma_3^S - \gamma_3^{CN})$ , where  $S$  and  $CN$  respectively denote the parameters of the regressions on the subsamples relative to Southern and Centre-Northern firms. We can test for non-linearity by considering the statistical significance of  $\gamma_3$  and  $\gamma_5$ . Finally, in equation (3), the marginal effect of localization (i.e. the difference in average growth between South and Centre-North) is equal to  $\gamma_1 + \gamma_4SUB + 2\gamma_5SUB^2$ . Using specification (3), we can run regressions on the whole sample, without the need for separate estimates for the two subsamples.

Concerning the estimation method, our choices are strongly constrained by the nature of available data. In particular, since firms are requested to indicate the value of subcontracting intensity for one year only, our data seem more suited to pool than to panel treatment, for at least two reasons. First, the number of firms sampled in both waves of the survey is just slightly more than 25% of cases, which would make a panel strongly unbalanced with a minor informational advantage with respect to pooled data, or alternatively would exclude many observations (almost all observations of Southern firms). Second, and more important, a panel would not allow (at least in a fixed effects specification) the use of the time invariant dummy variable  $SOU$ , which, in our analysis, is crucial.

The likely endogeneity of the variable  $SUB$  advises to consider GIV estimates since OLS are possibly affected by inconsistency. The unavailability of lagged data on subcontracting introduces the problem of appropriate instruments. We chose some other variables drawn from the

Capitalia survey, i.e. ROI, AVL (the ratio added value/employed) and HUM (an indicator of human capital as measured by the share of workers with a secondary schooling) as instruments. These variables show relatively high correlation coefficients with SUB (not less than 0.40).<sup>16</sup> Also, this set of instruments allows not to reject the hypothesis that over identification constraints hold.

### 4.3. The results

Tables 5 and 6 respectively, present the results of the OLS and GIV estimations of equations (1), (2) and (3), for the growth rates in real sales and employees. Concerning the dependence of growth rates on the initial values of real sales and employed, the econometric investigation shows that in all cases, growth rates are negatively related to the initial value with a significance level not lower than 5%. Theoretical growth rates are considerable for the lowest size (growth rate for employees is higher than 30% for firms with 11 employees), but much lower as firm size increases (17% for 31 employees, 9% for 51 employees and 4% for 100 employees). Estimates of parameter  $\theta_2$  indicate negative statistically significant growth persistence only for employees (not for real sales), which is in line with the literature on Italy (CONTINI and REVELLI, 1989). The overall conclusion is that the results of Tables 5 and 6 support the findings in most of literature on empirical lack of validity for Gibrat's law.

[Table 5 here]

[Table 6 here]

Control variables AGE, AVK, ICT and INP in almost all cases show a relationship with growth rates that is consistent with the theoretical predictions. In particular, the regressions confirm that firm age negatively affects the propensity to grow (but the link is statistically significant only for sales), while capital productivity, attitude to innovation and propensity to invest in ICT in most cases have a positive impact on growth rates. This latter result, although theoretically not surprising, is important since it contradicts many of the findings in the literature (e.g. DEL MONTE and PAPAGNI, 2003; OLIVEIRA and FORTUNATO, 2006).

Moving on to the results that are connected more closely to subcontracting, we notice that in the estimation of equation (1) neither subcontracting intensity nor geographic location have a statistically significant effect on firm growth. In equation (2) the estimated parameters of the control variables are almost unaltered with the exception of age, which loses significance in three out of four cases. More important is that the introduction of the interaction factor IXS between INP and SUB confirms that, on the one hand, innovation is crucial for growth for subcontractors and on the other hand, an increase in subcontracting intensity leads to higher growth in innovating firms. These results are obtained simply by noting that the estimated coefficient of the variable IXS  $\beta_4$  is positive and statistically significant (slightly above 5% for employee growth), while both  $\beta_3$  and  $\gamma_2$  are not significantly different from zero. Estimation of equation (2) shows that it is innovative subcontracting (rather than just subcontracting activity) that is positively related to growth, which is consistent with the view that product innovation and good positioning in the value chain are linked to growth.

In the non-linear specification (3), the effect of subcontracting on growth is definitely greater. In this case, the parameters of the control variables are substantially unaltered but the estimates of the  $\gamma$  parameters become statistically significant. In addition, the results show that there is strong geographic differentiation. The estimation of equation (3) suggests that location in the South negatively affects firms' growth performance. Moreover, the relationship between subcontracting and growth varies over the geographic areas we consider. In the case of Centre-North, the relation shows a reversed U-shape with the highest value around 51% of subcontracting intensity for both employees and real sales. The marginal effect at the average value for subcontracting is always positive, between 0.22 and 0.31 for sales growth (1% increase in subcontracting intensity involves about 0.25% increase in growth of real sales) and between 0.02 and 1.35 for the growth in employees. The theoretical forecast of sales growth varies from -4% for non subcontractors, +18% for firms with a 51% ratio subcontracting/sales, and +3% for absolute subcontractors. For employee growth, the theoretical forecast varies from -9% for non-

subcontractors and absolute subcontractors to +33% for intermediate subcontractors. The reverse U-shaped relation does not hold for the Mezzogiorno, where the impact of subcontracting is always negative at any value for subcontracting. At average subcontracting intensity, the marginal effect is between -0.18 and -0.57 for sales growth and between -0.09 and -0.14 for employee growth. The theoretical forecasts for growth for both sales and employees are between +8% for non-subcontracting firms and +1% for absolute subcontractors.

To summarize, the estimation of equation (3) seems to confirm the indications of equation (2). In the advanced areas of Italy, subcontracting activities do not penalize growth. Conversely, selling a share of output to order does not have a negative effect, but rather is a successful organizational choice and a crucial positive determinant of growth. However, this result does not hold for Southern firms, most likely because the nature of subcontracting in that area is still relatively undeveloped and the firms involved in these activities are less productive.

As a robustness check, we estimated equations (1), (2) and (3) using alternative proxies for firm productivity, return and attitude to innovation. Compared to the results presented in Tables 5 and 6, these changes produce only minor effects on the coefficient estimates while the signs and intensity of the relationships between growth and subcontracting are not significantly affected.

Thus, our econometric investigation allows us to draw the following main conclusions. First, in accordance with most of the literature, Gibrat's law is rejected, as current growth rate does not seem to be independent of variables such as age, initial size and past growth rates. Second, subcontracting intensity turns out to be a determinant of growth when coupled with the propensity to innovate: within the subsample of subcontracting firms, we can confirm that innovative firms grow faster. This finding seems to be consistent with the GVC view on the crucial nexus between product innovation, upgrading along the value chain, and firm growth. Third, the non-linear relationship identified between subcontracting and growth in the Centre-North regions highlights that an organizational mode not fully specialized in either subcontracting activities or direct sales may be optimal. This means that subcontracting cannot be considered a marginal choice for less productive

firms to access the market but rather should be seen as an avenue to growth. Finally, for Southern firms the relationship between subcontracting and growth is peculiarly monotonically decreasing, which hints at the possible different nature of subcontracting in this area which retains traditional traits and therefore is negatively related to growth.

## **5. Concluding remarks**

While a number of studies deal with the causes and effects of outsourcing, much less attention has been paid to subcontracting. This paper focuses on the role of subcontracting for explaining firm growth in Italy, in the second half of the 1990s, in the light of changes in the pattern of international division of labour. Starting from the intuitions of the GVC approach, our analysis emphasizes the incentives provided by positioning and upgrading along the global value chain for subcontracting firms to innovate in the search for higher returns and better growth performance. Unlike most contributions from GVC research, our work is based on an empirical investigation on almost 5,000 Italian manufacturing firms rather than on case studies. The evidence provided supports our working hypothesis about a substantial change in the role and nature of subcontracting, the latter being not necessarily (only) a residual marketing mode but (also) a means to participate successfully in the value chain. Indeed, according to our results, in the globalized market, subcontractors with a strong propensity to innovate come out to be the firms most likely to experience growth.

While the changes that have occurred affect the firms in all advanced countries, the case of Italy has some interesting peculiarities. We have argued that the emergence of firms able to enter global value chains has had detrimental effects in terms of crowding out many Italian suppliers, and the negative effects have been worst for Southern firms. Our findings confirm the deep dualism of the Italian industrial structure and show that Southern subcontractors grow less than other firms and less than Centre-North subcontractors. In the current international pattern of the division of labour, Southern subcontracting firms seem doomed to playing a marginal role and being exposed

increasingly to the risk to becoming losers in the competition with emerging countries. In the absence of effective industrial and regional policies, globalization is thus likely to worsen the divide between the Centre-North and the South of Italy.

<sup>1</sup> Several studies provide evidence of this phenomenon, e.g. OECD, 2007; MARIN, 2006; HAVIK and MCMORROW, 2006. In particular, HAVIK and MCMORROW estimate that between 1992 and 2000 the world average share of intermediate imports in total imports rose by some 4 percentage points, with increases of 6 percentage points for Europe, 3 for USA, 5 for South East Asia and 9 for China. JONES and KIERZKOWSKI, 1990 wrote a seminal piece on the emergence of a new trend in globalization, based on advances in the technologies of transportation and communication and the decomposition of the production process across borders.

<sup>2</sup> There are no clear cut definitions of outsourcing and offshoring (and their relative measures) in the literature; see OECD, 2007. In the present paper, outsourcing and offshoring respectively mean the relocation of activities outside the firm to an independent input supplier (subcontractor) and the relocation of activities to a different country within a structure belonging to the firm or external to the firm.

<sup>3</sup> The value chain is the set of activities involved in the production and sale of commodities. It is global/worldwide when activities are allocated across firms localized in several different countries. For a survey of industrial subcontracting networks, see SACCHETTI and SUGDEN, 2003.

<sup>4</sup> However, a substantial part of international vertical specialization among MNEs also takes place through these firms' intra industry trade in intermediate inputs (BORGA and ZEILE, 2004). See also ANTRAS, 2003 who underlines that capital-intensive intermediate goods tend to be imported within the boundaries of multinational firms, and HANSON *et al.*, 2003 who document equally impressive growth in trade within multinational firms.

<sup>5</sup> Worthwhile to mention here is the eclectic paradigm of international production by DUNNING, 1993. For a more recent appraisal of the OLI (Ownership, Location, International Advantage) theory in the light of the changing characteristics of MNE activity and of the global economic scenario, see DUNNING, 2001. The impact of multinational firms' investments on local subcontracting networks is documented, e.g. by DRIES and SWINNEN, 2004.

<sup>6</sup> From 1994 to 2005, annual labour productivity growth was 0.5% on average. In the same period, the share of Italy in total world exports decreased from 4.5% to 2.9%; see ROSSI, 2006.

<sup>7</sup> A comprehensive analysis of industrial districts is provided by BECATTINI *et al.*, 2009. On the geography of Italian industrial districts, see SFORZI, 2002.

<sup>8</sup> Several authors argue that the gains in productivity associated with ICT investment are conditional on micro-complementarities among ICT adoption, internal reorganization processes and high levels of human capital (see BRYNJOLFSSON and HITT, 2000; BRESNAHAN *et al.*, 2002; FALK, 2002; HUR *et al.*, 2005 and, with specific reference to Italy, TRENTO and WARGLIEN, 2003, BUGAMELLI and PAGANO, 2004, LUCCHETTI and STERLACCHINI, 2004).

<sup>9</sup> Mezzogiorno is used to describe the South of the country; in the literature it refers to the mainland regions of Abruzzo, Molise, Campania, Basilicata, Apulia and Calabria plus the islands of Sicily and Sardinia.

<sup>10</sup> Other possible effects of outsourcing have been investigated as well. There has been for example an intense discussion on the impact on wage and employment; see HEGGER and KREICKEMEIER, 2008 and KOHLER, 2009.

<sup>11</sup> GEREFFI and KORZENIEWICZ, 1994 use the term “global commodity chain”, rather than global value chain. The word “commodity” implies the production of undifferentiated products in processes with low barriers to entry, whereas, according to KAPLINSKY, 2000, page 9, “the search for sustainable income growth requires producers to position themselves precisely in non-commodity, high barriers to entry activities in the value chain”. HUMPHREY and SCHMITZ, 2002 highlight that Gereffi and other researchers agreed at a workshop held in Bellagio (Italy) in September 2000, to use the term global value chain to refer to the firms’ linkages in the global chain.

<sup>12</sup> HUMPHREY and SCHMITZ, 2002 suggest that four types of value chain relationships can be distinguished: arms’ length relations; networks; quasi hierarchy; hierarchy. Among others, GIULIANI *et al.*, 2005 deal with the relationship between value chain governance and firm upgrading.

<sup>13</sup> Note, however, that some studies (e.g. GEROSKI, 1998) find poor correlation between performance indicators based on accounting measures and growth rates.

<sup>14</sup> Statistics in Tables 1 to 4 are calculated on CAPITALIA, 1998, 2001 data; Tables 5 and 6 present the results of the econometric estimations carried out using data from the same sources. Where necessary, data are deflated by the ISTAT price index NIC.

<sup>15</sup> The same conclusions hold if we consider median growth rates (in parentheses in Tables 1 and 2). Especially for employees’ growth (Table 1), median values are considerably lower than mean values, indicating that high average growth rates are presumably due to a relatively low number of firms growing very quickly.

<sup>16</sup> Following the method suggested by ZIVOT and WANG, 2006, we regressed the variable presumably affected by endogeneity SUB on instruments and other explanatory variables, to test the joint statistical significance of the instruments.



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<b>Table 1 – Employees</b>					
<b>Panel A – Size distribution (number of observations)</b>					
Employees	11-50	51-100	101-250	251-500	Over 500
Centre-North	5588	991	621	425	306
Mezzogiorno	880	180	115	35	22
NOSUB	2524	534	368	235	186
LOSUB	625	114	91	51	43
HISUB	621	94	66	36	19
ONSUB	2666	425	206	119	70
<b>Panel B – Average yearly growth rates. Mean and median (in parentheses) values</b>					
	NOSUB	LOSUB	HISUB	ONSUB	Overall
11-50 employees	19.14 (9.09)	23.98 (11.11)	9.80 (5.19)	9.40 (2.27)	14.67 (7.98)
51-100 employees	17.78 (8.62)	32.30 (23.43)	11.11 (10.42)	9.41 (7.27)	15.61 (8.76)
101-250 employees	17.24 (12.22)	28.17 (20.00)	9.17 (4.94)	9.49 (4.73)	15.69 (9.93)
251-500 employees	13.32 (10.30)	13.83 (9.17)	15.01 (4.38)	8.76 (3.23)	12.29 (6.71)
Over 500 employees	19.74 (16.65)	19.53 (23.13)	14.87 (8.68)	9.22 (0.83)	17.10 (10.60)
Centre-North	18.80 (9.61)	25.82 (18.14)	10.30 (7.56)	9.55 (2.52)	14.97 (9.19)
Mezzogiorno	17.73 (14.19)	13.81 (5.88)	8.87 (3.51)	8.45 (1.61)	12.04 (6.14)
Overall	18.44 (9.72)	24.65 (13.26)	10.24 (5.63)	9.38 (2.40)	14.84 (7.84)

<b>Table 2 – Real sales</b>					
<b>Panel A – Size distribution (number of observations)</b>					
Billions Liras (prices of year 2000)	Up to 10	10 to 50	50 to 200	200 to 500	Over 500
Centre-North	4400	2473	743	198	87
Mezzogiorno	766	373	68	14	12
NOSUB	1911	1302	450	122	56
LOSUB	490	310	82	29	12
HISUB	491	261	58	16	6
ONSUB	2251	959	202	36	22
<b>Panel B – Average yearly growth rates. Mean and median (in parentheses) values</b>					
	NOSUB	LOSUB	HISUB	ONSUB	Overall
11-50 employees	4.82 (3.04)	4.36 (2.90)	7.86 (5.10)	5.91 (3.05)	5.52 (3.04)
51-100 employees	-1.36 (0.60)	1.83 (1.16)	2.38 (1.38)	6.13 (3.12)	1.98 (1.45)
101-250 employees	4.92 (3.99)	5.54 (3.86)	7.23 (5.02)	5.80 (3.75)	5.45 (3.80)
251-500 employees	3.66 (3.14)	4.57 (3.03)	6.83 (4.44)	5.42 (3.88)	4.50 (3.21)
>500 employees	5.06 (4.00)	9.19 (6.41)	6.53 (0.30)	5.32 (3.83)	5.76 (3.83)
Centre-North	3.77 (2.71)	4.28 (2.30)	7.23 (4.14)	5.86 (3.40)	5.50 (3.03)
Mezzogiorno	7.24 (3.29)	6.53 (2.70)	0.15 (1.08)	4.02 (0.90)	5.22 (1.76)
Overall	3.91 (2.87)	4.40 (2.54)	7.12 (4.53)	5.90 (3.20)	5.02 (3.01)

<b>Table 3 – ANOVA tests of mean equality (t and F values)</b>				
<b>Panel A – Growth of employees</b>				
	NOSUB	LOSUB	HISUB	ONSUB
NOSUB	–			
LOSUB	7.216*** 52.069***	–		
HISUB	16.256*** 264.249***	8.380*** 70.224***	–	
ONSUB	29.075*** 845.331***	11.933*** 142.387***	0.174 0.030	–
Test on mean equality over all groups: F=318.641***				
<b>Panel B – Growth of real sales</b>				
	NOSUB	LOSUB	HISUB	ONSUB
NOSUB	–			
LOSUB	0.086 0.007	–		
HISUB	3.873*** 14.997***	2.989*** 8.936***	–	
ONSUB	5.109*** 26.105***	3.059*** 9.359***	3.537*** 12.289***	–
Test on mean equality over all groups: F=11.709***				

	Description	Obs	Mean	Max	Min	SD
EMP	Number of employees	9163	103.85	12630	11	369.18
AGE	Age of firm (in years)	9115	23.57	182	0	18.03
AVK	Ratio added value / invested capital	7713	0.04	2.58	-0.18	0.06
AVL	Ratio added value / number of employed*	7721	24.95	550.88	-35.62	29.90
EXP	Dummy. Takes value 1 if the firm exports	9134	0.69	1	0	0.46
SAL	Real value of sales**	9134	41.30	8645.71	0	221.3
HUM	Share of workers with a with a secondary school degree	8149	0.40	1	0	0.26
ICT	Dummy. Takes value 1 if the firm makes ICT investments	8501	0.78	1	0	0.41
INP	Dummy. Takes value 1 if the firm makes product innovation	9174	0.19	1	0	0.40
ROI	Value of ROI	7721	0.20	5.52	-4.58	0.71
SUB	Share of subcontracting on sales	9107	0.48	1	0	0.47
SOU	Dummy. Takes value 1 if the firm is localized in a Southern region	9177	0.13	1	0	0.34

The number of observations for each estimation changes due to the different number of valid answers to the questionnaire. \* values expressed in million liras; \*\* values in billion liras; values at prices of year 2000.

	(1)		(2)		(3)	
	OLS	GIV	OLS	GIV	OLS	GIV
Log SAL	-0.0057** (0.0020)	-0.0205** (0.0078)	-0.0057** (0.0020)	-0.0408*** (0.0131)	-0.3420** (0.1670)	-0.0267*** (0.0049)
$\Delta$ SAL <sub>t-1</sub>	3.92E-06 (2.86E-06)	4.61E-06 (3.12E-06)	3.92E-06 (2.86E-06)	4.85E-06 (12.9E-06)	-5.86E-05 (5.01E-05)	8.08E-06 (9.01E-06)
Log AGE	-0.0438*** (0.0087)	-0.0474*** (0.0107)	-0.0438*** (0.0087)	-0.0113 (0.0513)	-0.0455** (0.0177)	-0.0377*** (0.0074)
SOU	0.0148 (0.0177)	0.0075 (0.0237)	0.0148 (0.0177)	-0.0252* (0.0136)	-0.09010 (0.5230)	0.1215 (0.4209)
SUB	0.0026 (0.0104)	0.0098 (0.0123)	0.0019 (0.0121)	0.0017 (0.0208)	3.6336** (1.5141)	2.6492*** (0.8710)
SUB <sup>2</sup>	–	–	–	–	-3.5408** (1.4119)	-2.5768*** (0.8484)
SXS	–	–	–	–	-4.6440** (2.2994)	-2.9665*** (0.8841)
SXS <sup>2</sup>	–	–	–	–	4.0087** (1.7570)	2.7327*** (0.8671)
AVK	-4.88E-05 (10.4E-05)	-3.18E-04 (3.30E-04)	-4.90E-05 (10.4E-05)	-2.25E-04 (2.32E-04)	0.0013* (6.81E-04)	3.66E-04** (1.78E-04)
ICT	0.0421*** (0.0101)	0.0494*** (0.0157)	0.0421*** (0.0101)	0.0337** (0.0169)	0.2161** (0.0099)	0.0291* (0.0151)
INP	-3.66E-04 (0.0108)	-0.0078 (0.0136)	-0.0018 (0.0168)	-0.0688 (0.1078)	0.1451 (0.1108)	-0.0076 (0.0135)
IXS	–	–	0.0378** (0.0190)	0.1970** (0.0866)	–	–
Constant	0.2455*** (0.0517)	0.0205*** (0.0078)	0.2458*** (0.0517)	0.4582** (0.2297)	2.8972** (1.4201)	0.1033 (0.0683)
Observations	7047	6919	7047	6919	7047	6917
R <sup>2</sup>	0.0964	–	0.0965	–	0.2521	–
Marginal effect CN	–	–	–	–	0.3052	0.2248
Marginal effect SOU	–	–	–	–	-0.5706	-0.1764
Turning point CN	–	–	–	–	0.5131	0.5145
Turning point SOU	–	–	–	–	1.0797	1.0678
OIR test	–	3.3498	–	4.0073	–	4.3923

OIR test on validity of overidentifying restrictions is carried out by the Newey and West, 1987 statistic, which distributes like a  $\chi^2$  with degrees of freedom equal to the difference between the number of instruments (included exogenous variables) and the number of parameters to be estimated.

	(1)		(2)		(3)	
	OLS	GIV	OLS	GIV	OLS	GIV
Log EMP	-0.1499*** (0.0240)	-0.1606*** (0.0250)	-0.1501*** (0.0240)	-0.1974*** (0.0546)	-0.1508*** (0.0240)	-0.1450*** (0.0271)
$\Delta EMP_{t-1}$	-0.8742*** (0.3197)	-0.8013** (0.3173)	-0.8744*** (0.3199)	-1.1202*** (0.1496)	-0.8738*** (0.3202)	-0.9144*** (0.3482)
Log AGE	-0.0177 (0.0137)	-0.0295* (0.0176)	-0.0179 (0.0137)	-0.0400 (0.0612)	-0.0162 (0.0138)	-0.0148 (0.0250)
SOU	0.0640 (0.0490)	0.0365 (0.0659)	0.0643 (0.0492)	0.0625 (0.1115)	0.0416 (0.0480)	0.0707 (0.1579)
SUB	0.0228 (0.0546)	0.0404 (0.0339)	0.0226 (0.0418)	0.0390 (0.1341)	0.2018* (0.1133)	16.4096*** (3.7725)
SUB <sup>2</sup>	–	–	–	–	-0.1935* (0.1054)	-16.0162*** (3.6694)
SXS	–	–	–	–	-0.3429* (0.1943)	-16.6609*** (3.7292)
SXS <sup>2</sup>	–	–	–	–	0.2514* (0.1382)	16.1412*** (3.6551)
AVK	0.0043*** (0.0009)	0.0033*** (0.0012)	0.0043*** (0.0009)	0.0052*** (0.0018)	0.0043*** (0.0009)	0.0068*** (0.0013)
ICT	0.1262*** (0.0233)	0.1477*** (0.0254)	0.1173*** (0.0236)	0.1731** (0.0877)	0.1239*** (0.0227)	0.0312 (0.0463)
INP	0.0995** (0.0399)	0.0792* (0.0427)	0.0558 (0.0583)	-0.1424 (0.2508)	0.0982** (0.0400)	0.0334 (0.0494)
IXS	–	–	0.5302*** (0.0675)	0.4384* (0.2562)	–	–
Constant	0.5439*** (0.0807)	0.8394*** (0.2774)	0.5517*** (0.0779)	0.6408 (0.7507)	0.5446*** (0.0794)	-0.2420 (0.1928)
Observations	7015	6889	7015	6889	7015	6889
R <sup>2</sup>	0.1994	–	0.1995	–	0.1999	–
Marginal effect CN	–	–	–	–	0.0199	1.3544
Marginal effect SOU	–	–	–	–	-0.0867	-0.1372
Turning point CN	–	–	–	–	0.5214	0.5123
Turning point SOU	–	–	–	–	1.2185	1.0052
OIR test	–	4.6366	–	1.2004	–	1.2262

OIR test on validity of overidentifying restrictions is carried out by the Newey and West, 1987 statistic, which distributes like a  $\chi^2$  with degrees of freedom equal to the difference between the number of instruments (included exogenous variables) and the number of parameters to be estimated.