The distinct effects of information technologies and communication technologies on the age-skill composition of labour demand

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by Sotiris Blanas

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Abstract

This paper is the first to study the distinct effects of Information Technologies (IT) and Communication Technologies (CT) on the skill, age, and age-skill composition of labour demand. The analysis is conducted on a sample comprising 10 developed countries, 30 industries covering the largest part of the economy, and the period 1982-2005. I find that IT intensity increases the relative demands for the high-skilled, low-skilled and oldest workers, while it decreases the relative demands for the medium-skilled and younger workers. Also, IT intensity increases the relative demands for the high-skilled and low-skilled of all age profiles, while it decreases the relative demands for the medium-skilled of all age profiles. CT intensity exerts opposite effects. Consistent with knowledge-based hierarchy theories highlighting the organisational aspect of the adoption of IT and CT by firms, the empowerment of agents at lower and higher levels of the hierarchy induced by IT and CT, respectively, rationalise these findings. I also find that the aforementioned effects operate mostly as of 1990, when the advancement rates of IT and CT were even higher than in the 1980s. Although a clear pattern of disproportionate effects across sectors is not identified, such a pattern across countries does exist: the inequalities generated by the two types of technologies are mitigated by higher union density.

JEL codes: O33; J21; J23; J24; J31

Keywords: Information Technologies; Communication Technologies; relative labour demand; age-skill profile

Author:

Sotiris Blanas, National Bank of Belgium – e-mail: sotirios.blanas@nbb.be

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1 Introduction

The development and expansion of Information and Communication Technologies (henceforth, ICT) have taken place at an unprecedented rate for the last forty years. The implications of ICT for labour have received particular attention by researchers generating three main streams of the literature. The first stream finds that ICT have increased the relative demand for more skilled workers, thereby leading to skill upgrading.[1] The second stream makes a task-based approach and finds that ICT have decreased the relative wages and relative employment of workers in occupations intensive in routine tasks that happen to be at the middle of the skill distribution, thereby leading to "job polarisation".[2] A third stream of the literature distinguishes between labour types by age and finds that ICT have decreased the relative demand for older workers.[3]

Although the extant literature has improved remarkably our understanding of ICT and labour outcomes, to the best of my knowledge, there is hardly any study that examines the individual effects of Information Technologies (IT) and Communication Technologies (CT) on labour. In this paper, I make a first attempt in this direction by studying the individual effects of IT and CT on the skill, age, and age-skill composition of labour demand. This type of analysis is essential if we consider the organisational aspect of the adoption of ICT by firms. Unlike the extant literature, knowledge-based hierarchy theories, most notably the one developed by Bloom et al. (2014), take the organisational aspect into consideration and argue that a distinction should be made between IT and CT, as the first type of technologies lead to the empowerment of agents at lower levels of the hierarchy, while CT lead to the empowerment of agents at higher levels of the hierarchy.

For instance, as stressed by Bloom et al. (2014), two types of IT that have become increasingly available to production workers, the Computer Assisted Design (CAD) and Computer

[1] Based on these findings, the term "Skill-biased technological change – SBTC" has been coined (Berman et al., 1994). More recent studies find that ICT polarise the demand for skill, that is, they are biased against the medium-skilled and in favour of the high-skilled and low-skilled (Michaels et al., 2014; Blanas et al., 2018).

[2] For such empirical evidence, see among others: D. H. Autor & Dorn (2013) and Goos et al. (2014). The rationale behind these findings based on the task-based approach of D. Autor et al. (2003) is that ICT substitute for routine-intensive occupations that are at the middle of the skill distribution, while they complement non-routine-intensive occupations that are at the two tails of the skill distribution. Also, Blanas et al. (2018) find heterogeneous effects of ICT on the skill, age, and gender compositions of labour demand across industries with different shares of routine-intensive tasks.

[3] Based on these findings, the term "Age-biased technological change – ABTC" has been coined (Aubert et al., 2006; Behaghel et al., 2014). In a recent study, Blanas et al. (2018) find that ICT are biased against the middle-aged and in favour of the youngest and oldest workers, although the positive bias towards the youngest does not hold for certain sub-periods examined.

Assisted Manufacturing (CAM) systems, have facilitated the access to information related to product design and product manufacturing, respectively, that is essential for these workers in order to solve problems on their own and rely less on plant managers. Similarly, the increasing use of Enterprise Resource Planning (ERP) systems, another type of IT, by middle managers has increased remarkably the pool of available information to them on various aspects of the production and distribution process allowing them to make decisions more independently and rely less on top managers at the headquarters.[4] In addition, the introduction of corporate intranet, a type of CT, connecting a company's plants to the headquarters, allows for a more swift and efficient decision-making process at the headquarter and plant levels. In particular, it becomes less costly for top managers to leverage their knowledge by providing effective solutions to relatively complex problems dealt with at the plants by middle managers and production workers. At the same time, top managers can monitor plants more easily and subsequently, increase their span of control, that is, the number of middle managers and production workers under their supervision. Similarly, the utilisation of intranet facilitates communication between middle managers and production workers within a plant, allowing middle managers to leverage their knowledge and to increase their span of control. Cell phones, emails, leased-lines and relay frames are other types of communication technologies that facilitate communication across hierarchical layers and are used extensively in the manufacturing sector, in retail and wholesale industries, in retail banking and other service industries, and to a lesser extent in other sectors such as agriculture and mining.[5]

I conduct the empirical analysis on a sample of 10 developed countries, 30 industries that cover the largest part of the economy, and a period that spans over 1982 and 2005. My main data source is EU KLEMS that has three distinct features relevant to my analysis. First, its data are comparable across countries, industries, and years. Second, it provides information on variables for workers classified in three skill and three age groups. A worker's skill is captured by her level of education. Third, it provides information on variables for different types of capital, including non-ICT, IT and CT capital. The econometric model is derived from the cost minimisation problem of the representative firm. It is a system of wage bill share equations for different worker types with IT and CT intensities, calculated as

[4] ERP is a unified system of databases of an organisation including metrics on production and distribution like output, waste, deliveries, machine failures, orders and stocks, as well as human resource and financial metrics (Bloom et al., 2014).

[5] A leased-line is a symmetric telecommunications line connecting two locations and can be used for telephone, data or Internet services. Relay frame is a technology for the transmission of digital information, such as data and voice, predominantly via local networks (Bloom et al., 2014).

the ratios of real IT and CT capital stocks to real gross value added, as the key regressors. I estimate the system of equations by Iterated Three-Stage Least Squares (I3SLS) while treating all explanatory variables as endogenous. Each explanatory variable is instrumented with its first and second lags. I also implement an alternative instrumentation strategy for the non-ICT, IT and CT intensities which relies on the concept that their levels in a year preceding the start year of the sample along with the evolution of telephone line installations and military expenditures of a country over the sample period could be strong predictors of the evolution of industry-level non-ICT, IT and CT intensities over the period examined. Based on this concept, I instrument each of the three variables by interacting its values in 1980 with country-level variables for the number of telephone lines per capita and the share of military expenditures in GDP. Data on the two country-level variables are drawn from the World Bank's World Development Indicators.

When I study the effects of IT and CT on the skill composition and age composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled, low-skilled and oldest workers, while it decreases the relative demands for the medium-skilled and younger workers. CT intensity exerts opposite effects. In particular, it decreases the relative demands for the low-skilled and the oldest workers, and increases the relative demands for the medium-skilled and the youngest. I identify very similar effects of IT and CT on the skill composition of labour demand within each age group and on the age composition of labour demand within each skill group. Studying the effects of IT and CT on the age-skill composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled and low-skilled of all age profiles, while it decreases the relative demands for the medium-skilled of all age profiles. CT intensity exerts mostly opposite effects. In particular, it decreases the relative demands for older low-skilled workers and increases the relative demands for the younger more skilled. Interestingly I show that the aforementioned effects are in operation mostly from 1990 onwards, when IT and CT advancements took place at an even higher rate compared to the 1980s. Although a clear pattern of disproportionate effects across sectors is not identified, such a pattern across countries does exist: the wage bill share differences that are generated by IT and CT intensities among worker types are smaller in countries where union density is higher. This result empirically validates the crucial role of collective bargaining –and more broadly, of labour market institutions– in the mitigation of inequalities among different worker types.

My analysis shows that in addition to the identification of distinct effects of each of the two types of technologies on the wage bill shares of workers differing in age and skill, IT and CT exert opposite effects on each worker type. These findings can hardly be rationalised by the traditional task-based approach that overlooks organisational issues associated with the adoption of ICT by firms. Instead, they are consistent with knowledge-based hierarchy theories and as such, they improve our understanding of how IT and CT lead to inequalities among workers differing in age and skill. In short, the knowledge-based hierarchy approach is a distinct specification of the task-based approach as tasks are linked to an explicit organisational problem and are ordered hierarchically. That is, the firm is conceptualised as a knowledge-based hierarchy where the more knowledgeable an agent is, the higher her position in the hierarchy and the greater the complexity of her tasks. When the representative firm adopts IT (e.g. CAD/CAM, ERP), the cost of access to information and knowledge acquisition is reduced and thus, agents at lower levels of the hierarchy (e.g. production workers and middle managers) become less dependent on those at higher levels of the hierarchy (e.g. middle and top managers). Similarly, when the representative firm adopts CT (e.g. intranet), the cost of communication across hierarchical layers is reduced and thus, agents at lower levels of the hierarchy (e.g. production workers and middle managers) become more dependent on those at higher levels of the hierarchy (e.g. middle and top managers) who can leverage their knowledge and increase their span of control.

The remainder of the paper is organised as follows. In Section 2, I provide the theoretical underpinnings of the effects of IT and CT on the skill, age, and age-skill composition of labour demand by relying on knowledge-based hierarchy theories. In Section 3, I describe the data and provide descriptive statistics which motivate the subsequent econometric analysis. In Section 4, I derive the econometric model and describe the estimation strategy. In Sections 5 and 6, I present the main results and the robustness checks, respectively. In Section 7, I conclude and provide some suggestions for further research.

2 Theoretical framework

In this section, I first describe the main elements of knowledge-based hierarchy theories developed by Garicano (2000) and Bloom et al. (2014). Using these elements, I then discuss theoretically the individual effects of IT and CT on the skill, age, and age-skill composition of labour demand.

2.1 The representative firm as a knowledge-based hierarchy

Same as the task-based approach, the production process of the representative firm is conceptualised in terms of tasks.[6] Unlike this approach, however, tasks are linked to an explicit organisational problem and ordered hierarchically. In this regard, the knowledge-based hierarchy approach is a distinct specification of the task-based approach.

The main pillars of knowledge-based hierarchy theories are the following three. First, production requires time and knowledge (assumption 1). This implies that there is a unit measure of problems per unit of time. As some problems may occur more often than others, these are distributed according to a density function *f(z)*. Second, knowledge acquisition is costly (assumption 2), implying that agent i can acquire knowledge only after incurring the relevant cost, k_i. This cost is dependent on the available technologies and the human capital of agent i. Third, knowledge can be communicated (assumption 3). That is, knowledge flows across hierarchical layers within the firm according to the "management by exception" principle: the more knowledgeable an agent is, the higher her position in the hierarchy and the greater the complexity of the problems she deals with. In other words, agents at lower hierarchical layers deal with relatively common problems, while agents at higher hierarchical layers deal with exceptional problems.[7] Each time agents at a lower hierarchical layer do not know the solution to a problem, they seek for help from agents at higher hierarchical layers who then communicate the solution to them. This two-way communication can take place only after each party incurs a communication cost, h.

Following Bloom et al. (2014), I consider a knowledge-based hierarchy with three layers. Top managers occupy the top layer of the hierarchy, middle managers occupy the intermediate layer, while production workers occupy the bottom layer. The hierarchy involves production and non-production decisions. Non-production decisions are made by top and middle managers, while production decisions are made by production workers and middle managers. Hence, under this setting, middle managers are at the bottom of the non-production hierarchy and at the top of the production hierarchy. For consistency between theory and empirics,

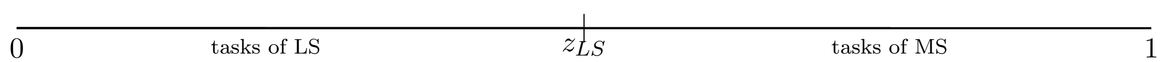
[6] Throughout this section, the terms "tasks", "problems" and "decisions" are used interchangeably.

[7] In relation to the traditional task-based approach (D. Autor et al., 2003), it is essential to emphasise that a relatively common problem is not necessarily a routine problem that can be easily dealt with by automation. In fact, some relatively common problems can be non-routine. Subsequently, the degree of complexity of a problem should not be viewed as a measure of its routine intensity.

top managers are proxied by agents with high level of education (high-skilled – HS), middle managers are proxied by agents with intermediate level of education (medium-skilled – MS), and production workers are proxied by agents with low level of education (low-skilled – LS).[8]

Starting with the description of the production hierarchy, I consider a unit measure of tasks per unit of time, $z \in [0, 1]$, as shown in Figure 1.

Figure 1: Unit measure of production tasks per unit of time in a knowledge-based hierarchy determined by workers' education



The threshold z_{LS} distinguishes between the tasks that are performed by production workers (LS) and the tasks that are performed by middle managers (MS). In particular, tasks z that are below this threshold, $z \leq z_{LS}$, are performed by production workers, while tasks z that are above the threshold, $z > z_{LS}$, are performed by middle managers. The values of z within the range $[0, z_{LS}]$ capture the degree of autonomy of production workers relative to middle managers. That is, the closer the tasks z of production workers are to the threshold, the higher is their level of autonomy.

As knowledge acquisition is costly, production workers and middle managers acquire knowledge by incurring the respective costs, k_{LS} and k_{MS}. Production workers perform a fraction $F(z_{LS})$ of tasks, while middle managers perform a fraction $h * (1 - F(z_{MS}))$ of tasks, where h is the communication cost. The middle managers' span of control is calculated as the ratio of the number of production workers to the number of middle managers: $S_{MS} = \frac{N_{LS}}{N_{MS}}$, where N_i: number of $i \in \{MS, LS\}$. In other words, this ratio captures the number of production workers that are monitored by middle managers and is thus a measure of the size of the production hierarchy.

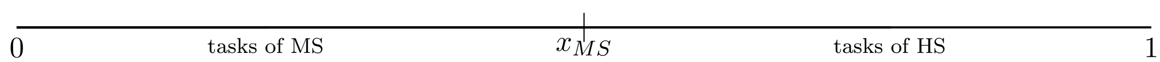
The description of the function of the non-production hierarchy is very similar. I consider a unit measure of tasks per unit of time, $x \in [0, 1]$, as shown in Figure 2.

In this case, the threshold x_{MS} distinguishes between the tasks that are performed by middle managers (MS) and the tasks that are performed by top managers (HS). In particular,

[8]My approach also serves for the tractability of the theoretical analysis, and by no means precludes cases where agents with relatively low education but high seniority occupy higher hierarchical layers than less senior agents with relatively high education.

tasks x that are below this threshold, $x \leq x_{MS}$, are performed by middle managers, while tasks x that are above the threshold, $x > x_{MS}$, are performed by top managers. The values of x within the range $[0, x_{MS}]$ capture the degree of autonomy of middle managers relative to top managers. That is, the closer the tasks x of middle managers are to the threshold, the higher is their level of autonomy.

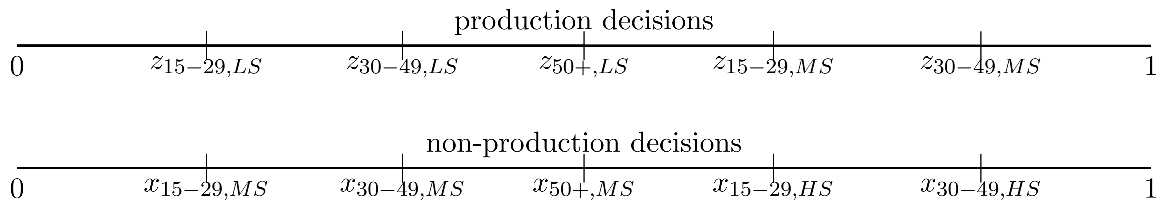
Figure 2: Unit measure of non-production tasks per unit of time in a knowledge-based hierarchy determined by workers' education



In order for middle and top managers to acquire knowledge, they incur the costs k_{MS} and k_{HS}, respectively. Middle managers perform a fraction $G(x_{MS})$ of tasks, while top managers perform a fraction $h * (1 - G(x_{HS}))$ of tasks. The top managers' span of control is calculated as the ratio of the number of middle managers to the number of top managers: $S_{HS} = \frac{N_{MS}}{N_{HS}}$, where N_i: number of $i \in \{HS, MS\}$. This ratio is a measure of the size of the non-production hierarchy as it captures the number of middle managers that are monitored by top managers.

The education level of a worker, especially of a worker of prime or older age, captures only part of her human capital. Other aspects of it such as work experience and tenure, on-the-job training, firm-specific know-how and expertise are also essential and can rather be captured by the age profile of a worker. In other words, the age profile can proxy for a worker's dynamic acquisition of human capital in her post-education period. Figure 3 shows the production and non-production hierarchies when combinations of education and age profiles are considered. As older workers have an advantage over younger workers in human capital accumulation (OECD, 2011), they are more autonomous and can perform a wider range of tasks at each hierarchical layer. I, thus, plausibly assume that the three age groups observed in the data, comprising the oldest (aged 50+), the middle-aged (aged 30–49) and the youngest (aged 15–29) agents, have a high, intermediate and low level of autonomy, respectively. Similar to Figures 1 and 2, the threshold $z_{50+,LS}$ distinguishes between the production tasks that are performed by production workers and middle managers, while the threshold $x_{50+,MS}$ distinguishes between the non-production tasks that are performed by middle managers and top managers. The additional thresholds define the different range of tasks performed by workers of different age profile at each hierarchical layer. The function of the hierarchy is very similar to that described in Figures 1 and 2.

Figure 3: Unit measure of production and non-production tasks per unit of time in a knowledge-based hierarchy determined by workers' education and age profiles



2.2 The distinct effects of IT and CT on the skill, age, and age-skill composition of labour demand

Having described the main elements and function of the three-layer knowledge-based hierarchy, I study theoretically the effects of the adoption of IT and CT by the representative firm on the skill, age-skill, and age composition of labour demand, as captured by the wage bill shares of the respective groups of workers.

Effects of IT and CT on the skill composition of labour demand

The adoption of IT facilitates access to information by agents, thereby reducing the cost that they have to incur in order to acquire knowledge (k). A lower knowledge acquisition cost shifts the upper bound of tasks z that a production worker can perform and the upper bound of tasks x that a middle manager can perform closer to the thresholds, z_{LS} and x_{MS}, respectively. These shifts imply that production workers and middle managers become more autonomous. That is, they can perform a wider range of tasks without asking for help from their superiors. In turn, superiors can increase their span of control (S) as the amount of questions addressed to them by their subordinates decreases. For instance, Bloom et al. (2014) argue that the increasing availability of Computer Assisted Design (CAD) and Computer Assisted Manufacturing (CAM) systems to production workers has facilitated the access to information related to product design and product manufacturing, respectively, that is essential for them in order to solve problems on their own and rely less on plant managers. Plant managers can, in turn, increase their span of control, that is, supervise a larger number of production workers. Similarly, the increasing use of Enterprise Resource Planning (ERP) systems by middle managers has increased remarkably the pool of available information to them on various aspects of the production and distribution process allowing them to make decisions more independently and rely less on top managers. Top managers can, in turn, increase their span of control, that is, supervise a larger number of middle managers.

The effect of IT on the wage bill share of production workers is expected to be positive as the increase in their level of autonomy will increase their relative wage, while their relative employment can also increase due to the possible increase in middle managers' span of control. The effect of IT on the wage bill share of middle managers is ambiguous. On the one hand, their relative wage may increase because they become less dependent on top managers, whose knowledge and expertise becomes less valuable. Their relative employment may also increase as top managers may increase their span of control within the non-production hierarchy (positive effect). On the other hand, middle managers' relative wage may decrease because production workers become less dependent on them or their relative employment may decrease because of a possible increase in their span of control within the production hierarchy (negative effect). The effect of IT on the wage bill share of top managers is also ambiguous. On the one hand, their relative wage may decrease because middle managers and production workers become less dependent on them or their relative employment may decrease because of a possible increase in their span of control within the non-production and production hierarchies (negative effect). On the other hand, their wage bill share may increase because of greater losses incurred by middle managers, resulting from the lower dependence of production workers on them and the possible increase in middle managers' span of control (positive effect).

The adoption of CT reduces the cost of communication (h) between agents at different hierarchical layers. This allows agents at higher hierarchical layers to leverage their knowledge and, possibly, to increase their span of control (S). Subsequently, the upper bound of tasks z that a production worker performs and the upper bound of tasks x that a middle manager performs shift away from the thresholds, z_{LS} and x_{MS}, respectively. These shifts imply that production workers and middle managers become less autonomous. That is, they perform a narrower range of tasks and rely on their superiors for the more complex tasks. For instance, according to Bloom et al. (2014), the introduction of corporate intranet connecting a company's plants to the headquarters makes less costly for top managers to leverage their knowledge by providing effective solutions to relatively complex problems dealt with at the plants by middle managers and production workers. At the same time, top managers can monitor plants more easily and subsequently, increase their span of control, that is, the number of middle managers and production workers under their supervision. Similarly, the utilisation of intranet facilitates communication between middle managers and production workers within a plant, allowing middle managers to leverage their knowledge and to increase their span of control. Overall, the decision-making process becomes more swift and efficient at the headquarter and plant levels as a result of the introduction of corporate intranet.

The effect of CT on the wage bill share of top managers is ambiguous. On the one hand, their relative wage may increase as they can leverage their knowledge by providing more help to their subordinates (positive effect). On the other hand, their relative employment may decrease because of an increase in their span of control, that is, the number of middle managers and production workers that they monitor (negative effect). The effect of CT on the wage bill share of production workers is also ambiguous. While their relative wage may decrease because they become more dependent on middle managers (negative effect), their relative employment may increase because of an increase in middle managers' span of control (positive effect). Same as in the previous two cases, the effect of CT on the wage bill share of middle managers is ambiguous. Within the production hierarchy, the relative wage of middle managers may increase because they can leverage their knowledge by providing more help to production workers (positive effect). However, the relative employment of middle managers may decrease because of an increase in their span of control, that is, the number of production workers that they monitor (negative effect). Within the non-production hierarchy, the relative wage of middle managers may decrease as they become more dependent on top managers who, in turn, leverage their knowledge (negative effect), but their relative employment may increase because of an increase in top managers' span of control (positive effect).

Effects of IT and CT on the age-skill composition of labour demand

Extending the analysis by considering the combinations of age and skill profiles of agents, I conclude that the effects of IT and CT on the wage bill shares of workers differing in age and skill are theoretically indeterminate. As IT lower the cost of knowledge acquisition incurred by agents, the relative wage or relative employment of agents occupying a certain hierarchical layer may, on the one hand, increase as they become less dependent on their superiors (positive effect), but on the other hand, their relative wage or relative employment may decrease as their subordinates become less dependent on them (negative effect).

Similarly, as CT lower the cost of communication across hierarchical layers, the relative wage of agents at a certain hierarchical layer may increase because they can leverage their knowledge as a result of the greater dependence of subordinate workers on them (positive effect), while their relative employment may decrease because of an increase in their span of control of subordinates (negative effect). In addition, while the relative wage of the agents may decrease because they become more dependent on their superiors who can leverage their knowledge (negative effect), their relative employment may increase because of an increase in their superiors' span of control (positive effect).

Effects of IT and CT on the age composition of labour demand

As stressed in Section 2.1, older workers have an advantage over younger workers in the *level* of human capital (OECD, 2011) which is translated into a greater level of autonomy.

Although the adoption of IT by the representative firm increases the autonomy of both younger and older workers, the latter are expected to benefit disproportionately as they are more knowledgeable and autonomous. For instance, the introduction of CAD/CAM or ERP systems into the firm will most likely allow older workers to solve their existing problems more efficiently than younger workers or to increase by more the range of problems they deal with. Hence, the relative wage and possibly the relative employment of older workers (aged 50+ and possibly 30–49) are expected to increase, thereby leading to an increase in their wage bill shares. Similarly, the adoption of CT by the representative firm decreases the autonomy of both younger and older workers, but the latter are expected to incur disproportionate losses because of their greater levels of knowledge and autonomy. For instance, the installation of intranet in the firm will most likely make the knowledge advantage of older workers less important or narrow the range of their tasks by more compared to younger workers, thereby reducing their relative wage and possibly their relative employment. As a consequence, the wage bill shares of older workers (aged 50+ and possibly 30–49) will decrease to the benefit of younger workers (aged 15–29 and possibly 30–49).

3 Data and descriptive statistics

In this section, I first describe the data and the construction of variables that I use in the main empirical analysis. Then, I present useful patterns and trends of IT and CT, and of wage bill shares by skill, age, and age-skill.

3.1 Data and variables

I conduct the empirical analysis on a sample that comprises 10 countries, 30 industries and 24 years spanning from 1982 to 2005. The 10 countries are shown in Panel A of Table A1. All of them are among the most developed countries in the world. The 30 industries examined cover the largest part of the economy and are shown in Panel B of the same table. They are aggregated at the two-digit level and their codes correspond to the NACE Rev. 1.1. The formation of the sample is based on the availability of data for key labour and capital variables.

All information on labour, capital and other production-related variables is retrieved from EU KLEMS. This data source has three main distinct features that render it suitable for the scope of my analysis. The first distinct feature is that its data are comparable across countries, industries and years. Second, it provides information on the wage bill shares of workers with different skill and age profiles, as well as on the total wage bill and total employment. Employment is captured by the hours worked by persons engaged.[9] Workers are classified in three age groups, young (aged 15–29), middle-aged (aged 30–49), and elder (aged 50+), and three skill groups, high-skilled (HS), medium-skilled (MS), and low-skilled (LS) based on their level of education. By and large, a high-skilled worker has at least a Bachelor's degree, a medium-skilled worker has upper-secondary education or vocational training, and a low-skilled worker has lower-secondary education or no formal qualification. The third distinct feature of EU KLEMS is that it provides information on different types of capital, including the real fixed stocks of non-ICT, IT and CT capital. According to EU KLEMS, IT comprises computing equipment, while CT comprises communication equipment. The normalisation of the three capital variables by real gross value added yields non-ICT, IT and CT capital intensities. Alternatively, I normalise the capital variables by real gross output, the total hours worked by persons engaged, or the total hours worked by employees. Information on these three variables is retrieved from EU KLEMS as well.

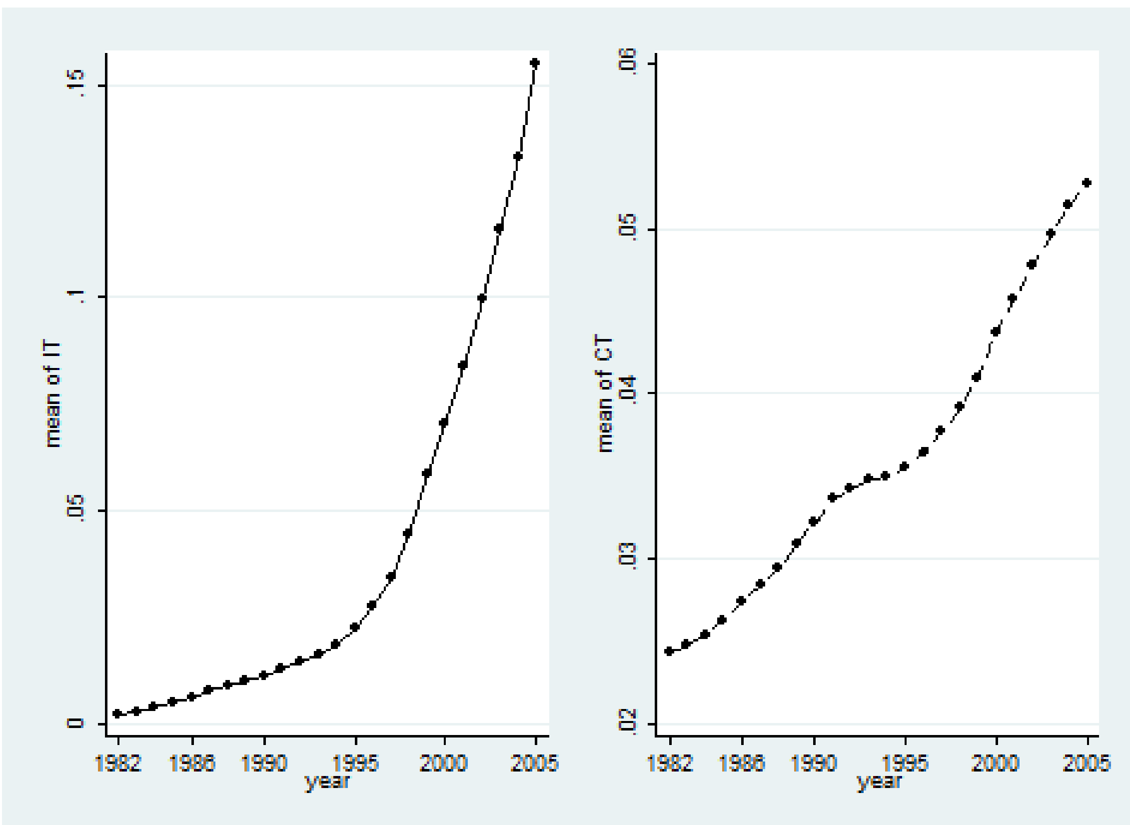
All real variables are in 1995 prices. As monetary variables are in national currencies, I convert these in US dollars (USD) using real exchange rate data from the OECD.

[9] This is preferred to the number of persons engaged as workers may differ in the amount of hours that they work (Graetz & Michaels, 2018).

3.2 Descriptive statistics

Figure 4 shows the evolution of the adoption of IT (left panel) and CT (right panel) over 1982–2005 for the whole sample. IT stands for IT intensity and is calculated as the ratio of real IT capital stock to real gross value added. Similarly, CT stands for CT intensity and is calculated as the ratio of real CT capital stock to real gross value added. As IT and CT intensities vary by country, industry and year, for the production of the statistics shown in the figure, I first average the ratios across industries within each country using as weights each industry's employment share in country-wide employment in 1982. I then average across countries by year using equal weights for each country.

Figure 4: IT and CT intensities



Notes: IT: ratio of real IT capital stock to real gross value-added; CT: ratio of real CT capital stock to real gross value-added. I first average the ratios across industries within each country using as weights each industry's employment share in country-wide employment in 1982. I then average across countries by year using equal weights for each country. *Source*: Author's calculations based on EU KLEMS.

The two panels document the remarkably increasing trends in the adoption of IT and CT over the period examined. The average IT intensity increased from 0.002 in 1982 to 0.155 in 2005, while the average CT intensity increased from 0.024 in 1982 to 0.053 in 2005 (see also bottom of Panel A of Table A2). As a result of these trends, the pattern between 1982 and 2005 changed: while IT intensity was lower than CT intensity in 1982, this was reversed in 2005. The reversal in the pattern is also observed by country and by industry (Table A2).[10] Indeed, IT intensity grew faster than CT intensity over the period examined, as revealed by both the graph and the average percentage changes[11] shown in Table A2. Although the slope of the CT line is steeper in the pre-1995 period –except for some years before 1995 when the CT line slightly flattens–, the slope of the IT line becomes much steeper as of 1995.[12] The significant advancements in the processing and storage capacity of personal computers (PCs) that took place in the 1990s along with the launch of much more user-friendly operating systems on which PCs ran as compared to the 1980s (e.g. MS-DOS Vs Microsoft Windows 95 and subsequent versions) may be among the key drivers of such a steep increase in IT intensity in the post-1995 period. Similarly, the commercialisation of the internet in 1994–1995 upon which modern networks have been developed since then, can partly explain the continuing increase in CT intensity post-1995.

Having described the patterns and trends of IT and CT, I now focus on the patterns and trends of wage bill shares of different worker types. Figure 5 shows the evolution of wage bill shares of workers differing in skill (left panel) and in age (right panel). Same as for IT and CT intensities, for the production of the statistics shown in the figure, I first average the wage bill shares across industries within each country using as weights each industry's employment share in country-wide employment in 1982. I then average across countries by year using equal weights for each country. According to the two panels, the medium-skilled and middle-aged workers account for the largest shares in the total wage bill, followed by the high-skilled and the oldest workers, respectively. In terms of trends, high-skilled workers experienced a steady increase in their share in the total wage bill (0.137 in 1982 to 0.244 in 2005). Despite a small decrease in their wage bill share before 1986, the oldest workers increased their share in the

[10]For the production of the statistics by industry, I average the ratios across countries within each industry using equal weights for each country.

[11]I first calculate the percentages of the ratios by country-industry pair. Then, I average the percentage changes across industries within each country using as weights each industry's employment share in country-wide employment in 1982 (Panel A), or I average the ratios across countries within each industry using equal weights for each country (Panel B).

[12]In figures and tables that are available upon request, I derive the same patterns and trends for IT and CT intensities when I normalise the real gross fixed IT and CT capital stocks with real gross output, the hours worked by persons engaged, or the hours worked by employees.

total wage bill in the rest of the period (from 0.196 in 1982 to 0.249 in 2005). The medium-skilled and middle-aged workers increased as well their wage bill shares between 1982 and 2005, although the trend for the middle-aged was mostly decreasing after 1996 (from 0.527 in 1982 to 0.594 in 2005, and from 0.521 in 1982 to 0.566 in 2005, respectively). By contrast, the low-skilled and the youngest workers experienced steady decreases in their wage bill shares (from 0.337 in 1982 to 0.162 in 2005, and from 0.282 in 1982 to 0.185 in 2005, respectively). The aforementioned statistics are shown in Panel A of Tables A3 and A4. The same tables also display the levels and percentage changes of wage bill shares averaged by country (Panel A) and by industry (Panel B).[13] As shown in the two tables, the aforementioned patterns and trends of wage bill shares are also observed for the vast majority of countries and industries.

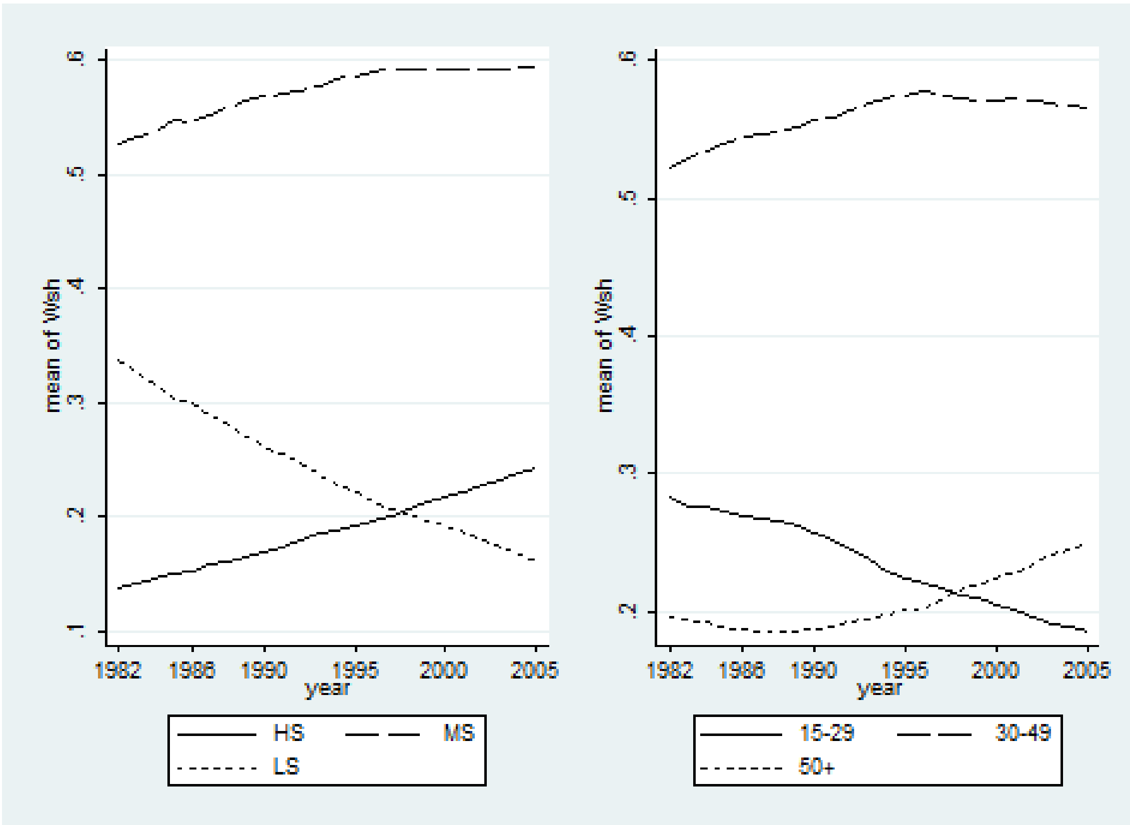
The evolution of the wage bill shares of the nine age-skill groups of workers is shown in Table 1. The statistics are produced in the same way as those for the wage bill shares of different skill or age groups. According to this table, the medium-skilled workers of all three age profiles accounted for the largest shares in the total wage bill in 1982, followed by the low-skilled workers of all three age profiles. In 2005, this pattern changes in an important way as the highest shares in the total wage bill are held by the medium-skilled and the high-skilled workers of all age profiles. As shown at the bottom row of the table, this change in the pattern between 1982 and 2005 is explained by the relatively high positive growth rates of the wage bill shares of high-skilled workers of all age profiles, the relatively moderate positive growth rates of the wage bill shares of older medium-skilled workers and the relatively high negative growth rates of the wage bill shares of low-skilled workers of all age profiles. These patterns and trends are also observed by country and by industry (Tables A5 to A7).

In summary, low-skilled workers, the youngest workers, and the less skilled workers of all generations experience declines in their wage bill shares over 1982–2005. By contrast, the high-skilled and medium-skilled workers, the oldest and middle-aged, as well as the more skilled of all three generations experience increases in their wage bill shares over the same period. As the trends of wage bill shares of different worker types coincide with the remarkably increasing trends of IT and CT intensities, my goal in the next sections is to identify their

[13] In order to calculate the average levels by industry, I average the wage bill shares across countries within each industry using equal weights for each country. For the calculation of the average percentage changes by country, I first calculate the percentages of the wage bill shares by country-industry pair. Then, I average the percentage changes across industries within each country using as weights each industry's employment share in country-wide employment in 1982. For the calculation of the percentage changes by industry, I first calculate the percentages of the wage bill shares by country-industry pair. Then, I average the percentage changes across countries within each industry using equal weights for each country.

causal relationships.

Figure 5: Wage bill shares by skill and by age



Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. I first average the wage bill shares across industries within each country using as weights each industry's employment share in country-wide employment in 1982. I then average across countries by year using equal weights for each country.
Source: Author's calculations based on EU KLEMS.

Table 1: Wage bill shares by age-skill

	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
Mean level 1982	0.030	0.172	0.081	0.081	0.277	0.164	0.026	0.078	0.092
Mean level 2005	0.033	0.121	0.031	0.149	0.343	0.073	0.062	0.130	0.058
Mean % change 1982–2005	246.34	-17.56	-67.15	233.12	76.50	-60.50	200.34	114.18	-43.75

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. I first average the wage bill shares across industries within each country using as weights each industry's employment share in country-wide employment in 1982. I then average across countries by year using equal weights for each country.
Source: Author's calculations based on EU KLEMS.

4 Econometric model and estimation strategy

In this section, I derive the econometric model and describe the strategy that I implement for its estimation.

4.1 Econometric model

Assuming a perfectly inelastic labour supply, the representative firm makes optimal labour utilisation adjustments for given wages while adopting IT and CT. Hence, the two types of technologies act as labour demand shifters that increase or decrease the relative demand for different types of workers.

In addition to IT and CT, the representative firm utilises non-ICT capital. Treating all three types of capital as quasi-fixed factors (Berman et al., 1994), the cost function of the representative firm is of the short-run form:

$$C_{SR}(W, Y, K, IT', CT') = \min(W \cdot E') \;\; s.t. Y = f(E, K, IT', CT') \tag{1}$$

C_{SR} is the short-run cost of the firm which includes the total wage bill. W and E are vectors of hourly wages and total hours of work, respectively, of workers who differ in skill, age, or both. Y stands for output, while K, IT and CT stand for non-ICT, IT and CT capital, respectively.

Considering the cost function to be of translog representation[14] and differentiating with respect to wages, I obtain the following system of wage bill share equations:

$$\begin{aligned} Wsh^{a,s}_{cit} =& \alpha_{ct} + \alpha_{ci} + \beta^{a,s}_{Y} \cdot \ln Y_{cit} + \beta^{a,s}_{K} \cdot K_{cit} + \beta^{a,s}_{IT} \cdot IT_{cit} + \beta^{a,s}_{CT} \cdot CT_{cit} + \epsilon^{a,s}_{cit}, \\ & \forall a \in A = \{15-29, 30-49, 50+\}, s \in \{HS, MS, LS\} \end{aligned} \tag{2}$$

The dependent variable, $Wsh^{a,s}_{cit}$, is the wage bill share of workers of age a and skill s in country c, industry i, and year t. Country-year fixed effects, α_{ct}, capture time-varying country characteristics, such as changes in the aggregate supply of production factors, in trade

[14]See among others: Berman et al. (1994), Feenstra & Hanson (1996), Hijzen et al. (2005), and Crinò (2012). The translog form is preferred to other functional forms such as the CES, Cobb-Douglas and Leontief, as it imposes no *a priori* restrictions on substitutability between inputs.

openness, in labour market institutions (e.g. strictness of employment protection legislation, collective bargaining, minimum wage policy), as well as in relative wages, assuming that the wage-setting process takes place at the national level (Michaels et al., 2014; Graetz & Michaels, 2018; Blanas et al., 2018).[15] Country-industry fixed effects, α_{ci}, capture time-invariant unobserved heterogeneity across country-industry pairs such as the initial level of technological sophistication and initial factor endowments.[16]

The additional control, Y_{cit}, is the real value added and accounts for industry size. This variable enters the model in logs. K_{cit} is the ratio of real fixed non-ICT capital stock to real gross value added. The two key regressors of the model are IT_{cit} and CT_{cit} and are calculated as the ratios of real fixed stocks of IT and CT capital to real gross value added. The coefficient estimates, $\beta_{a,s,IT}$ and $\beta_{a,s,CT}$, capture the individual effects of IT and CT, respectively, on the wage bill shares of workers differing in age and skill. Capital variables do not enter the model in logs as the values of IT and CT for some country-industry pairs in early years of the sample are close to zero and thus, their logged values are negative and extremely large (Michaels et al., 2014; Graetz & Michaels, 2018). The error term, $\epsilon_{cit}^{a,s}$, includes unobserved factors that affect wage bill shares.

The parameters of the equations of system (2) are subject to the following constraints stemming from linear price homogeneity and symmetry:

$$\sum_{a,s} \beta_{Y}^{a,s} = \sum_{a,s} \beta_{K}^{a,s} = \sum_{a,s} \beta_{IT}^{a,s} = \sum_{a,s} \beta_{CT}^{a,s} = 0. \quad (3)$$

4.2 Estimation strategy

The identical right-hand side of the system of equations and the cross-equation constraints in (3) imply that the error terms are likely to be correlated (Berndt, 1991). In such a case, the simultaneous estimation of the equations in (2) produces more efficient coefficient estimates as compared to those produced by the estimation of each equation separately. Under the assumption of exogenous explanatory variables, the simultaneous estimation is implemented with the Seemingly Unrelated Regressions (SUR) method. As the wage bill shares on the

[15] As a robustness check, I control for the possibility that the wage-setting process is determined at the industry level by incorporating in the specification relative wages and replacing the country-year fixed effects with year fixed effects.

[16] Country-industry fixed effects are included in the model by deviating all variables from their country-industry means.

left-hand side of the equations add up to one, the estimation of the system is feasible only if one of the equations is eliminated. When both age and skill profiles are considered, I choose to eliminate the equation that corresponds to the oldest low-skilled workers (50+,LS). When only the skill profile or the age profile is considered, I choose to eliminate the equation that corresponds to the low-skilled workers (LS) and the oldest workers (50+), respectively. In order to ensure that the coefficient estimates are invariant to the equation that is eliminated, I iterate the SUR method (ISUR).[17] Estimates for the parameters that are not directly estimated are obtained from the use of the constraints in (3). Their asymptotic standard errors are obtained with the use of the delta method.

As mentioned above, ISUR estimations are predicated upon the assumption that all explanatory variables are exogenous. IT and CT, however, may be endogenous as decisions over the adoption of IT and CT and optimal labour utilisation adjustments are likely to be made simultaneously by the representative firm, thereby leading to a simultaneity bias. By the same token, non-ICT capital may also lead to a simultaneity bias. In order to deal with this issue, I instrument each capital variable using its first and second lags. These instruments are selected on the basis that they are strongly correlated with the instrumented variables and uncorrelated with the error terms (Crinò, 2012). Output may be another source of endogeneity because it is likely to adjust to shocks rather than remain fixed (Egger & Egger, 2005; Hijzen, 2005). Therefore, I treat also output as endogenous and instrument it with its first and second lags.

For the production of the main results, I treat all explanatory variables as endogenous and estimate the system by Iterated Three-Stages Least Squares (I3SLS). The missing values for the first- and second-lagged instrumented variables are replaced with zeros (Arellano & Bond, 1991). In order to account for the relative size of each industry by country, the system of equations is weighted by the industries' shares of employment in country-wide employment in 1982 (Michaels et al., 2014; Graetz & Michaels, 2018).

In addition to the benchmark instrumentation strategy, I implement an alternative one for the non-ICT, IT and CT intensities. The concept of this strategy is that the non-ICT, IT and CT intensities of industries in a given year along with the evolution of telephone line installations and military expenditures of a country could be strong predictors of the future evolution

[17] The iteration of this method guarantees that the coefficient estimates and the residual covariance matrix converge (Berndt & Wood, 1975; Hijzen et al., 2005).

of industry-level non-ICT, IT and CT intensities. Based on this concept, I instrument each of the three variables by interacting its values in the year 1980 with country-level variables for the number of telephone lines per capita and the share of military expenditures in GDP. Data on the two country-level variables are drawn from the World Bank's World Development Indicators. In addition to telephone lines being a type of communication technology which can proxy also for non-ICT advancements (e.g. infrastructure, transport equipment) and for IT advancements (e.g. PCs), military expenditures have often led to the invention and development of information and communication technologies that have been later commercialised. One of the most notable examples is the Advanced Research Projects Agency Network (ARPANET) that was initially funded by the US Department of Defense and developed in the late 1960s. ARPANET was an experimental computer network relying on the packet-switching technology[18] and the first network to implement the protocol suite TCP/IP. Both technologies were later among the rudimentary elements of the Internet (Castells, 2001). Therefore, the aforementioned interaction terms are expected to be correlated with the instrumented variables. The exogeneity of the instruments is ensured for two reasons. First, the values of non-ICT, IT and CT intensities correspond to 1980, a year that precedes the start year of the benchmark sample. Second, the country-level variables used in the interaction terms are unlikely to impact the industry-level wage bill shares of different worker types. In these alternative IV estimations, log output is instrumented with its first and second lags, as in the benchmark IV strategy.

5 Empirical results

I start off the empirical analysis by studying the effects of IT and CT on the skill composition and age composition of labour demand. The results of I3SLS estimations are shown in Panel A of Table 2. The first three columns include the system of wage bill share equations corresponding to the three skill groups of workers, while the last three columns include the system of wage bill share equations corresponding to the three age groups of workers.

[18] Digital network that transmits data that are grouped in packets.

Table 2: IT, CT and worker types by skill and by age

Panel A: Wage bill shares						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.031***	-0.078***	0.046***	0.0050	0.011**	-0.016***
	[0.004]	[0.006]	[0.005]	[0.004]	[0.004]	[0.003]
K	0.0020	-0.0087***	0.0068***	-0.0012	0.0045**	-0.0033**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	0.093***	-0.18***	0.091***	-0.036***	-0.021**	0.057***
	[0.009]	[0.01]	[0.010]	[0.008]	[0.009]	[0.007]
CT	0.019	0.069***	-0.088***	0.095***	-0.010	-0.085***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
Obs		7053			7053	
R^2	0.647	0.524	0.820	0.685	0.530	0.712
F-test H_0: $\beta_{IT} = \beta_{CT}$ (P-value)	0.00123	5.66e-19	1.68e-13	2.68e-10	0.638	2.20e-18
Hansen J statistic		2165.1			819.8	
Instruments	First and second lags of instrumented variables					
Panel B: Employment shares						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Esh	HS	MS	LS	15–29	30–49	50+
ln Y	0.032***	-0.066***	0.034***	0.0027	0.0083*	-0.011***
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]
K	0.0054***	-0.0063***	0.00087	-0.0055***	0.0047***	0.00076
	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	0.083***	-0.17***	0.083***	-0.046***	0.0059	0.040***
	[0.007]	[0.01]	[0.009]	[0.010]	[0.009]	[0.006]
CT	-0.015	0.093***	-0.078***	0.10***	-0.029	-0.076***
	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
Obs		7053			7053	
R^2	0.648	0.650	0.853	0.631	0.548	0.687
Hansen J statistic		2301.2			1017.6	
Instruments	First and second lags of instrumented variables					
Panel C: Employment						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: ln E	HS	MS	LS	15–29	30–49	50+
ln Y	0.53***	0.45***	0.57***	0.65***	0.62***	0.61***
	[0.06]	[0.05]	[0.06]	[0.07]	[0.06]	[0.06]
K	0.045	0.041	0.083***	0.073**	0.094***	0.094***
	[0.03]	[0.03]	[0.03]	[0.04]	[0.04]	[0.03]
IT	0.063	0.064	0.41***	0.35***	0.48***	0.69***
	[0.1]	[0.07]	[0.10]	[0.09]	[0.09]	[0.10]
CT	1.35***	0.34***	0.29	0.67***	0.20	-0.11
	[0.3]	[0.1]	[0.2]	[0.2]	[0.2]	[0.2]
Obs	7053	7053	7053	7053	7053	7053
R^2	0.711	0.681	0.768	0.471	0.479	0.463
Instruments	First and second lags of instrumented variables					
Panel D: Wages						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: ln W	HS	MS	LS	15–29	30–49	50+
ln Y	0.041**	0.028	0.029	0.039**	0.050**	0.040
	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]
K	-0.037***	-0.024*	-0.0053	-0.023**	-0.028**	-0.034**
	[0.01]	[0.01]	[0.02]	[0.010]	[0.01]	[0.02]
IT	0.12***	0.083**	0.042	0.088**	0.047	0.14***
	[0.04]	[0.04]	[0.05]	[0.04]	[0.04]	[0.05]
CT	-0.11	-0.20**	-0.21**	-0.15*	-0.15*	-0.20**
	[0.1]	[0.08]	[0.10]	[0.09]	[0.08]	[0.08]
Obs	7053	7053	7053	7053	7053	7053
R^2	0.936	0.959	0.902	0.952	0.963	0.952
Instruments	First and second lags of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of Panels A and B. Two-Stage Least Squares (2SLS) with robust standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of Panels C and D. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

The positive and statistically significant coefficient estimates of IT in columns (1) and (3) suggest that IT intensity increases the wage bill shares of the high-skilled and low-skilled. The negative and significant coefficient estimate of IT in column (2) suggests that IT intensity decreases the wage bill shares of medium-skilled workers. By contrast, CT intensity increases the wage bill share of the medium-skilled and decreases the wage bill share of the low-skilled, as suggested by the respective coefficient estimates of CT in columns (2) and (3). The coefficient estimate of CT in column (1) suggests that there is no statistically significant effect of CT intensity on the wage bill share of high-skilled workers. Output and non-ICT capital polarise the demand for skill. In particular, output increases the wage bill shares of the high-skilled and low-skilled, and decreases the wage bill share of the medium-skilled. Similarly, non-ICT capital increases the wage bill share of low-skilled workers, while it increases the wage bill share of the medium-skilled. Related to the literature providing evidence on capital complementing more skilled labour (i.e., capital-skill complementarity), my analysis, by decomposing capital into non-ICT, IT and CT, reveals that each of the three skill groups of workers is complementary to at least one of these types of capital.

In columns (1)–(3) of Panel B, I estimate by I3SLS the same system of equations as in the first three columns of Panel A after replacing the wage bill shares with employment shares as the dependent variables, where employment is captured by the hours worked by persons engaged. This way, I aim at identifying whether the effects shown in Panel A operate through employment share adjustments. Panel B reveals that the effects of IT and CT on the employment shares of workers differing in skill are very similar qualitatively and quantitatively to the effects of the two types of technologies on their wage bill shares, implying that part of their wage bill share adjustments is accounted for by employment share adjustments.

Given, though, that Panel B shows evidence on the *relative* employment adjustments of these worker types to changes in IT and CT intensities, in Panels C and D, I provide suggestive evidence on the underlying mechanisms of the effects shown in Panel A by making 2SLS estimations of employment and wage equations. The dependent variable in the equations of these two panels is the logged employment level and the logged real hourly wage, respectively, of each worker type. Employment is captured by hours worked by each worker type, while the real hourly wage is calculated as the ratio of the wage bill of each worker type to its total hours worked. My IV strategy in these estimations is identical to the one implemented in I3SLS. That is, I treat all explanatory variables as endogenous and I instrument each with its first and second lags. The results in the first three columns of the two panels suggest that the increase in the employment level of low-skilled workers and the larger increase in the wage of high-skilled workers compared to the medium-skilled induced by IT explain the effects of this type of technologies on the wage bill shares of the three skill groups. The effects of CT on their wage bill shares seem to be explained by the increase in the wages of high-skilled and medium-skilled workers and the decrease of similar magnitude in the employment levels of the medium-skilled and low-skilled that are induced by this type of technologies.

Focusing on the three different age groups of workers, the negative and significant coefficient estimates of IT in columns (4) and (5) of Panel A suggest that IT intensity decreases the wage bill shares of the youngest and middle-aged workers. The wage bill share of the oldest workers increase with IT intensity, as suggested by its positive and significant coefficient estimate in column (6). By contrast, the coefficient estimates of CT in columns (4) and (6) suggest that CT intensity increases the wage bill share of the youngest, while it decreases the wage bill share of the oldest. CT intensity exerts no statistically significant effect on the wage bill share of the middle-aged as the respective coefficient estimate is statistically insignificant at all conventional levels (column 5). Output and non-ICT capital are biased against the oldest and in favour of the middle-aged as they decrease the wage bill share of the first worker type and increase the wage bill share of the second. According to columns (4)–(6) of Panel B, the effects of IT and CT on the employment shares of workers differing in age are very similar qualitatively and quantitatively to the effects of the two types of technologies on their wage bill shares, implying that the wage bill share adjustments are partly accounted for by employment share adjustments. Identifying the possible underlying mechanisms of the wage bill share adjustments, columns (4)–(6) of Panels C and D suggest that the effects of IT on the wage bill shares of different age groups are explained by the larger increase in the employment level and wage of the oldest workers induced by this type of technologies compared to younger workers. Also, the increase in the employment level of the youngest and the decrease of smaller magnitude in the wage of the oldest compared to younger workers that are induced by CT seem to explain the effects of this type of technologies on the wage bill shares of the three age groups.

The first-stage results of the I3SLS and 2SLS estimations suggest that the IV strategy that I implement is successful. In particular, the instruments are correlated with the instrumented variables as the coefficient estimates of the majority of these are statistically significant, the

F-statistic is above 10 and its p-value lower than 10%, and the R-squared value is relatively high. The IV strategy is also successful in all subsequent tables where I make I3SLS or 2SLS estimations.[19] The test for over-identifying restrictions should be treated with caution in Table 2 and in subsequent tables as the Hansen J statistic is relatively high.[20]

As IT and CT exert opposite effects on the wage bill shares of the medium-skilled, the low-skilled, the youngest, and the oldest, I am also interested in identifying the net effects. To this end, I first confirm that the coefficient estimates of the two key explanatory variables in the corresponding columns are statistically different from each other so that their magnitudes can be compared.[21] Then, I calculate the standard deviations of IT and CT on the whole sample and multiply each of these with the respective coefficient estimates of Table 2. Table B1 reveals that the effect of IT intensity dominates the effect of CT intensity in all cases. For instance, an increase of one standard deviation in the ratio of IT capital stock to value added results in a decrease of roughly 0.02 in the wage bill share of the medium-skilled. By contrast, the wage bill share of the same worker type increases by roughly 0.002 due to an increase of one standard deviation in the ratio of CT capital stock to value added. The economic magnitudes of the rest of the effects are interpreted similarly. Consequently, the net effect of IT and CT intensities on the wage bill share of the medium-skilled is negative, while the net effect on the wage bill share of the low-skilled is positive. These results, in addition to the positive effect of IT on the wage bill share of the high-skilled, point to the polarisation of the demand for skill. This is in line with the recent studies that lump IT and CT together and find that ICT lead to skill polarisation (Michaels et al., 2014; Blanas et al., 2018). In addition, while the net effect of IT and CT intensities on the wage bill share of the youngest is negative, the net effect on the wage bill share of the oldest is positive. The second result challenges the evidence of earlier studies on ICT being biased against workers aged above 50 (Aubert et al., 2006; Behaghel et al., 2014). It is, however, in line with Blanas et al. (2018) who show that ICT increase the relative demand for the oldest. Also, Blanas et al. (2018)

[19] The first-stage results of the estimations in Table 2 and in all subsequent tables are available upon request.

[20] As shown at the bottom of Table 2, the Hansen J statistic of the first system of equations is 2165.1, while the Hansen J statistic of the second system is 819.8. Either statistic is above the respective degrees of freedom of the system: Degrees of freedom of the system of equations in columns (1)–(3) = G * m - k = 97, where G: number of simultaneous regressions (3), m: number of instruments (35), k: number of endogenous variables (8); Degrees of freedom of the system of equations in columns (4)–(6) = G * m - k = 97, where G = 3, m = 35, k = 8. In estimations where each explanatory variable is instrumented only with its first lag, the Hansen J statistic becomes smaller, albeit is still greater than the respective degrees of freedom of the system (Table 2 Vs Table C1).

[21] The p-value of the relevant F-test is below 10% in each of the four columns, implying that the coefficient estimates of IT and CT are indeed statistically different from each other.

find a positive, rather than a negative, effect of ICT on the wage bill share of the youngest, albeit this becomes insignificant in some sub-periods that are examined. Provided that the faster growth rates of IT intensity of the period 1982–2005 have occurred also since 2005, the aforementioned net effects of IT and CT intensities may have continued to operate post-2005.

Thus far, I have identified the effects of IT and CT on the skill composition of labour demand unconditional on age, and on the age composition of labour demand unconditional on skill. In Panel A of Table B2, I estimate three systems of wage bill share equations corresponding to workers differing in skill within each age group. Similarly, in Panel B, I estimate three systems of wage bill share equations corresponding to workers differing in age within each skill group. The results in the two panels suggest that the effects of the two types of technologies on the skill composition of labour demand within each age group are very similar to those identified when age is not accounted for, and that the effects of IT and CT on the age composition of labour demand within each skill group are very similar to those identified when skill is not accounted for.

Extending the analysis further, I study the effects of IT and CT on the age-skill composition of labour demand, that is, how these two types of technologies lead to inequalities among workers differing in age and skill. To this end, I estimate system (2) that comprises nine wage bill share equations, one per worker type. The results are shown in Panel A of Table 3. The coefficient estimates of IT suggest that IT intensity increases the wage bill shares of high-skilled and low-skilled workers of all age profiles (columns 1, 3, 4, 6, 7, and 9), while it decreases the wage bill shares of the medium-skilled of all age profiles (columns 2, 5, and 8). By contrast, CT intensity increases the wage bill shares of the youngest and middle-aged medium-skilled (columns 2 and 5) and decreases the wage bill shares of the middle-aged and oldest low-skilled (columns 6 and 9). Also, CT intensity increases the wage bill shares of the youngest high-skilled and low-skilled (columns 1 and 3). Output increases the wage bill shares of the older high-skilled and low-skilled and decreases the wage bill shares of all the rest. Non-ICT capital increases the wage bill shares of the older high-skilled and the youngest low-skilled, while it decreases the wage bill shares of the youngest high-skilled and the youngest and oldest medium-skilled.[22]

[22] Same as in Table 2, the test for over-identifying restrictions in the estimations of Panel A of Table 3 should be treated with caution as the Hansen J statistic is relatively high. In estimations where each explanatory variable is instrumented only with its first lag, the Hansen J statistic becomes smaller, albeit is still greater than the respective degrees of freedom of the system (Table C2).

Table 3: IT, CT and worker types by age-skill

Panel A: Wage bill shares									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0025*	-0.016***	0.023***	0.029***	-0.033***	0.015***	0.0053***	-0.028***	0.0075***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0036***	-0.0040***	0.0064***	0.0043***	0.00065	-0.00045	0.0012*	-0.0054***	0.00086
	[0.0005]	[0.002]	[0.0009]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0009]	[0.0007]
IT	0.014***	-0.059***	0.0093**	0.053***	-0.12***	0.042***	0.026***	-0.0078*	0.039***
	[0.003]	[0.008]	[0.004]	[0.008]	[0.009]	[0.007]	[0.004]	[0.004]	[0.004]
CT	0.034***	0.027*	0.034***	-0.0029	0.051***	-0.059***	-0.012	-0.0096	-0.063***
	[0.005]	[0.02]	[0.009]	[0.02]	[0.02]	[0.01]	[0.007]	[0.009]	[0.007]
Obs					7053				
R^2	0.300	0.543	0.677	0.541	0.556	0.731	0.629	0.796	0.641
F-test H_0: $\beta_{IT} = \beta_{CT}$ (P-value)	0.00199	0.00000471	0.0230	0.00218	9.62e-15	6.65e-09	0.0000296	0.872	5.06e-32
Hansen J statistic					5563.5				
Instruments					First and second lags of instrumented variables				

Panel B: Employment shares									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Esh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.0010	-0.016***	0.018***	0.028***	-0.027***	0.0078**	0.0034***	-0.023***	0.0081***
	[0.001]	[0.004]	[0.002]	[0.003]	[0.004]	[0.003]	[0.001]	[0.002]	[0.002]
K	-0.0022***	-0.0036**	0.00034	0.0063***	0.00031	-0.0019	0.0013**	-0.0030***	0.0024***
	[0.0005]	[0.002]	[0.0010]	[0.001]	[0.001]	[0.001]	[0.0005]	[0.0008]	[0.0008]
IT	0.020***	-0.062***	-0.0046	0.044***	-0.085***	0.047***	0.019***	-0.020***	0.041***
	[0.002]	[0.009]	[0.005]	[0.006]	[0.008]	[0.007]	[0.003]	[0.004]	[0.004]
CT	0.023***	0.052***	0.030***	-0.028**	0.048***	-0.049***	-0.0098*	-0.0066	-0.059***
	[0.005]	[0.02]	[0.01]	[0.01]	[0.02]	[0.01]	[0.005]	[0.008]	[0.008]
Obs					7053				
R^2	0.358	0.499	0.676	0.568	0.678	0.745	0.608	0.820	0.700
Hansen J statistic					5036.8				
Instruments					First and second lags of instrumented variables				

Panel C: Employment									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: ln E	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.54***	0.52***	0.67***	0.51***	0.45***	0.56***	0.53***	0.43***	0.56***
	[0.09]	[0.06]	[0.08]	[0.06]	[0.05]	[0.06]	[0.06]	[0.05]	[0.06]
K	-0.00090	0.043	0.046	0.059*	0.041	0.088***	0.043	0.015	0.099***
	[0.05]	[0.03]	[0.04]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]
IT	-0.13	0.023	0.62***	0.040	0.035	0.32***	-0.091	0.31***	0.51***
	[0.2]	[0.09]	[0.1]	[0.1]	[0.08]	[0.1]	[0.2]	[0.09]	[0.1]
CT	2.34***	0.59***	0.58**	1.14***	0.15	0.36	1.29***	0.10	-0.26
	[0.6]	[0.2]	[0.2]	[0.3]	[0.1]	[0.2]	[0.3]	[0.2]	[0.3]
Obs	7053	7053	7053	7053	7053	7053	7053	7053	7053
R^2	0.384	0.507	0.562	0.710	0.777	0.819	0.460	0.752	0.608
Instruments					First and second lags of instrumented variables				

Panel D: Wages									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: ln W	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.051**	0.019	0.019	0.028	0.036	0.033	0.046*	0.015	-0.0067
	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]	[0.03]
K	-0.019*	-0.028**	-0.011	-0.044***	-0.020	-0.0047	-0.029**	-0.029	-0.024
	[0.01]	[0.01]	[0.02]	[0.010]	[0.01]	[0.02]	[0.01]	[0.02]	[0.02]
IT	0.095**	-0.030	0.097*	0.044	0.032	-0.025	0.26***	0.16***	0.067
	[0.05]	[0.04]	[0.05]	[0.05]	[0.04]	[0.06]	[0.06]	[0.05]	[0.06]
CT	0.025	-0.21**	-0.10	-0.083	-0.13	-0.18**	0.17	-0.23***	-0.19*
	[0.1]	[0.09]	[0.1]	[0.1]	[0.09]	[0.09]	[0.1]	[0.07]	[0.1]
Obs	7053	7053	7053	7053	7053	7053	7053	7053	7053
R^2	0.882	0.948	0.831	0.932	0.955	0.890	0.834	0.939	0.912
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in Panels A and B. Two-Stage Least Squares (2SLS) with robust standard errors in square brackets in Panels C and D. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Estimating a system of nine employment share equations by I3SLS, I show in Panel B that the effects of IT and CT on the employment shares of workers differing in age and skill bear a very close resemblance in qualitative and quantitative terms to the effects shown in Panel A. Hence, their employment share adjustments partly account for their wage bill share adjustments to IT and CT intensities. According to the results of I2SLS estimations of employment and wage equations in Panels C and D of Table 3, I find that the effects of IT identified in Panel A are explained by this type of technologies leading to relatively large increases in the employment levels of the low-skilled of all age profiles and to relatively large increases in the wages of the youngest high-skilled and low-skilled and of the oldest high-skilled. Regarding the effects of CT identified in Panel A, these are explained by the relatively large increases in the employment levels of the youngest high-skilled and medium-skilled and the decreases of similar magnitude in the wages of the middle-aged and oldest low-skilled workers that are induced by this type of technologies.

As IT and CT intensities exert opposite effects on the wage bill shares of the youngest and middle-aged medium-skilled and of the middle-aged and oldest low-skilled, I identify their net effects by doing the same exercise as in Table 2. After confirming that the coefficient estimates of the two key explanatory variables are statistically different from each other in the corresponding columns and their magnitudes can be compared,[23] I multiply the standard deviations of IT and CT on the whole sample with their respective coefficient estimates in Table 3 in order to obtain the economic magnitude of each effect. The effect of IT intensity dominates the effect of CT intensity in all cases, as shown in Table B3. For instance, while an increase of one standard deviation in the ratio of IT capital stock leads to a decrease of roughly 0.003 in the wage bill share of the youngest medium-skilled, an increase of one standard deviation in the ratio of CT capital stock leads to an increase of roughly 0.00085 in the wage bill share of the same worker type. The interpretation of the economic magnitudes of the rest of the effects is similar. Consequently, the net effects of IT and CT intensities on the wage bill shares of the youngest and middle-aged medium-skilled are negative, while the net effects of the two types of technologies on the wage bill shares of the middle-aged and oldest low-skilled are positive. These net effects are likely to be in operation post-2005, if the faster growth rates of IT intensity over 1982–2005 have taken place also since 2005.

[23] The p-values of the relevant F-tests, shown at the bottom of Table 3, are below 10%.

Heterogeneous effects of IT and CT across sub-periods, sectors, countries

Having discussed the main results, in the next two tables I look into heterogeneous effects of IT and CT between different sub-periods. The reason for this exercise is the unprecedented high rate at which IT and CT developed and expanded every year over the last decades, including over 1982–2005, as shown in Figure 4. For instance, the processing and storage capacities of personal computers (PCs) in the 2000s were much greater than the processing and storage capacities of PCs in the 1990s, which, in turn, were much greater than those in the 1980s. In addition, the operating systems on which PCs have run since the mid-1990s (e.g. launch of Windows 95 and all subsequent versions) have been much more user-friendly than the operating systems on which PCs ran in the 1980s (e.g. MS-DOS, IBM PC DOS). These are two of the reasons for which PCs have become highly commercialised and been used *en masse* for personal and professional purposes. Similarly, data networks (i.e., intranet) were better customised to business needs and operations in the 2000s than data networks in the 1990s, which, in turn, were themselves better customised to business needs and operations than those available in the 1980s.

For the purpose of this exercise, I create dummy variables for different year bins within the sample period 1982–2005 which I, then, interact with IT and CT intensities in wage bill share equations. As IT and CT intensities are treated as endogenous, they are instrumented with their first and second lags also when they are in the interaction terms. In Panel A of Tables 4 and 5, I use dummies for 8-year bins (i.e., 1982–1989, 1990–1997, 1998–2005) where the first 8-year bin is the reference group. In Panel B of the two tables, I use dummies for 4-year bins (i.e., 1982–1985, 1986–1989, 1990–1993, 1994–1997, 1998–2001, 2002–2005) where the reference group is the first 4-year bin. The dummies for the year bins do not enter the model individually as they are captured by the fixed effects. I start with the analysis of heterogeneous effects of IT and CT between different sub-periods on the skill composition and age composition of labour demand. The coefficient estimates of IT and CT in Panel A of Table 4 suggest that neither IT intensity nor CT intensity exert statistically significant effects on the wage bill shares of different skill groups prior to 1990. Similarly, CT intensity exerts no statistically significant effects on the wage bill shares of different age groups in the same sub-period. The only statistically significant effects over this sub-period are exerted by IT intensity on the wage bill shares of different age groups. In line with the main results, IT intensity increases the wage bill share of the oldest and decreases the wage bill share of the middle-aged prior to 1990.

Table 4: Heterogeneous effects by skill and by age across sub-periods

Panel A: IT and CT interacted with 8-year bins						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.029***	-0.076***	0.047***	0.0050	0.0076	-0.013***
	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
K	0.0018	-0.0085***	0.0067***	-0.0012	0.0045**	-0.0033**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	-0.018	-0.068	0.086	0.12	-0.28***	0.17***
	[0.08]	[0.1]	[0.09]	[0.08]	[0.09]	[0.06]
CT	-0.031	0.042	-0.011	0.013	-0.014	0.00081
	[0.03]	[0.03]	[0.03]	[0.02]	[0.03]	[0.02]
IT * D_1990-1997	0.22***	-0.25***	0.029	-0.11	0.21***	-0.10**
	[0.07]	[0.09]	[0.08]	[0.07]	[0.07]	[0.05]
IT * D_1998-2005	0.11	-0.12	0.0031	-0.14*	0.25***	-0.11*
	[0.08]	[0.1]	[0.09]	[0.07]	[0.08]	[0.06]
CT * D_1990-1997	0.0046	0.015	-0.020**	0.018**	0.0043	-0.022***
	[0.008]	[0.01]	[0.009]	[0.008]	[0.008]	[0.006]
CT * D_1998-2005	0.025***	0.011	-0.036***	0.039***	0.0073	-0.046***
	[0.009]	[0.01]	[0.010]	[0.008]	[0.009]	[0.007]
Obs		7053			7053	
R^2	0.649	0.526	0.821	0.687	0.532	0.715
Hansen J statistic		2218.5			811.5	
Instruments		First and second lags of instrumented variables				
Panel B: IT and CT interacted with 4-year bins						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.027***	-0.075***	0.048***	0.0052	0.0054	-0.011***
	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
K	0.0015	-0.0085***	0.0070***	-0.0011	0.0045**	-0.0034***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	-0.20	-0.038	0.24	0.074	-0.58***	0.51***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
CT	-0.042	0.031	0.011	0.0048	-0.012	0.0076
	[0.03]	[0.04]	[0.03]	[0.03]	[0.03]	[0.02]
IT * D_1986-1989	0.27	-0.12	-0.16	0.083	0.26	-0.34***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
IT * D_1990-1993	0.39**	-0.25	-0.14	0.053	0.38**	-0.44***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
IT * D_1994-1997	0.45**	-0.34	-0.10	-0.099	0.52***	-0.42***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
IT * D_1998-2001	0.37**	-0.23	-0.14	-0.097	0.55***	-0.45***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
IT * D_2002-2005	0.28	-0.13	-0.15	-0.100	0.55***	-0.45***
	[0.2]	[0.2]	[0.2]	[0.2]	[0.2]	[0.1]
CT * D_1986-1989	0.0080	0.0077	-0.016	0.0072	0.0039	-0.011
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.008]
CT * D_1990-1993	0.011	0.014	-0.025**	0.019*	0.0025	-0.022***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.008]
CT * D_1994-1997	0.0085	0.027*	-0.035***	0.025**	0.0088	-0.034***
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.009]
CT * D_1998-2001	0.022*	0.025	-0.047***	0.041***	0.0028	-0.044***
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.009]
CT * D_2002-2005	0.038***	0.010	-0.049***	0.046***	0.016	-0.062***
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.009]
Obs		7053			7053	
R^2	0.651	0.529	0.821	0.687	0.533	0.716
Hansen J statistic		2123.5			843.7	
Instruments		First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table 5: Heterogeneous effects by age-skill across sub-periods

Panel A: IT and CT interacted with 8-year bins									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0028**	-0.015***	0.023***	0.026***	-0.034***	0.016***	0.0056***	-0.027***	0.0084***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]
K	-0.0036***	-0.0039***	0.0064***	0.0043***	0.00074	-0.00058	0.0012	-0.0053***	0.00091
	[0.0005]	[0.002]	[0.0009]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0009]	[0.0007]
IT	0.057**	0.049	0.0095	-0.10	-0.25***	0.072	0.026	0.14***	0.0042
	[0.02]	[0.07]	[0.04]	[0.07]	[0.08]	[0.06]	[0.03]	[0.04]	[0.03]
CT	0.0040	-0.010	0.019	-0.045**	0.055**	-0.024	0.011	-0.0025	-0.0072
	[0.008]	[0.02]	[0.01]	[0.02]	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]
IT * D_1990-1997	-0.0042	-0.11*	0.0044	0.20***	-0.0040	0.013	0.019	-0.13***	0.012
	[0.02]	[0.06]	[0.03]	[0.06]	[0.07]	[0.06]	[0.03]	[0.03]	[0.03]
IT * D_1998-2005	-0.039*	-0.10	0.00092	0.15**	0.13*	-0.029	-0.00034	-0.14***	0.031
	[0.02]	[0.07]	[0.04]	[0.07]	[0.08]	[0.06]	[0.03]	[0.04]	[0.03]
CT * D_1990-1997	0.0059**	0.0047	0.0073*	0.0027	0.012	-0.010	-0.0040	-0.0017	-0.017***
	[0.002]	[0.007]	[0.004]	[0.007]	[0.008]	[0.006]	[0.003]	[0.004]	[0.003]
CT * D_1998-2005	0.015***	0.018**	0.0062	0.022***	-0.00014	-0.015**	-0.012***	-0.0068	-0.028***
	[0.003]	[0.008]	[0.004]	[0.007]	[0.009]	[0.007]	[0.004]	[0.004]	[0.004]
Obs					7053				
R^2	0.307	0.544	0.677	0.543	0.558	0.732	0.630	0.798	0.645
Hansen J statistic					5512.9				
Instruments					First and second lags of instrumented variables				
Panel B: IT and CT interacted with 4-year bins									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0032**	-0.015***	0.023***	0.025***	-0.035***	0.016***	0.0059***	-0.026***	0.0090***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]
K	-0.0037***	-0.0038**	0.0064***	0.0040***	0.00085	-0.00040	0.0011	-0.0055***	0.0010
	[0.0005]	[0.002]	[0.0009]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0009]	[0.0007]
IT	-0.046	0.027	0.092	-0.21	-0.45**	0.074	0.057	0.38***	0.070
	[0.06]	[0.2]	[0.09]	[0.2]	[0.2]	[0.1]	[0.08]	[0.09]	[0.07]
CT	-0.00056	-0.0088	0.014	-0.049**	0.045	-0.0088	0.0069	-0.0050	0.0057
	[0.008]	[0.02]	[0.01]	[0.02]	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]
IT * D_1986-1989	0.14***	0.030	-0.087	0.16	0.092	0.0045	-0.029	-0.24***	-0.073
	[0.05]	[0.1]	[0.08]	[0.1]	[0.2]	[0.1]	[0.07]	[0.08]	[0.06]
IT * D_1990-1993	0.14***	-0.0091	-0.080	0.26*	0.088	0.034	-0.017	-0.32***	-0.097
	[0.05]	[0.1]	[0.08]	[0.1]	[0.2]	[0.1]	[0.07]	[0.08]	[0.07]
IT * D_1994-1997	0.093*	-0.12	-0.071	0.36**	0.15	0.0041	-0.0060	-0.38***	-0.036
	[0.05]	[0.1]	[0.09]	[0.1]	[0.2]	[0.1]	[0.07]	[0.08]	[0.07]
IT * D_1998-2001	0.082	-0.099	-0.080	0.32**	0.26	-0.029	-0.029	-0.39***	-0.034
	[0.05]	[0.2]	[0.09]	[0.2]	[0.2]	[0.1]	[0.07]	[0.09]	[0.07]
IT * D_2002-2005	0.061	-0.079	-0.081	0.25	0.33*	-0.032	-0.030	-0.38***	-0.035
	[0.05]	[0.2]	[0.09]	[0.2]	[0.2]	[0.1]	[0.08]	[0.09]	[0.07]
CT * D_1986-1989	0.0034	-0.0011	0.0050	0.0027	0.0081	-0.0069	0.0019	0.00075	-0.014***
	[0.003]	[0.009]	[0.005]	[0.009]	[0.01]	[0.009]	[0.005]	[0.005]	[0.004]
CT * D_1990-1993	0.0064*	0.0025	0.010*	0.0050	0.011	-0.013	0.000038	0.00035	-0.022***
	[0.003]	[0.010]	[0.006]	[0.009]	[0.01]	[0.009]	[0.005]	[0.006]	[0.005]
CT * D_1994-1997	0.0095***	0.0051	0.010*	0.0038	0.023**	-0.018**	-0.0048	-0.0020	-0.027***
	[0.003]	[0.01]	[0.006]	[0.010]	[0.01]	[0.009]	[0.005]	[0.006]	[0.005]
CT * D_1998-2001	0.016***	0.018*	0.0077	0.014	0.011	-0.022**	-0.0076	-0.0037	-0.033***
	[0.004]	[0.01]	[0.006]	[0.01]	[0.01]	[0.010]	[0.005]	[0.006]	[0.005]
CT * D_2002-2005	0.018***	0.016	0.011*	0.033***	0.0028	-0.019*	-0.013**	-0.0088	-0.040***
	[0.004]	[0.01]	[0.006]	[0.01]	[0.01]	[0.010]	[0.005]	[0.006]	[0.005]
Obs					7053				
R^2	0.311	0.545	0.677	0.546	0.559	0.732	0.630	0.798	0.646
Hansen J statistic					5519.4				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

The coefficient estimates of the interaction terms suggest that IT intensity increases the wage bill shares of the high-skilled and decreases the wage bill shares of the medium-skilled during the period 1990–1997, but these effects disappear from 1998 onwards. In addition, IT intensity decreases the wage bill share of the middle-aged in both 1990–1997 and 1998–2005, albeit less than prior to 1990, as the respective coefficient estimates are positive and significant but of smaller size than the negative and significant coefficient estimate of the non-interacted IT. The wage bill share of the youngest also decreases with IT intensity over 1998–2005. By contrast, IT intensity increases the wage bill share of the oldest in both 1990–1997 and 1998–2005, albeit less than prior to 1990, as the respective coefficient estimates are negative and significant but of smaller size than the positive and significant coefficient estimate of the non-interacted IT. CT intensity decreases the wage bill share of the low-skilled in both 1990–1997 and 1998–2005 and increases the wage bill share of the high-skilled only as of 1998. In addition, CT intensity increases the wage bill share of the youngest and decreases the wage bill share of the oldest in both 1990–1997 and 1998–2005.

The analysis in Panel A reveals that the effects of IT and CT on the skill composition and age composition of labour demand that I identify for the whole sample period are mostly driven by the post-1990 period. This is also confirmed by estimations in which I consider shorter sub-periods. Indeed, the coefficient estimates of non-interacted IT and CT and of their interactions with dummies for 4-year bins in Panel B suggest that there is only one statistically significant effect over 1986–1989 and only two prior to 1986, while the majority of the effects, that are in line with the main results, are identified for the post-1990 period.

Same as in the analysis in the previous table, Panel A of Table 5 reveals that there are very few statistically significant effects of IT and CT on the age-skill composition of labour demand prior to 1990. Instead, the majority of the effects that I identify for the whole sample period are accounted for by effects identified for the post-1990 sub-periods. In particular, the coefficient estimates in Panel A suggest that the negative effect of IT intensity on the wage bill share of the youngest medium-skilled is identified only for the period 1990–1997, while the negative effect of IT intensity on the wage bill share of the oldest medium-skilled is identified only for the periods 1990–1997 and 1998–2005. Also, CT intensity increases the wage bill share of the youngest high-skilled only for the periods 1990–1997 and 1998–2005, while it increases the wage bill share of the youngest medium-skilled only for the post-1998 period. Similarly, the negative effect of CT intensity on the wage bill share of the oldest low-skilled is identified only for the periods 1990–1997 and 1998–2005, while its negative effect on the wage bill share of the middle-aged low-skilled is identified only for the post-1998 period.

Table 6: Heterogeneous effects by skill and by age across sectors and across countries

Panel A: IT and CT interacted with sector dummies						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.028***	-0.067***	0.038***	0.0025	0.016***	-0.018***
	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
K	0.00089	-0.0065***	0.0056***	-0.0016	0.0069***	-0.0053***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	-0.12	1.13***	-1.01***	-0.21**	0.90***	-0.69***
	[0.1]	[0.1]	[0.1]	[0.09]	[0.1]	[0.07]
CT	0.67*	1.26**	-1.94***	0.046	-1.32***	1.28***
	[0.4]	[0.5]	[0.4]	[0.4]	[0.4]	[0.3]
IT * D_mining	0.0016	-1.02***	1.02***	0.011	-0.73***	0.72***
	[0.1]	[0.2]	[0.1]	[0.1]	[0.1]	[0.10]
IT * D_manufacturing	0.17*	-1.19***	1.03***	0.091	-0.75***	0.66***
	[0.10]	[0.1]	[0.1]	[0.09]	[0.1]	[0.07]
IT * D_services	0.19*	-1.28***	1.09***	0.19**	-0.93***	0.74***
	[0.10]	[0.1]	[0.1]	[0.09]	[0.1]	[0.07]
IT * D_utilities	0.15	-1.26***	1.11***	0.19**	-0.91***	0.72***
	[0.1]	[0.1]	[0.1]	[0.10]	[0.1]	[0.08]
IT * D_construct	-0.55***	-0.58***	1.13***	0.58***	-1.22***	0.64***
	[0.1]	[0.1]	[0.1]	[0.1]	[0.1]	[0.08]
CT * D_mining	-0.24	-1.64***	1.89***	0.22	0.98*	-1.20***
	[0.5]	[0.6]	[0.5]	[0.5]	[0.5]	[0.4]
CT * D_manufacturing	-0.72*	-0.75	1.47***	0.33	0.60	-0.94***
	[0.4]	[0.5]	[0.4]	[0.4]	[0.4]	[0.3]
CT * D_services	-0.65*	-1.20**	1.85***	0.038	1.33***	-1.37***
	[0.4]	[0.5]	[0.4]	[0.4]	[0.4]	[0.3]
CT * D_utilities	-0.53	-1.12**	1.65***	0.015	1.31***	-1.33***
	[0.4]	[0.5]	[0.4]	[0.4]	[0.4]	[0.3]
CT * D_construct	-1.20***	-0.49	1.69***	0.11	1.26***	-1.37***
	[0.4]	[0.5]	[0.4]	[0.4]	[0.4]	[0.3]
Obs		7053			7053	
R^2	0.660	0.545	0.825	0.690	0.551	0.723
Hansen J statistic		992.2			2600.3	
Instruments	First and second lags of instrumented variables					
Panel B: IT and CT interacted with country-wide union density						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.029***	-0.074***	0.045***	0.0056	0.015***	-0.020***
	[0.005]	[0.007]	[0.005]	[0.005]	[0.006]	[0.004]
K	0.0012	-0.0052*	0.0040*	-0.0011	0.0058***	-0.0046***
	[0.002]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
IT	0.13***	-0.25***	0.12***	-0.16***	-0.047**	0.21***
	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
CT	0.050**	0.11***	-0.16***	0.12***	0.048*	-0.17***
	[0.03]	[0.03]	[0.03]	[0.02]	[0.03]	[0.02]
IT * UD	-0.12***	0.079	0.037	0.31***	0.039	-0.35***
	[0.04]	[0.06]	[0.05]	[0.04]	[0.05]	[0.03]
CT * UD	-0.15***	0.013	0.13**	0.0076	-0.24***	0.23***
	[0.06]	[0.08]	[0.06]	[0.06]	[0.06]	[0.04]
Obs		6063			6063	
R^2	0.644	0.532	0.840	0.651	0.464	0.714
Hansen J statistic		2647.3			1255.3	
Instruments	First and second lags of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table 7: Heterogeneous effects by age-skill across sectors and across countries

Panel A: IT and CT interacted with sector dummies									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0020	-0.016***	0.021***	0.028***	-0.022***	0.0096***	0.0023	-0.029***	0.0080***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0036***	-0.0038**	0.0058***	0.0038**	0.0031*	-0.000011	0.00075	-0.0059***	-0.00022
	[0.0005]	[0.002]	[0.0009]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0009]	[0.0007]
IT	-0.10***	0.16*	-0.26***	0.078	1.23***	-0.41***	-0.094**	-0.25***	-0.34***
	[0.03]	[0.08]	[0.05]	[0.08]	[0.10]	[0.08]	[0.04]	[0.05]	[0.04]
CT	0.061	0.23	-0.25	0.71**	0.64*	-2.67***	-0.10	0.39**	0.98***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.1]
IT * D_mining	0.0055	-0.26**	0.27***	-0.042	-1.08***	0.38***	0.038	0.32***	0.37***
	[0.04]	[0.1]	[0.07]	[0.1]	[0.1]	[0.1]	[0.05]	[0.06]	[0.05]
IT * D_manufacturing	0.11***	-0.24***	0.23***	-0.010	-1.18***	0.44***	0.071*	0.22***	0.36***
	[0.03]	[0.08]	[0.05]	[0.08]	[0.09]	[0.08]	[0.04]	[0.05]	[0.04]
IT * D_services	0.11***	-0.20**	0.28***	-0.040	-1.33***	0.45***	0.12***	0.25***	0.37***
	[0.03]	[0.08]	[0.05]	[0.08]	[0.09]	[0.08]	[0.04]	[0.05]	[0.04]
IT * D_utilities	0.083***	-0.21**	0.32***	-0.037	-1.31***	0.43***	0.10**	0.26***	0.35***
	[0.03]	[0.09]	[0.05]	[0.09]	[0.1]	[0.08]	[0.04]	[0.05]	[0.04]
IT * D_construct	0.045	0.080	0.45***	-0.46***	-1.03***	0.26***	-0.14***	0.37***	0.42***
	[0.03]	[0.09]	[0.05]	[0.09]	[0.1]	[0.09]	[0.04]	[0.05]	[0.04]
CT * D_mining	0.18	-0.41	0.46*	-0.68	-0.68	2.34***	0.26	-0.55**	-0.91***
	[0.1]	[0.4]	[0.2]	[0.4]	[0.5]	[0.4]	[0.2]	[0.2]	[0.2]
CT * D_manufacturing	0.085	-0.017	0.27	-0.87***	-0.52	1.99***	0.069	-0.22	-0.79***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.2]
CT * D_services	-0.031	-0.21	0.28	-0.71**	-0.58	2.62***	0.089	-0.41**	-1.05***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.1]
CT * D_utilities	-0.040	-0.16	0.22	-0.57*	-0.61	2.50***	0.086	-0.35*	-1.07***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.2]
CT * D_construct	-0.035	-0.19	0.34*	-1.05***	-0.16	2.47***	-0.11	-0.15	-1.12***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.2]
Obs					7053				
R^2	0.308	0.546	0.686	0.551	0.580	0.741	0.641	0.801	0.661
Hansen J statistic					6835.2				
Instruments					First and second lags of instrumented variables				
Panel B: IT and CT interacted with country-wide union density									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0019	-0.020***	0.028***	0.026***	-0.023***	0.012***	0.0057***	-0.031***	0.0050**
	[0.001]	[0.005]	[0.003]	[0.004]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
K	-0.0035***	-0.0045**	0.0069***	0.0040**	0.0043**	-0.0025	0.00072	-0.0049***	-0.00043
	[0.0006]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.0008]	[0.001]	[0.0008]
IT	0.0061	-0.15***	-0.011	0.046***	-0.15***	0.059***	0.074***	0.054***	0.077***
	[0.006]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]	[0.009]	[0.01]	[0.009]
CT	0.040***	0.040*	0.041***	0.034	0.11***	-0.093***	-0.024**	-0.036***	-0.11***
	[0.007]	[0.02]	[0.01]	[0.02]	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]
IT * UD	0.012	0.20***	0.097***	-0.020	0.032	0.028	-0.11***	-0.15***	-0.087***
	[0.01]	[0.04]	[0.02]	[0.04]	[0.05]	[0.04]	[0.02]	[0.02]	[0.02]
CT * UD	-0.036**	0.067	-0.024	-0.16***	-0.14**	0.057	0.047**	0.085***	0.099***
	[0.02]	[0.05]	[0.03]	[0.05]	[0.06]	[0.05]	[0.02]	[0.03]	[0.02]
Obs					6063				
R^2	0.255	0.490	0.680	0.499	0.553	0.746	0.624	0.805	0.668
Hansen J statistic					8483.3				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Although the development and expansion of IT and CT have taken place at an unprecedented rate in recent decades, the adoption rate of the two types of technologies differs across sectors and industries, as shown in Panel B of Table A2. In order to identify potential heterogeneous effects of IT and CT across sectors, I first split the economy in agriculture, mining, manufacturing, services, utilities, and construction.[24] Then, I estimate systems of wage bill share equations for different worker types augmented with interaction terms of IT and CT intensities with dummies for the last five sectors, as I treat agriculture as the reference group. Sector dummies do not enter the model individually as they are captured by the fixed effects. As IT and CT intensities are treated as endogenous, they are instrumented with their first and second lags also when they are in the interaction terms.

Indeed, the effects of IT and CT intensities on the skill composition and age composition of labour demand across sectors are heterogeneous and are shown in Table 6. Same as the main results, IT intensity increases the wage bill share of low-skilled workers in all sectors but agriculture. The magnitude of the positive effects is the strongest in construction and utilities. CT intensity decreases the wage bill share of the same type of workers in all sectors, with the strongest negative effects being identified in agriculture and manufacturing. The positive effect of IT on the wage bill share of high-skilled workers is accounted for by manufacturing and services. The magnitude of the positive effect is slightly larger in services than in manufacturing. Manufacturing, services and utilities are the sectors where IT intensity decreases the wage bill share of medium-skilled workers. Among these three sectors, the strongest negative effect is identified in services. Also, the positive effect of CT intensity on the wage bill share of medium-skilled workers is accounted for by mining, services and utilities, with the strongest effect being exerted in the first sector.

The coefficient estimates in the last three columns suggest that the negative effect of IT intensity on the wage bill share of the youngest workers and the negative effect on the wage bill share of the middle-aged are accounted for by services, utilities and construction. Among these sectors, the strongest positive and negative effects are identified in construction. The positive effect of IT intensity on the wage bill share of the oldest is accounted for by mining, services and utilities, with the strongest effect being exerted in services. Also, the negative effect of CT intensity on the wage bill share of the oldest is accounted for by services, utilities and construction, with the strongest effect being exerted in the first and the third sector.

Same as in the previous table, the results in Table 7 reveal that that there are heterogeneous effects of IT and CT on the age-skill composition of labour demand across sectors. In particular, the positive effect of IT intensity on the wage bill share of the youngest high-skilled

[24] The NACE Rev. 1.1 of these sectors are: agriculture (AtB), mining (C), manufacturing (15–16, 17–19, 20, 21–22, 23, 24, 25, 26, 27–28, 29, 30–33, 34–35, 36–37), services (50, 51, 52, 60–63, 64, 70, 71–74, J, H, L, M, N, O), utilities (E), and construction (F).

is accounted for by manufacturing and services, where the magnitude of the effect is identical. The positive effect of IT intensity on the wage bill share of the youngest low-skilled is accounted for by all sectors but manufacturing, with construction being the sector where the strongest effect is identified. Manufacturing, services and utilities are the three sectors where IT intensity increases the wage bill share of the middle-aged low-skilled, with the largest increase being identified in services. The negative effect of IT intensity on the wage bill share of the youngest medium-skilled is accounted for by all sectors but construction, while its negative effect on the wage bill share of the middle-aged medium-skilled is identified in services and utilities. In the first case, the strongest negative effects are exerted in mining and manufacturing, while in the second case, the strongest negative effect is exerted in services. In addition, the negative effect of CT intensity on the wage bill share of the middle-aged low-skilled is accounted for by all sectors, with the strongest effect being identified in manufacturing. The negative effect of CT intensity on the wage bill share of the oldest low-skilled is accounted for by services, utilities and construction, with the strongest effect being identified in the last sector.

Having identified heterogeneous effects of IT and CT on the wage bill shares of different worker types across sub-periods and across sectors, my next goal is to look into heterogeneous effects across countries. Given that collective bargaining can determine the wage-setting process and other terms of employment, I aim at exploiting the cross-country variation in this dimension. To this purpose, I use union density, calculated as the ratio of union members to the total number of employees, as a proxy for country-level collective bargaining and interact it with IT and CT intensities. Data on union density are drawn from the OECD.[25] Union density does not enter the model individually as it is captured by country-year fixed effects. As IT intensity, CT intensity and union density are treated as endogenous, they are instrumented with their first and second lags also when they are in the interaction terms. The results of estimations of wage bill share equations augmented with these interaction terms are shown in Panel B of Tables 6 and 7.

From both tables a clear pattern arises: the inequalities generated by IT and CT among workers with different skill, different age, and different age-skill profiles are smaller in countries

[25]Collective bargaining coverage is a broader measure of collective bargaining developed by the OECD as it also includes workers who are covered by the negotiations made by trade unions, albeit they are not members of them. Unfortunately, the missing information on this measure for the countries examined in this paper is such that makes its use inappropriate (i.e., more than two thirds of the observations of the benchmark sample are dropped when this measure is used in lieu of union density.

with higher union density. In particular, the positive effects of IT and CT intensities on the wage bill share of high-skilled workers and the negative effect of CT intensity on the wage bill share of low-skilled workers are dampened by higher union density. Similarly, higher union density dampens the positive and negative effects of IT intensity on the wage bill shares of the oldest and the youngest, respectively, as well as the positive effect of CT intensity on the wage bill share of the middle-aged and its negative effect on the wage bill share of the oldest. Looking at age-skill groups, while higher union density dampens the negative effect of IT intensity on the wage bill share of the youngest medium-skilled, it also dampens its positive effects on the wage bill shares of the oldest high-skilled and low-skilled. Similarly, higher union density dampens the positive effects of CT intensity on the wage bill shares of the youngest and middle-aged high-skilled and the middle-aged medium-skilled, as well as its negative effects on the wage bill shares of the oldest of all skill profiles.

Alternative IV strategy and non-IV

For the production of the main results, I treat all explanatory variables as endogenous using as instruments their first and second lags. In addition to the benchmark instrumentation strategy, I implement an alternative one for the non-ICT, IT and CT intensities, while I instrument log output with its first and second lags. In particular, I instrument each of the three variables by interacting its values in the year 1980 with country-level variables for the number of telephone lines per capita and the share of military expenditures in GDP. Data on the two country-level variables are drawn from the World Bank's World Development Indicators. As described in detail in Section 4, a telephone line is a type of communication technology which can proxy also for non-ICT advancements (e.g. infrastructure, transport equipment) and for IT advancements (e.g. PCs). Also, military expenditures have often led to the invention and development of information and communication technologies that have been later commercialised (e.g. key technologies of the ARPANET as rudimentary elements of the Internet). Hence, the non-ICT, IT and CT intensities of industries in a given year along with the evolution of telephone line installations and military expenditures of a country are expected to be strong predictors of the future evolution of industry-level non-ICT, IT and CT intensities. In other words, the instruments that I use are expected to be correlated with the instrumented variables. The exogeneity of the instruments is ensured for two reasons. First, the values of non-ICT, IT and CT intensities correspond to 1980, a year that precedes the start year of the benchmark sample. Second, the country-level variables used in the interaction terms are unlikely to impact the industry-level wage bill shares of different worker types.

Table 8: IT, CT and worker types by skill and by age (alternative IV and non-IV)

Panel A: Alternative IV						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	-0.028***	-0.0073	0.035***	0.016**	0.00068	-0.016***
	[0.009]	[0.010]	[0.007]	[0.007]	[0.008]	[0.006]
K	-0.031***	0.019***	0.011**	0.0073*	-0.0058	-0.0016
	[0.006]	[0.006]	[0.005]	[0.004]	[0.005]	[0.004]
IT	0.29***	-0.35***	0.051*	0.041*	-0.10***	0.063***
	[0.03]	[0.04]	[0.03]	[0.02]	[0.03]	[0.02]
CT	0.019	0.057	-0.075*	0.086**	0.035	-0.12***
	[0.05]	[0.05]	[0.04]	[0.03]	[0.04]	[0.03]
Obs		5317			5317	
R^2	0.528	0.392	0.808	0.706	0.472	0.740
Hansen J statistic		653.2			909.5	
Instruments for ln Y	First and second lags of instrumented variable					
Instruments for K, IT, CT	K, IT, CT in year 1980 interacted with telephone lines per capita K, IT, CT in year 1980 interacted with share of military expenditure in GDP					
Panel B: Non-IV strategy						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.022***	-0.048***	0.026***	0.013***	-0.0061***	-0.0068***
	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.001]
K	-0.00060	-0.0046***	0.0052***	0.0014***	-0.0022***	0.00074**
	[0.0008]	[0.0010]	[0.0009]	[0.0004]	[0.0005]	[0.0003]
IT	0.098***	-0.20***	0.097***	-0.013***	0.015***	-0.0013
	[0.008]	[0.01]	[0.009]	[0.004]	[0.005]	[0.003]
CT	0.011	0.043**	-0.054***	0.053***	0.015	-0.068***
	[0.01]	[0.02]	[0.01]	[0.009]	[0.01]	[0.007]
Obs		7053			7053	
R^2	0.648	0.530	0.822	0.719	0.553	0.723

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of Panel A. Iterated Seemingly Unrelated Regressions (ISUR) with robust standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of Panel B. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

The results of the alternative IV strategy are shown in Panel A of Tables 8 and 9 and bear a very close resemblance to the main ones in terms of sign and precision. In terms of size, most of the coefficient estimates of IT and CT intensities are larger compared to the main ones. The first-stage results of all these estimations suggest that the alternative IV strategies are successful, as the coefficient estimates of the instruments are statistically significant, the F-statistic is above 10 and its p-value lower than 10%, and the R-squared value is relatively high.[26] Assuming that all explanatory variables are exogenous, in Panel B of the same tables,

[26] I obtain very similar results to the main ones also when I instrument the non-ICT, IT and CT intensities only with their values in 1980 interacted with the number of telephone lines per capita or only with their values in 1980 interacted with the share of military expenditures in GDP. Similarly, the results remain largely unchanged when I implement the alternative IV strategies using in the interaction terms the values of IT and CT intensities in 1982 rather than 1980. The relevant tables are available upon request.

I show the results of ISUR estimations of the main specification. Their similarity to the IV results suggests that endogeneity may not be a major issue in the specification.

Table 9: IT, CT and worker types by age-skill (alternative IV and non-IV)

Panel A: Alternative IV									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.012***	0.015***	0.013***	-0.011	0.0017	0.0096*	-0.0050	-0.024***	0.012***
	[0.002]	[0.006]	[0.003]	[0.007]	[0.008]	[0.006]	[0.003]	[0.004]	[0.003]
K	-0.010***	0.012***	0.0055**	-0.018***	0.013**	-0.00027	-0.0023	-0.0051**	0.0058***
	[0.002]	[0.004]	[0.002]	[0.005]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
IT	0.068***	-0.087***	0.060***	0.20***	-0.23***	-0.073***	0.030**	-0.031**	0.064***
	[0.009]	[0.02]	[0.01]	[0.03]	[0.03]	[0.02]	[0.01]	[0.01]	[0.01]
CT	0.041***	0.011	0.033*	-0.0042	0.062	-0.023	-0.018	-0.016	-0.085***
	[0.01]	[0.03]	[0.02]	[0.04]	[0.04]	[0.03]	[0.02]	[0.02]	[0.02]
Obs					5317				
R^2	0.153	0.639	0.600	0.340	0.428	0.702	0.645	0.788	
Hansen J statistic					4005.4				
Instruments for ln Y					First and second lags of instrumented variable				
Instruments for K, IT, CT					K, IT, CT in year 1980 interacted with telephone lines per capita K, IT, CT in year 1980 interacted with share of military expenditure in GDP				
Panel B: Non-IV strategy									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.0010	-0.0016	0.015***	0.019***	-0.024***	0.0032*	0.0021**	-0.023***	0.0019**
	[0.0007]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.0010]	[0.001]	[0.0008]
K	-0.0029***	-0.0014**	0.0042***	0.0017***	0.00049	-0.00058	0.00067**	-0.0037***	0.00050***
	[0.0002]	[0.0007]	[0.0004]	[0.0006]	[0.0008]	[0.0006]	[0.0003]	[0.0004]	[0.0002]
IT	0.013***	-0.064***	0.016***	0.056***	-0.13***	0.043***	0.029***	-0.0046	0.0017
	[0.002]	[0.007]	[0.004]	[0.007]	[0.008]	[0.006]	[0.003]	[0.004]	[0.002]
CT	0.022***	0.010	0.028***	-0.0053	0.042***	-0.033***	-0.0058	-0.0098	-0.039***
	[0.004]	[0.01]	[0.007]	[0.01]	[0.01]	[0.01]	[0.005]	[0.006]	[0.004]
Obs					7053				
R^2	0.303	0.546	0.679	0.542	0.558	0.733	0.629	0.797	0.653

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in Panel A. Iterated Seemingly Unrelated Regressions (ISUR) with robust standard errors in square brackets in Panel B. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Discussion

In summary, when I study the effects of IT and CT on the skill composition and age composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled, low-skilled and oldest workers, while it decreases the relative demands for the medium-skilled and younger workers. CT intensity exerts opposite effects: it decreases the relative demands for the low-skilled and the oldest workers, and increases the relative demands for the medium-skilled and the youngest. I identify very similar effects of IT and CT on the skill composition of labour demand within each of the three age groups, and on the age composition of labour demand within each of the three skill groups. As suggestive evidence of the underlying mechanisms, I show that the effects of IT intensity operate through an increase in the employment level of low-skilled workers, a larger increase in the wage of high-skilled workers compared to the medium-skilled, and a larger increase in the employment level and wage of the oldest workers. The effects of CT intensity operate through an increase in the wages of high-skilled and medium-skilled workers, a decrease of similar magnitude in the employment levels of the medium-skilled and low-skilled, an increase in the employment level of the youngest, and a decrease of smaller magnitude in the wage of the oldest compared to younger workers.

Studying the effects of IT and CT on the age-skill composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled and low-skilled of all age profiles, while it decreases the relative demands for the medium-skilled of all age profiles. CT intensity exerts mostly opposite effects: it decreases the relative demands for older low-skilled workers and increases the relative demands for the younger more skilled. Identifying the underlying mechanisms, I show that the effects of IT intensity operate through relatively large increases in the employment levels of the low-skilled of all age profiles and relatively large increases in the wages of the youngest high-skilled and low-skilled and of the oldest high-skilled. The effects of CT intensity operate through relatively large increases in the employment levels of the youngest high-skilled and medium-skilled and decreases of similar magnitude in the wages of the middle-aged and oldest low-skilled workers.

Accounting for the advancements of IT and CT over time, the different adoption rates of the two types of technologies across industries and sectors, as well as the different levels of union density across countries, I obtain very interesting results. First, I find that the aforementioned effects are in operation mostly from 1990 onwards, when IT and CT advancements took place at an even higher rate compared to the 1980s. Second, although the heterogeneity in the effects of IT and CT across sectors is salient, especially in quantitative terms, there is not a clear pattern of disproportionate effects in certain sectors. By contrast, I identify a clear pattern of disproportionate effects across countries differing in the level of collective bargaining as captured by union density. In particular, I find that the wage bill share differences that are generated by IT and CT intensities among worker types are smaller in countries where union density is higher. This result empirically validates the crucial role of collective bargaining –and more broadly, of labour market institutions– in the mitigation of inequalities among different worker types.

The identified effects of IT and CT on the skill, age, and age-skill composition of labour demand are novel and complement existing evidence on ICT being biased in favour of more skilled workers, against workers in routine-intensive occupations, and against older workers. By making the crucial distinction between IT and CT, not only do I identify distinct effects of each of the two types of technologies on different worker types, but I also identify distinct effects of IT and CT on each worker type. These findings can hardly be explained by the traditional task-based approach and are, instead, rationalised by the theoretical framework in Section 2 which is predicated upon knowledge-based hierarchy theories. Low-skilled workers, who are at the bottom of the knowledge-based hierarchy, gain wage bill shares from the adoption of IT by the representative firm as this type of technologies allows them to acquire knowledge at a lower cost and subsequently, to become less dependent on their superiors, namely, the medium-skilled and high-skilled workers. The wage bill share losses of the medium-skilled, who proxy for middle managers, from the adoption of IT suggest that their losses from the lower dependence of the low-skilled on them are greater than their gains from their lower dependence on their superiors, namely, the high-skilled workers who are at the top the hierarchy. This also explains the wage bill share gains of the high-skilled. In addition, the wage bill share gains of the medium-skilled and the wage bill share losses of the low-skilled from the adoption of CT suggest that low-skilled workers become more dependent on medium-skilled workers and that the gains of the medium-skilled from the greater dependence of the low-skilled on them are greater than the losses that the medium-skilled incur due to their greater dependence on their superiors, namely, the high-skilled.

The wage bill share gains of the oldest workers and the losses of the middle-aged from the adoption of IT suggest that this type of technologies allow the oldest workers, who are more knowledgeable and autonomous, to solve their existing problems more efficiently than the middle-aged or to increase by more the range of problems they deal with. The wage bill share gains of younger workers and the losses of the oldest from the adoption of CT suggest that the knowledge advantage of the oldest workers becomes less important or the range of their tasks narrows more than the range of tasks of younger workers.

Finally, the wage bill share changes due to the adoption of IT that I identify are explained by the trade-off between the gains of a worker type from its lower dependence on superiors and the losses from the lower dependence of subordinates on this worker type. Similarly, the wage bill share changes due to the adoption of CT are explained by the trade-off between the losses of a worker type from its greater dependence on superiors and the gains from the greater dependence of subordinates on this worker type.

6 Robustness checks

In this section, I discuss numerous checks for the robustness of the main results shown in Tables 2 and 3. Although the first and second lags of explanatory variables that I use as instruments can capture the potential sluggish response of wage bill shares to changes in IT and CT intensities, I estimate the main specification on a sample with biannual frequency covering the period 1982–2004. The results, shown in Panel A of Tables B4 and B5, bear a very close resemblance to the main ones in terms of sign, size and precision.[27] Relatedly, in Panel B of Tables C1 and C2, I obtain very similar results to the main ones when I control for a 5-year span at maximum in the sluggishness of wage bill share adjustments by estimating the main specification using as instruments the first, second, and fifth lags of the instrumented variables.

In the second group of robustness checks, I ensure that the main results are robust to the use of alternative capital variables or to the benchmark variables being incorporated in the main specification in logs. Panel B of Tables B4 and B5 confirms that the main results remain largely unchanged when I normalise the real fixed non-ICT, IT and CT capital stocks by real gross output. The results are also robust to estimations with capital variables being normalised by the total hours worked by persons engaged or the total hours worked by employees (Tables C3 and C4). As shown in Panel C of Tables B4 and B5, the main results remain largely unchanged also when I construct capital intensities as the ratios of real gross fixed non-ICT, IT and CT capital formations, rather than stocks, to real gross value added. Third, I use the inverse hyperbolic sine transformation (IHST) method in order to deal with the presence of some very small values of IT and CT capital intensities in early years of the sample which lead to extremely high values when in logs. I, then, incorporate in the main specification the transformed capital variables in logs. Tables C5 and C6 reveal that the results of these estimations are very similar to the main ones.

As mentioned in Section 4.1, country-year fixed effects capture wages under the assumption that the wage-setting process takes place at the national level. In order to control for the possibility that wages are determined at the industry level, I incorporate in the main specification relative wages and replace the country-year fixed effects with year fixed effects. For the construction of the relative wages, I first calculate the real hourly wage of a worker

[27] In tables that are available upon request, I show that the results remain largely unchanged also when I re-estimate the main specification on a sample with biannual frequency covering the period 1983–2005.

type as the ratio of her wage bill to her total hours of work, and then, I calculate the ratio of her real hourly wage to the real hourly wage for the reference worker type. The reference group comprises the low-skilled, the oldest, and the oldest low-skilled when I consider workers differing in skill, in age, and in age-skill, respectively. Relative wages are treated as endogenous and each of these is instrumented with its first and second lags. The results obtained from these estimations are very similar to the main ones and are shown in the Tables C7 and C8.

By adding to the specification with the relative wages the ratios of country-level exports and country-level imports to GDP, I show that the main results are robust to country-level trade openness (Tables C9 and C10). Data on the two variables capturing trade openness are drawn from the World Bank's World Development Indicators. Using again the specification with the relative wages, I also show that the main results are not spuriously driven by publicly-funded labour market programmes aiming at the improvement of the labour market prospects of workers (Tables C11 and C12). The variables that I incorporate in the specification are the ratios of government expenditures on active and passive labour market programmes to country-wide GDP.[28] Data on these variables are drawn from the OECD. In the estimations controlling for trade openness and for labour market programmes, the additional control variables are treated as endogenous and are instrumented with their first and second lags.

As a final robustness check, in order to ensure that changes in IT and CT intensities do not simply pick up labour productivity shocks affecting the wage bill shares of different worker types, I estimate the benchmark specification with the log of industry-level aggregate labour productivity incorporated. Data on this control variable are drawn from EU KLEMS. Same as the rest of the explanatory variables, this control is treated as endogenous and is instrumented with its first and second lags. As shown in Panel D of Tables B4 and B5, the results remain largely unchanged.

7 Conclusion

This paper is the first to study the distinct effects of Information Technologies (IT) and Communication Technologies (CT) on the skill, age, and age-skill composition of labour demand.

[28] Active measures comprise training, job rotation and job sharing, employment incentives, supported employment and rehabilitation, direct job creation, and start-up incentives. Passive measures comprise out-of-work income maintenance and support and early retirement.

The analysis is conducted on a sample comprising 10 developed countries, 30 industries that cover the largest part of the economy, and the period 1982–2005.

When I study the effects of IT and CT on the skill composition and age composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled, low-skilled and oldest workers, while it decreases the relative demands for the medium-skilled and younger workers. CT intensity exerts opposite effects by decreasing the relative demands for the low-skilled and the oldest workers, and increasing the relative demands for the medium-skilled and the youngest. Studying the effects of IT and CT on the age-skill composition of labour demand, I find that IT intensity increases the relative demands for the high-skilled and low-skilled of all age profiles, while it decreases the relative demands for the medium-skilled of all age profiles. CT intensity exerts mostly opposite effects by decreasing the relative demands for older low-skilled workers and increasing the relative demands for the younger more skilled. These findings can hardly be explained by the traditional task-based approach that overlooks the organisational aspect of the adoption of IT and CT by firms. They are, instead, rationalised by knowledge-based hierarchy theories, according to which, the adoption of IT leads to the empowerment of agents at lower levels of the hierarchy, while the adoption of CT leads to the empowerment of agents at higher levels of the hierarchy. Interestingly, I also find that the aforementioned effects are in operation mostly from 1990 onwards, when IT and CT advancements took place at an even higher rate compared to the 1980s. Although a clear pattern of disproportionate effects in certain sectors is not identified, such a pattern across countries does exist: the inequalities that are generated by IT and CT intensities among worker types are smaller in countries where union density is higher.

My analysis in this paper would be nicely complemented by an analysis using a matched employer-employee dataset that provides information on key labour variables such as the wage bill shares of different types of workers and on firms' investment in different types of IT and CT. For instance, Bloom et al. (2014) observe two types of IT, Enterprise Resource Planning (ERP) and Computer Assisted Design/Computer Assisted Manufacturing (CAD/CAM) that are used by middle managers and production workers respectively, as well as one type of CT, data network/intranet. However, the goal of their study is to identify the effects of these variables on the organisational structure of firms, rather than on their labour force. Information on other variables that can capture the organisational structure of firms in the spirit of Caroli & Van Reenen (2001) would allow for the possible identification of separate effects on different worker types of variables capturing technological change and variables capturing organisation change.

Identifying the effects of IT and CT on the relative demands for workers differing in age and skill shows how these two types of technologies lead to inequalities among these worker types, but remains silent about whether and how the terms and conditions of employment of these worker types are impacted by these two types of technologies. An increase in own-wage elasticities of demand for specific groups of the working-age population implies a worsening of the terms and conditions of their employment (e.g. higher job insecurity and earnings volatility), while a decrease in their own-wage demand elasticities implies the opposite. Therefore, another interesting complementary analysis would be the investigation of the individual effects of IT and CT on the elasticities of demand for workers with different age and skill profiles.

What is more, the evidence on the mitigation of inequalities among worker types generated by IT and CT in countries with higher union density calls for shedding more light on the role of labour market institutions. For instance, are other labour market laws such as the minimum wage, the cap on executive payments and bonuses, and the costly lay-offs effective ways of reducing inequalities among worker types generated by the introduction of IT and CT? If yes, to which extent does a reduction in inequalities occur? Also, is such a reduction achieved at a cost, namely, an increase in unemployment or a lower potential for productivity gains from the utilisation of new IT and CT? In the same vein, the evidence that I provide on the opposite effects of IT and CT on the relative demand for each worker type call for an in-depth investigation of the role of training and lifelong learning in helping each worker type to maximise the gains from the utilisation of one of the two types of technologies, while at the same time, minimise the loses from the utilisation of the other.

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Appendix

A Additional descriptive statistics

Table A1: Countries and industries

Panel A: Countries			
No.	Country Name	No.	Country Name
1	Australia	6	Japan
2	Austria	7	Netherlands
3	Denmark	8	Spain
4	Finland	9	United Kingdom
5	Italy	10	United States of America
Panel B: Industries			
NACE Rev 1.1	Industry Name	NACE Rev 1.1	Industry Name
AtB	Agriculture, Hunting, Forestry, and Fishing	E	Electricity, Gas and Water Supply
C	Mining and Quarrying	F	Construction
15–16	Food products, Beverages and Tobacco	50	Wholesale and Retail; Motor Vehicles
17–19	Textiles, Textile Products, Leather and Footwear	51	Wholesale, expect Motor Vehicles
20	Wood and Products of Wood and Cork	52	Retail, except Motor Vehicles
21–22	Pulp, Paper, Paper Products, Printing and Publishing	H	Hotels and Restaurants
23	Coke, Refined Petroleum Products and Nuclear Fuel	60–63	Transportation and Storage
24	Chemicals and Chemical Products	64	Post and Telecommunications
25	Rubber and Plastics Products	J	Financial Intermediation
26	Other Non-Metallic Mineral Products	70	Real Estate
27–28	Basic Metals and Fabricated Metal Products	71–74	Other Business Activities
29	Machinery and Equipment, n.e.c.	L	Public Administration and Defence
30–33	Electrical and Optical Equipment	M	Education
34–35	Transport Equipment	N	Health and Social Work
36–37	Manufacturing n.e.c.; Recycling	O	Other Community, Social and Personal Services

Source: EU KLEMS.

Table A2: IT and CT by country and by industry

Panel A: By country						
Country	Mean level 1982		Mean level 2005		Mean % change 1982–2005	
	IT	CT	IT	CT	IT	CT
Australia	0.002	0.042	0.325	0.048	20593.38	81.36
Austria	0.001	0.036	0.122	0.043	39696.13	201.85
Denmark	0.004	0.004	0.314	0.014	12578.57	377.77
Finland	0.001	0.007	0.052	0.092	4935.94	3473.14
Italy	0.001	0.037	0.097	0.060	13502.49	242.32
Japan	0.004	0.015	0.045	0.041	1874.63	666.65
Netherlands	0.002	0.030	0.198	0.040	28885.25	106.32
Spain	0.002	0.038	0.077	0.081	5351.97	308.72
United Kingdom	0.001	0.007	0.179	0.042	24977.10	2030.81
United States	0.002	0.028	0.137	0.066	16533.56	4327.87
Unweighted mean	0.002	0.024	0.155	0.053	16892.90	1181.68

Panel B: By industry						
Industry	Mean level 1982		Mean level 2005		Mean % change 1982–2005	
	IT	CT	IT	CT	IT	CT
15T16	0.002	0.010	0.129	0.027	9107.83	306.80
17T19	0.001	0.006	0.120	0.023	25796.47	315.09
20	0.001	0.016	0.082	0.021	16512.24	313.31
21T22	0.003	0.011	0.239	0.044	14489.53	424.23
23	0.005	0.033	1.562	0.094	28647.04	645.93
24	0.002	0.024	0.097	0.026	12849.27	94.01
25	0.001	0.008	0.082	0.018	9153.69	230.80
26	0.002	0.011	0.126	0.030	18344.21	258.38
27T28	0.002	0.013	0.082	0.022	9761.96	683.09
29	0.002	0.008	0.142	0.022	11884.69	252.25
30T33	0.007	0.039	0.141	0.055	6543.76	58.21
34T35	0.002	0.013	0.105	0.031	10729.51	331.80
36T37	0.001	0.010	0.127	0.024	22605.61	359.22
50	0.002	0.012	0.132	0.035	9784.66	425.11
51	0.003	0.014	0.188	0.036	6404.79	423.06
52	0.003	0.011	0.173	0.035	10057.89	441.51
60	0.002	0.104	0.149	0.227	13304.26	389.02
64	0.004	0.541	0.210	0.615	11629.55	307.82
70	0.000	0.002	0.051	0.007	21579.66	1421.78
71	0.008	0.010	0.388	0.081	9887.10	1366.50
ATB	0.001	0.012	0.036	0.010	12284.02	372.95
C	0.004	0.015	0.116	0.032	21379.34	150.61
E	0.003	0.044	0.154	0.070	7936.31	119.34
F	0.000	0.004	0.056	0.023	32222.00	9517.83
H	0.001	0.007	0.090	0.034	20450.69	3209.65
J	0.007	0.012	0.330	0.023	8282.35	213.53
L	0.003	0.013	0.251	0.061	26094.29	1086.31
M	0.002	0.003	0.172	0.020	56526.66	1308.19
N	0.001	0.005	0.121	0.017	15804.34	740.20
O	0.002	0.034	0.228	0.140	14101.55	866.80

Notes: IT: ratio of real IT capital stock to real gross value added; CT: ratio of real CT capital stock to real gross value added. In Panel A, levels and percentage changes are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, levels and percentage changes are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

Table A3: Wage bill shares by skill

Panel A: By country									
Country	Mean level 1982			Mean level 2005			Mean % change 1982–2005		
	HS	MS	LS	HS	MS	LS	HS	MS	LS
Australia	0.093	0.426	0.481	0.235	0.398	0.367	161.09	-6.47	-23.89
Austria	0.085	0.608	0.307	0.148	0.687	0.165	139.50	19.38	-45.68
Denmark	0.062	0.534	0.409	0.103	0.678	0.219	94.47	31.50	-47.87
Finland	0.271	0.301	0.428	0.419	0.414	0.168	64.09	37.65	-62.05
Italy	0.049	0.886	0.065	0.096	0.900	0.004	147.40	1.82	-89.62
Japan	0.195	0.509	0.297	0.320	0.598	0.082	75.40	20.05	-75.80
Netherlands	0.080	0.780	0.140	0.168	0.792	0.040	482.27	1.91	-69.06
Spain	0.130	0.109	0.761	0.262	0.310	0.428	346.87	288.30	-46.77
United Kingdom	0.105	0.555	0.340	0.259	0.657	0.085	240.00	20.46	-75.82
United States	0.301	0.561	0.138	0.428	0.510	0.062	54.57	-9.27	-59.30
Unweighted mean	0.137	0.527	0.337	0.244	0.594	0.162	180.57	40.53	-59.59

Panel B: By industry									
Industry	Mean level 1982			Mean level 2005			Mean % change 1982–2005		
	HS	MS	LS	HS	MS	LS	HS	MS	LS
15T16	0.067	0.507	0.427	0.157	0.631	0.212	187.10	44.95	-55.27
17T19	0.056	0.484	0.464	0.145	0.630	0.225	209.86	68.66	-56.57
20	0.076	0.500	0.430	0.177	0.638	0.200	147.25	46.07	-57.64
21T22	0.104	0.544	0.352	0.207	0.634	0.159	154.31	32.60	-60.65
23	0.126	0.551	0.330	0.227	0.620	0.152	133.65	28.71	-56.55
24	0.135	0.518	0.347	0.272	0.577	0.150	140.74	27.26	-63.72
25	0.094	0.522	0.392	0.188	0.632	0.180	134.49	37.16	-59.23
26	0.080	0.504	0.416	0.179	0.628	0.193	138.50	40.80	-58.63
27T28	0.080	0.531	0.388	0.176	0.646	0.179	131.00	37.41	-58.65
29	0.093	0.585	0.322	0.213	0.646	0.141	143.31	24.89	-62.19
30T33	0.120	0.573	0.307	0.265	0.607	0.128	145.03	14.16	-64.03
34T35	0.109	0.572	0.328	0.218	0.634	0.148	158.73	26.97	-60.11
36T37	0.084	0.508	0.415	0.176	0.622	0.203	154.53	49.15	-57.48
50	0.073	0.593	0.341	0.138	0.684	0.178	389.41	34.21	-54.74
51	0.112	0.559	0.329	0.206	0.629	0.164	139.90	30.66	-58.70
52	0.086	0.576	0.338	0.165	0.657	0.178	119.10	32.64	-54.34
60T63	0.061	0.539	0.401	0.123	0.665	0.212	117.48	44.28	-54.17
64	0.080	0.599	0.325	0.247	0.607	0.146	559.44	5.21	-41.82
70	0.257	0.514	0.229	0.391	0.514	0.095	68.46	5.01	-59.20
71T74	0.288	0.503	0.209	0.482	0.429	0.089	96.83	-5.69	-61.96
ATB	0.064	0.411	0.524	0.139	0.582	0.279	669.77	98.75	-54.20
C	0.109	0.526	0.370	0.205	0.624	0.171	155.69	46.00	-60.75
E	0.118	0.598	0.284	0.232	0.656	0.112	126.78	22.43	-67.18
F	0.074	0.545	0.381	0.111	0.693	0.196	69.88	68.23	-54.28
H	0.062	0.535	0.402	0.138	0.651	0.211	227.69	76.00	-54.45
J	0.207	0.609	0.184	0.422	0.511	0.067	139.88	-16.98	-71.95
L	0.202	0.573	0.226	0.376	0.555	0.069	118.23	1.92	-72.38
M	0.481	0.396	0.124	0.622	0.335	0.044	44.61	-7.37	-69.43
N	0.259	0.540	0.201	0.398	0.532	0.070	93.31	16.98	-67.70
O	0.179	0.537	0.285	0.303	0.572	0.125	87.03	13.78	-61.02

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. In Panel A, levels and percentage changes are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, levels and percentage changes are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

Table A4: Wage bill shares by age

Panel A: By country									
Country	Mean level 1982			Mean level 2005			Mean % change 1982–2005		
	15–29	30–49	50+	15–29	30–49	50+	15–29	30–49	50+
Australia	0.310	0.463	0.226	0.212	0.510	0.278	-30.93	10.24	26.85
Austria	0.286	0.490	0.225	0.186	0.584	0.230	-33.67	19.86	9.02
Denmark	0.264	0.524	0.207	0.165	0.553	0.281	-38.43	6.89	38.71
Finland	0.255	0.564	0.181	0.137	0.543	0.321	-45.99	-3.18	78.61
Italy	0.289	0.632	0.078	0.238	0.709	0.053	-16.52	13.10	-31.09
Japan	0.210	0.570	0.220	0.155	0.508	0.337	-25.04	-10.37	57.41
Netherlands	0.265	0.531	0.204	0.159	0.570	0.270	-37.72	8.72	38.16
Spain	0.228	0.482	0.290	0.174	0.558	0.267	-21.93	17.24	-5.51
United Kingdom	0.329	0.511	0.160	0.185	0.562	0.253	-41.87	11.89	63.39
United States	0.387	0.446	0.167	0.242	0.560	0.197	-37.86	25.95	18.11
Unweighted mean	0.282	0.521	0.196	0.185	0.566	0.249	-32.99	10.03	29.36

Panel B: By industry									
Industry	Mean level 1982			Mean level 2005			Mean % change 1982–2005		
	15–29	30–49	50+	15–29	30–49	50+	15–29	30–49	50+
15T16	0.283	0.519	0.197	0.185	0.579	0.236	-32.79	12.99	18.36
17T19	0.319	0.490	0.189	0.176	0.574	0.251	-44.98	18.78	26.50
20	0.284	0.510	0.206	0.177	0.564	0.258	-30.16	11.98	25.35
21T22	0.268	0.537	0.196	0.171	0.578	0.251	-32.54	9.54	26.66
23	0.260	0.548	0.192	0.137	0.618	0.246	-42.56	14.43	29.56
24	0.253	0.553	0.194	0.154	0.601	0.245	-35.34	10.65	27.52
25	0.274	0.544	0.182	0.180	0.575	0.245	-26.81	8.46	31.44
26	0.261	0.538	0.201	0.159	0.583	0.258	-35.23	9.81	25.81
27T28	0.277	0.532	0.191	0.172	0.577	0.251	-34.36	10.42	26.52
29	0.281	0.544	0.175	0.166	0.594	0.240	-39.16	10.27	32.56
30T33	0.284	0.552	0.164	0.176	0.606	0.219	-36.99	10.33	32.22
34T35	0.259	0.568	0.168	0.160	0.601	0.239	-35.24	6.76	41.90
36T37	0.302	0.515	0.182	0.195	0.572	0.233	-35.02	12.57	26.06
50	0.342	0.492	0.158	0.229	0.561	0.210	-30.09	16.43	38.35
51	0.292	0.528	0.180	0.213	0.568	0.219	-26.83	8.26	23.07
52	0.335	0.498	0.168	0.270	0.527	0.203	-19.17	6.77	21.76
60T63	0.237	0.552	0.211	0.157	0.595	0.248	-31.31	8.39	19.11
64	0.246	0.555	0.198	0.172	0.618	0.210	-26.10	12.54	8.28
70	0.266	0.537	0.196	0.195	0.547	0.258	-28.52	2.71	34.72
71T74	0.294	0.542	0.164	0.205	0.584	0.211	-30.35	8.62	31.54
ATB	0.251	0.467	0.282	0.171	0.513	0.316	-28.64	12.05	16.33
C	0.226	0.574	0.205	0.126	0.595	0.280	-39.58	4.97	30.07
E	0.199	0.567	0.234	0.118	0.599	0.283	-36.04	6.69	32.30
F	0.274	0.535	0.190	0.215	0.553	0.232	-19.92	4.46	19.78
H	0.349	0.485	0.166	0.288	0.523	0.189	-17.64	8.99	12.32
J	0.298	0.545	0.158	0.150	0.637	0.213	-49.63	19.06	34.15
L	0.265	0.524	0.211	0.143	0.586	0.272	-44.40	12.71	31.91
M	0.197	0.589	0.214	0.103	0.580	0.317	-46.27	0.37	55.18
N	0.323	0.512	0.165	0.152	0.586	0.262	-51.90	16.12	63.63
O	0.271	0.512	0.217	0.200	0.545	0.256	-26.11	7.22	18.43

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. In Panel A, levels and percentage changes are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, levels and percentage changes are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

Table A5: Wage bill shares by age-skill in 1982

Panel A: By country									
Country	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
Australia	0.026	0.116	0.169	0.048	0.214	0.201	0.019	0.096	0.111
Austria	0.011	0.196	0.079	0.041	0.304	0.145	0.033	0.108	0.083
Denmark	0.006	0.140	0.121	0.039	0.313	0.173	0.013	0.080	0.115
Finland	0.047	0.127	0.082	0.177	0.149	0.238	0.047	0.025	0.109
Italy	0.006	0.279	0.004	0.037	0.547	0.048	0.006	0.060	0.013
Japan	0.042	0.144	0.024	0.126	0.285	0.160	0.028	0.080	0.113
Netherlands	0.007	0.230	0.028	0.051	0.406	0.073	0.021	0.144	0.039
Spain	0.026	0.042	0.160	0.071	0.047	0.365	0.034	0.020	0.236
United Kingdom	0.019	0.201	0.109	0.069	0.270	0.171	0.016	0.084	0.059
United States	0.106	0.243	0.038	0.149	0.234	0.063	0.046	0.084	0.037
Unweighted mean	0.030	0.172	0.081	0.081	0.277	0.164	0.026	0.078	0.092
Panel B: By industry									
Industry	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
15T16	0.016	0.159	0.109	0.039	0.268	0.212	0.012	0.080	0.105
17T19	0.012	0.167	0.140	0.030	0.243	0.217	0.011	0.074	0.107
20	0.014	0.164	0.107	0.042	0.262	0.206	0.014	0.074	0.117
21T22	0.022	0.157	0.089	0.062	0.302	0.173	0.021	0.085	0.090
23	0.023	0.140	0.081	0.077	0.325	0.163	0.025	0.086	0.086
24	0.024	0.142	0.087	0.085	0.298	0.170	0.025	0.079	0.090
25	0.018	0.155	0.101	0.054	0.293	0.197	0.018	0.074	0.095
26	0.015	0.149	0.097	0.049	0.279	0.209	0.016	0.076	0.109
27T28	0.014	0.164	0.099	0.050	0.290	0.192	0.016	0.077	0.097
29	0.019	0.187	0.074	0.058	0.316	0.170	0.015	0.082	0.078
30T33	0.027	0.185	0.072	0.076	0.312	0.164	0.017	0.076	0.072
34T35	0.021	0.170	0.067	0.062	0.322	0.184	0.017	0.080	0.077
36T37	0.017	0.164	0.121	0.047	0.266	0.202	0.014	0.078	0.093
50	0.016	0.233	0.103	0.039	0.291	0.162	0.012	0.070	0.076
51	0.026	0.176	0.089	0.067	0.302	0.159	0.019	0.081	0.080
52	0.022	0.211	0.102	0.050	0.290	0.158	0.014	0.076	0.078
60T63	0.015	0.147	0.075	0.035	0.301	0.216	0.011	0.091	0.109
64	0.023	0.161	0.057	0.045	0.341	0.173	0.011	0.097	0.095
70	0.050	0.156	0.060	0.157	0.277	0.103	0.050	0.081	0.066
71T74	0.065	0.169	0.060	0.172	0.270	0.100	0.052	0.063	0.049
ATB	0.015	0.133	0.104	0.032	0.200	0.235	0.018	0.079	0.186
C	0.022	0.141	0.063	0.063	0.302	0.209	0.020	0.083	0.099
E	0.022	0.136	0.041	0.071	0.354	0.143	0.025	0.108	0.101
F	0.015	0.172	0.087	0.047	0.291	0.197	0.012	0.082	0.097
H	0.018	0.201	0.130	0.035	0.265	0.185	0.010	0.070	0.087
J	0.048	0.203	0.046	0.126	0.324	0.094	0.033	0.082	0.043
L	0.038	0.178	0.049	0.119	0.302	0.104	0.045	0.093	0.073
M	0.088	0.085	0.024	0.291	0.238	0.059	0.101	0.073	0.041
N	0.058	0.217	0.047	0.148	0.263	0.102	0.054	0.060	0.052
O	0.032	0.170	0.069	0.105	0.275	0.131	0.041	0.092	0.084

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. In Panel A, the wage bill shares are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, the wage bill shares are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

Table A6: Wage bill shares by age-skill in 2005

Panel A: By country									
Country	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
Australia	0.044	0.077	0.091	0.129	0.211	0.169	0.062	0.110	0.107
Austria	0.014	0.141	0.031	0.093	0.407	0.084	0.040	0.139	0.051
Denmark	0.007	0.105	0.053	0.067	0.385	0.102	0.029	0.188	0.064
Finland	0.033	0.085	0.020	0.249	0.226	0.067	0.137	0.103	0.081
Italy	0.009	0.228	0.000	0.081	0.626	0.002	0.006	0.045	0.002
Japan	0.047	0.104	0.004	0.189	0.300	0.019	0.084	0.194	0.059
Netherlands	0.018	0.136	0.005	0.103	0.449	0.019	0.047	0.207	0.016
Spain	0.036	0.066	0.073	0.162	0.188	0.208	0.064	0.056	0.147
United Kingdom	0.041	0.135	0.009	0.162	0.362	0.037	0.056	0.160	0.038
United States	0.083	0.138	0.021	0.254	0.277	0.029	0.090	0.095	0.012
Unweighted mean	0.033	0.121	0.031	0.149	0.343	0.073	0.062	0.130	0.058
Panel B: By industry									
Industry	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
15T16	0.023	0.124	0.037	0.102	0.375	0.102	0.032	0.131	0.072
17T19	0.020	0.119	0.036	0.093	0.372	0.108	0.032	0.138	0.081
20	0.019	0.122	0.036	0.101	0.372	0.092	0.047	0.145	0.072
21T22	0.028	0.115	0.028	0.129	0.375	0.074	0.050	0.144	0.057
23	0.026	0.085	0.027	0.149	0.396	0.072	0.052	0.139	0.054
24	0.035	0.093	0.026	0.175	0.354	0.071	0.062	0.130	0.053
25	0.023	0.125	0.032	0.117	0.372	0.086	0.048	0.135	0.062
26	0.021	0.106	0.033	0.112	0.381	0.090	0.046	0.142	0.071
27T28	0.021	0.119	0.032	0.109	0.384	0.084	0.045	0.142	0.063
29	0.028	0.113	0.024	0.138	0.391	0.065	0.047	0.141	0.052
30T33	0.038	0.115	0.022	0.173	0.368	0.064	0.054	0.124	0.041
34T35	0.029	0.105	0.025	0.141	0.390	0.070	0.047	0.139	0.053
36T37	0.024	0.131	0.040	0.113	0.360	0.098	0.038	0.130	0.064
50	0.022	0.162	0.045	0.087	0.396	0.079	0.029	0.126	0.055
51	0.031	0.145	0.037	0.128	0.363	0.076	0.047	0.121	0.052
52	0.031	0.189	0.050	0.100	0.351	0.075	0.035	0.117	0.052
60T63	0.017	0.106	0.034	0.079	0.413	0.103	0.027	0.146	0.075
64	0.042	0.101	0.029	0.171	0.376	0.071	0.034	0.130	0.046
70	0.052	0.127	0.016	0.236	0.265	0.046	0.103	0.121	0.033
71T74	0.090	0.098	0.018	0.298	0.243	0.044	0.094	0.089	0.028
ATB	0.014	0.113	0.044	0.078	0.322	0.112	0.047	0.146	0.123
C	0.019	0.086	0.021	0.125	0.385	0.085	0.061	0.153	0.066
E	0.025	0.078	0.014	0.146	0.403	0.050	0.061	0.174	0.047
F	0.014	0.153	0.048	0.067	0.394	0.092	0.030	0.145	0.057
H	0.028	0.200	0.061	0.085	0.345	0.093	0.026	0.106	0.057
J	0.064	0.077	0.009	0.281	0.326	0.030	0.077	0.109	0.028
L	0.043	0.090	0.010	0.223	0.333	0.029	0.110	0.132	0.030
M	0.059	0.038	0.006	0.373	0.187	0.020	0.190	0.110	0.018
N	0.046	0.096	0.010	0.245	0.310	0.032	0.108	0.127	0.028
O	0.043	0.131	0.026	0.173	0.311	0.061	0.087	0.130	0.039

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. In Panel A, the wage bill shares are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, the wage bill shares are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

Table A7: Percentage change in wage bill shares by age-skill over 1982–2005

Panel A: By country									
Country	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
Australia	105.44	-32.82	-45.46	177.97	-0.26	-15.22	230.13	15.94	3.12
Austria	534.69	-23.86	-56.96	336.83	44.06	-39.02	57.89	36.08	-35.93
Denmark	66.97	-23.93	-57.69	125.11	32.61	-42.12	126.85	154.63	-44.17
Finland	-26.52	-33.42	-76.81	53.64	56.97	-73.01	207.16	332.48	-26.86
Italy	40.28	-16.65	-73.48	194.07	15.44	-93.18	3.01	-23.86	-81.33
Japan	22.54	-25.24	-82.41	60.35	6.83	-89.64	268.91	159.63	-53.95
Netherlands	1284.39	-37.50	-82.11	546.41	12.50	-71.26	329.66	54.67	-52.45
Spain	198.17	92.62	-55.28	512.93	540.38	-45.16	297.07	294.10	-40.08
United Kingdom	254.56	-30.61	-90.25	231.38	38.35	-78.61	365.35	104.54	-36.30
United States	-17.15	-44.15	-51.06	92.52	18.10	-57.75	117.38	13.64	-69.52
Unweighted mean	246.34	-17.56	-67.15	233.12	76.50	-60.50	200.34	114.18	-43.75

Panel B: By industry									
Industry	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
15T16	204.32	-16.06	-67.00	244.32	82.43	-54.89	166.48	103.51	-38.55
17T19	228.59	-16.19	-74.71	317.84	110.08	-53.73	220.67	162.63	-32.64
20	108.41	-13.97	-65.94	173.44	59.95	-57.89	233.30	145.41	-42.32
21T22	155.58	-18.31	-69.70	183.05	44.53	-61.72	156.21	114.25	-43.52
23	121.87	-25.67	-57.44	158.84	45.05	-58.83	154.41	114.47	-38.97
24	131.02	-26.72	-71.19	161.46	40.56	-63.99	157.87	115.50	-49.04
25	105.15	-14.54	-67.54	184.38	49.14	-59.20	191.24	133.73	-42.20
26	100.24	-19.64	-67.37	163.14	54.25	-60.55	166.16	138.47	-41.49
27T28	106.92	-19.59	-67.07	156.14	50.87	-58.60	158.62	135.64	-42.31
29	98.08	-22.18	-74.87	162.38	34.27	-63.36	202.91	116.14	-44.30
30T33	93.40	-29.96	-73.54	151.92	26.55	-63.29	229.72	98.89	-49.10
34T35	108.62	-26.22	-70.07	169.92	37.18	-62.31	221.28	142.17	-38.71
36T37	175.43	-8.15	-69.20	204.17	86.03	-53.96	215.12	114.96	-38.66
50	200.95	-12.66	-65.45	459.98	62.92	-54.58	232.53	107.99	-33.74
51	168.06	-10.22	-67.14	151.94	50.32	-58.08	165.27	72.45	-43.27
52	164.09	-1.93	-59.91	123.81	51.28	-56.36	171.01	79.18	-38.59
60T63	226.00	-20.58	-60.76	140.80	75.13	-58.02	142.57	103.92	-35.40
64	4784.34	-33.29	23.35	603.24	20.73	-48.35	318.66	52.57	-36.54
70	41.16	-26.27	-22.77	75.77	7.51	-60.01	122.91	72.05	-40.53
71T74	115.95	-38.76	-71.66	98.68	4.93	-60.48	105.19	65.33	-45.47
ATB	1036.25	2.28	-64.33	942.58	190.78	-55.49	533.21	176.18	-40.53
C	60.72	-18.43	-73.98	135.38	68.67	-64.09	364.51	158.21	-42.03
E	72.03	-37.31	-68.28	158.92	38.21	-70.05	179.57	113.05	-55.84
F	63.58	12.99	-56.68	79.48	98.36	-57.07	118.32	176.91	-40.32
H	230.44	27.42	-62.01	277.51	144.39	-54.19	298.65	103.94	-39.85
J	128.44	-59.33	-76.29	172.80	-3.62	-73.11	118.19	46.46	-46.60
L	63.03	-48.62	-77.30	142.54	22.29	-75.44	151.95	52.82	-59.30
M	-16.32	-49.33	-74.11	41.47	0.50	-71.62	127.19	56.70	-60.95
N	16.10	-49.89	-77.04	102.79	59.95	-71.14	151.45	135.07	-46.20
O	74.74	-20.89	-68.98	77.43	28.43	-56.26	142.90	57.15	-56.15

Notes: HS: high-skilled; MS: medium-skilled; LS: low-skilled. In Panel A, the percentage changes of wage bill shares are averaged across industries within each country using as weights each industry's employment share in country-wide employment in 1982. In Panel B, the percentage changes of wage bill shares are averaged across countries within each industry. No country weights are used.
Source: Author's calculations based on EU KLEMS.

B Additional empirical results

Table B1: Contribution of changes in IT and CT to changes in wage bill shares by skill and by age

	(1) HS	(2) MS	(3) LS	(4) 15–29	(5) 30–49	(6) 50+
IT	0.093***	-0.18***	0.091***	-0.036***	-0.021**	0.057***
CT	0.019	0.069***	-0.088***	0.095***	-0.010	-0.085***
F-test H_0: $\beta_{IT} = \beta_{CT}$ (P-value)	0.00123	5.66e-19	1.68e-13	2.68e-10	0.638	2.20e-18
St. deviation of IT	0.1082	0.1082	0.1082	0.1082	0.1082	0.1082
St. deviation of CT	0.0314	0.0314	0.0314	0.0314	0.0314	0.0314
Magnitude of IT effect	0.01	-0.0195	0.0098	-0.0039	-0.0023	0.0062
Magnitude of CT effect	N/A	0.0022	-0.0028	0.0029	N/A	-0.0027
Net effect	N/A	(-)	(+)	(+)	N/A	(-)

Notes: The first two rows show the coefficient estimates of IT and CT of Table 2. The third row shows the p-values of the F-tests for the statistical difference between the coefficient estimates of IT and CT. The fourth and fifth rows show the standard deviation of IT and CT, respectively, on the estimating sample. The magnitude of the IT and CT effects in the sixth and seventh row are calculated as the product of the standard deviation of IT and CT, respectively, with the corresponding coefficient estimate. The net effect in the last row is the outcome of the comparison of the magnitudes of the effects of IT and CT.

Table B2: IT, CT and skill groups by age and age groups by skill

Panel A: Skill composition of labour demand by age									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		15–29			30–49			50+	
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.029***	-0.079***	0.050***	0.027***	-0.079***	0.053***	0.030***	-0.064***	0.033***
	[0.005]	[0.007]	[0.005]	[0.005]	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]
K	-0.0010	-0.0079***	0.0089***	0.00027	-0.0062**	0.0059**	0.0035*	-0.018***	0.014***
	[0.002]	[0.003]	[0.002]	[0.002]	[0.003]	[0.002]	[0.002]	[0.003]	[0.002]
IT	0.17***	-0.22***	0.053***	0.080***	-0.19***	0.11***	0.027***	-0.14***	0.11***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.010]	[0.01]	[0.01]
CT	0.011	-0.026	0.015	0.031	0.055**	-0.086***	0.052***	0.099***	-0.15***
	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.03]	[0.02]
Obs		7053			7053			7053	
R^2	0.566	0.406	0.701	0.595	0.540	0.801	0.589	0.658	0.834
Hansen J statistic		2192.9			1622.6			2429.9	
Instruments	First and second lags of instrumented variables								
Panel B: Age composition of labour demand by skill									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		HS			MS			LS	
Dep. var: Wsh	(15–29,HS)	(30–49,HS)	(50+,HS)	(15–29,MS)	(30–49,MS)	(50+,MS)	(15–29,LS)	(30–49,LS)	(50+,LS)
ln Y	-0.0022	-0.0012	0.0034	0.012**	0.0068	-0.019***	0.018***	0.0015	-0.019***
	[0.005]	[0.008]	[0.007]	[0.005]	[0.005]	[0.003]	[0.005]	[0.006]	[0.005]
K	-0.0040**	0.0045	-0.00050	0.0023	0.0046**	-0.0068***	-0.00084	0.0027	-0.0019
	[0.002]	[0.003]	[0.003]	[0.002]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]
IT	0.011	-0.037**	0.026*	-0.028***	-0.036***	0.064***	0.028***	-0.064***	0.036***
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.007]	[0.01]	[0.01]	[0.01]
CT	0.091***	-0.10***	0.011	0.092***	-0.034	-0.058***	0.10***	0.039	-0.14***
	[0.02]	[0.04]	[0.03]	[0.02]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]
Obs		7053			7053			7053	
R^2	0.405	0.300	0.373	0.753	0.612	0.773	0.528	0.722	0.796
Hansen J statistic		900.9			932.3			891.1	
Instruments	First and second lags of instrumented variables								

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3), (4)–(6), and (7)–(9) of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table B3: Contribution of changes in IT and CT to changes in wage bill shares by age-skill

	(1) (15–29,HS)	(2) (15–29,MS)	(3) (15–29,LS)	(4) (30–49,HS)	(5) (30–49,MS)	(6) (30–49,LS)	(7) (50+,HS)	(8) (50+,MS)	(9) (50+,LS)
IT	0.014***	-0.059***	0.0093**	0.053***	-0.12***	0.042***	0.026***	-0.0078*	0.039***
CT	0.034***	0.027*	0.034***	-0.0029	0.051***	-0.059***	-0.012	-0.0096	-0.063***
F-test H_0: $\beta_{IT} = \beta_{CT}$ (P-value)	0.00199	0.00000471	0.0230	0.00218	9.62e-15	6.65e-09	0.0000296	0.872	5.06e-32
St. deviation of IT	0.1082	0.1082	0.1082	0.1082	0.1082	0.1082	0.1082	0.1082	0.1082
St. deviation of CT	0.0314	0.0314	0.0314	0.0314	0.0314	0.0314	0.0314	0.0314	0.0314
Magnitude of IT effect	0.0015	-0.0029	0.001	0.0057	-0.013	0.0045	0.0028	-0.008	0.0042
Magnitude of CT effect	0.0011	0.00085	0.001	N/A	0.0016	-0.0019	N/A	N/A	-0.002
Net effect	(+)	(-)	(+)	N/A	(-)	(+)	N/A	N/A	(+)

Notes: The first two rows show the coefficient estimates of IT and CT of Table 3. The third row shows the p-values of the F-tests for the statistical difference between the coefficient estimates of IT and CT. The fourth and fifth rows show the standard deviation of IT and CT, respectively, on the estimating sample. The magnitude of the IT and CT effects in the sixth and seventh row are calculated as the product of the standard deviation of IT and CT, respectively, with the corresponding coefficient estimate. The net effect in the last row is the outcome of the comparison of the magnitudes of the effects of IT and CT.

Table B4: IT, CT and worker types by skill and by age (robustness checks)

Panel A: Biannual frequency (1982–2004)						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.039***	-0.12***	0.077***	-0.0095	0.023**	-0.013**
	[0.009]	[0.01]	[0.010]	[0.008]	[0.009]	[0.006]
K	0.0043	-0.019***	0.014***	-0.0042	0.0077*	-0.0035
	[0.004]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
IT	0.092***	-0.18***	0.083***	-0.034**	-0.020	0.055***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
CT	0.028	0.12***	-0.14***	0.15***	-0.037	-0.11***
	[0.03]	[0.04]	[0.04]	[0.03]	[0.03]	[0.02]
Obs		3525			3525	
R^2	0.646	0.512	0.814	0.680	0.542	0.702
Hansen J statistic		334.2			361.3	
Instruments	First and second lags of instrumented variables					
Panel B: IT and CT capital stocks normalised by real gross output						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.011***	-0.062***	0.051***	0.020***	0.0063	-0.026***
	[0.004]	[0.005]	[0.004]	[0.004]	[0.004]	[0.003]
K	-0.0073**	0.0056	0.0017	-0.0067**	0.018***	-0.011***
	[0.003]	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]
IT_Y	0.21***	-0.35***	0.13***	-0.055***	-0.11***	0.16***
	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.01]
CT_Y	-0.023	0.078**	-0.055**	0.035	0.0019	-0.037**
	[0.03]	[0.03]	[0.03]	[0.02]	[0.03]	[0.02]
Obs		7053			7053	
R^2	0.650	0.542	0.824	0.690	0.537	0.716
Hansen J statistic		682.4			645.7	
Instruments	First and second lags of instrumented variables					
Panel C: Gross fixed non-ICT, IT and CT capital formations normalised by real gross value added						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.029***	-0.069***	0.040***	0.013***	0.0024	-0.015***
	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.002]
K	0.0023	-0.071***	0.068***	0.054***	-0.024*	-0.029***
	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.010]
IT2	0.23***	-0.44***	0.21***	-0.076***	-0.064***	0.14***
	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]	[0.02]
CT2	-0.021	0.28***	-0.26***	0.22***	-0.042	-0.18***
	[0.07]	[0.08]	[0.07]	[0.06]	[0.07]	[0.05]
Obs		7053			7053	
R^2	0.647	0.524	0.821	0.685	0.532	0.711
Hansen J statistic		1866.4			890.7	
Instruments	First and second lags of instrumented variables					
Panel D: Labour productivity						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.034***	-0.099***	0.066***	0.011**	-0.0040	-0.0069**
	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
K	0.0011	-0.0030	0.0019	-0.0021	0.0074***	-0.0052***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	0.090***	-0.16***	0.068***	-0.044***	-0.0026	0.046***
	[0.009]	[0.01]	[0.010]	[0.009]	[0.009]	[0.007]
CT	0.017	0.087***	-0.10***	0.093***	-0.0016	-0.091***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
LPROD	-0.0058	0.055***	-0.049***	-0.016***	0.038***	-0.022***
	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.003]
Obs		7053			7053	
R^2	0.648	0.553	0.829	0.687	0.542	0.716
Hansen J statistic		1473.9			790.5	
Instruments	First and second lags of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in all panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table B5: IT, CT and worker types by age-skill (robustness checks)

Panel A: Biannual frequency (1982–2004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0063**	-0.034***	0.030***	0.033***	-0.048***	0.037***	0.012***	-0.035***	0.0094***
	[0.003]	[0.008]	[0.004]	[0.007]	[0.009]	[0.007]	[0.003]	[0.004]	[0.003]
K	-0.0049***	-0.0082**	0.0089***	0.0059	-0.0024	0.0042	0.0034*	-0.0080***	0.0011
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]
IT	0.019***	-0.055***	0.0020	0.052***	-0.11***	0.037***	0.021***	-0.011	0.044***
	[0.005]	[0.01]	[0.008]	[0.01]	[0.02]	[0.01]	[0.006]	[0.008]	[0.006]
CT	0.049***	0.057**	0.042**	-0.0015	0.069**	-0.10***	-0.019	-0.010	-0.081***
	[0.010]	[0.03]	[0.02]	[0.03]	[0.03]	[0.03]	[0.01]	[0.02]	[0.01]
Obs					3525				
R^2	0.299	0.515	0.677	0.540	0.573	0.722	0.620	0.791	0.644
Hansen J statistic					1571.8				
Instruments					First and second lags of instrumented variables				

Panel B: IT and CT capital stocks normalised by real gross output

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.00020	-0.0051	0.025***	0.013***	-0.024***	0.016***	-0.0019	-0.033***	0.0090***
	[0.001]	[0.003]	[0.002]	[0.003]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.010***	-0.0018	0.0053***	0.0031	0.019***	-0.0046*	-0.00028	-0.012***	0.0011
	[0.0010]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.001]	[0.002]	[0.001]
IT_Y	0.014***	-0.10***	0.031***	0.10***	-0.27***	0.059***	0.096***	0.025***	0.043***
	[0.004]	[0.01]	[0.007]	[0.01]	[0.01]	[0.01]	[0.006]	[0.007]	[0.006]
CT_Y	0.011	-0.0029	0.027**	-0.020	0.078***	-0.057***	-0.014	0.0025	-0.025**
	[0.007]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]	[0.01]	[0.01]	[0.010]
Obs					7053				
R^2	0.330	0.544	0.683	0.537	0.584	0.734	0.640	0.798	0.635
Hansen J statistic					2909.9				
Instruments					First and second lags of instrumented variables				

Panel C: Gross fixed non-ICT, IT and CT capital formations normalised by real gross value added

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.0028***	-0.0094***	0.019***	0.022***	-0.035***	0.015***	0.0045***	-0.025***	0.0053***
	[0.001]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.001]	[0.002]	[0.001]
K	-0.0026	0.0068	0.049***	-0.0088	-0.029**	0.014	0.014***	-0.048***	0.0051
	[0.004]	[0.01]	[0.006]	[0.01]	[0.01]	[0.01]	[0.005]	[0.006]	[0.005]
IT2	0.026***	-0.14***	0.038***	0.14***	-0.29***	0.085***	0.064***	-0.012	0.088***
	[0.006]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]	[0.008]	[0.010]	[0.008]
CT2	0.089***	0.052	0.080**	-0.075	0.22***	-0.19***	-0.035	0.0062	-0.15***
	[0.02]	[0.06]	[0.03]	[0.05]	[0.06]	[0.05]	[0.03]	[0.03]	[0.03]
Obs					7053				
R^2	0.283	0.542	0.676	0.541	0.559	0.732	0.629	0.795	0.637
Hansen J statistic					4581.6				
Instruments					First and second lags of instrumented variables				

Panel D: Labour productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0022	-0.017***	0.030***	0.026***	-0.054***	0.024***	0.0096***	-0.029***	0.012***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.004]	[0.002]	[0.002]	[0.002]
K	-0.0036***	-0.0034**	0.0049***	0.0045***	0.0056***	-0.0028*	0.00022	-0.0053***	-0.00021
	[0.0005]	[0.002]	[0.0009]	[0.002]	[0.002]	[0.001]	[0.0007]	[0.0009]	[0.0007]
IT	0.013***	-0.059***	0.0018	0.056***	-0.091***	0.032***	0.020***	-0.0078*	0.034***
	[0.003]	[0.008]	[0.004]	[0.008]	[0.009]	[0.007]	[0.004]	[0.004]	[0.004]
CT	0.034***	0.029*	0.029***	-0.0022	0.067***	-0.067***	-0.015**	-0.0095	-0.067***
	[0.005]	[0.02]	[0.009]	[0.02]	[0.02]	[0.01]	[0.007]	[0.009]	[0.007]
LPROD	-0.00083	0.00099	-0.016***	0.0059**	0.054***	-0.021***	-0.011***	0.00037	-0.012***
	[0.001]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.001]	[0.002]	[0.001]
Obs					7053				
R^2	0.300	0.543	0.686	0.540	0.593	0.736	0.637	0.797	0.646
Hansen J statistic					4986.4				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in all panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

C Additional robustness checks

Table C1: IT, CT and worker types by skill and by age (other alternative IV)

Panel A: Only first lag of instrumented variables as IVs						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.032***	-0.076***	0.043***	0.0060	0.0085*	-0.015***
	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.003]
K	0.0025	-0.0071***	0.0045**	-0.00037	0.0035*	-0.0032**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	0.091***	-0.18***	0.093***	-0.036***	-0.021**	0.057***
	[0.009]	[0.01]	[0.01]	[0.009]	[0.009]	[0.007]
CT	0.019	0.068***	-0.087***	0.094***	-0.0081	-0.086***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
Obs		7053			7053	
R^2	0.647	0.525	0.820	0.685	0.530	0.712
Hansen J statistic		1433.9			744.1	
Instruments	First lag of instrumented variables					
Panel B: First, second and fifth lag of instrumented variables as IVs						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.031***	-0.081***	0.050***	0.0043	0.013***	-0.017***
	[0.004]	[0.005]	[0.005]	[0.004]	[0.004]	[0.003]
K	0.00081	-0.011***	0.0098***	-0.0016	0.0045**	-0.0029**
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
IT	0.092***	-0.18***	0.086***	-0.033***	-0.025***	0.059***
	[0.009]	[0.01]	[0.010]	[0.008]	[0.009]	[0.007]
CT	0.017	0.070***	-0.086***	0.094***	-0.014	-0.081***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.01]
Obs		7053			7053	
R^2	0.647	0.523	0.820	0.685	0.529	0.712
Hansen J statistic		3160.1			1004.5	
Instruments	First, second, fifth lag of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C2: IT, CT and worker types by age-skill (other alternative IV)

Panel A: Only first lag of instrumented variables as IVs									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0028**	-0.016***	0.024***	0.029***	-0.033***	0.012***	0.0059***	-0.027***	0.0067***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0036***	-0.0035**	0.0067***	0.0047***	0.0013	-0.0025*	0.0014*	-0.0049***	0.00027
	[0.0005]	[0.002]	[0.0009]	[0.002]	[0.002]	[0.001]	[0.0008]	[0.0009]	[0.0007]
IT	0.014***	-0.059***	0.0084*	0.052***	-0.12***	0.045***	0.025***	-0.0081*	0.040***
	[0.003]	[0.008]	[0.004]	[0.008]	[0.009]	[0.007]	[0.004]	[0.004]	[0.004]
CT	0.034***	0.026*	0.034***	-0.0027	0.052***	-0.058***	-0.012	-0.011	-0.063***
	[0.005]	[0.02]	[0.009]	[0.02]	[0.02]	[0.01]	[0.007]	[0.009]	[0.007]
Obs					7053				
R^2	0.300	0.543	0.676	0.540	0.556	0.731	0.628	0.797	0.640
Hansen J statistic					4381.2				
Instruments					First lag of instrumented variables				
Panel B: First, second and fifth lag of instrumented variables as IVs									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	-0.0025**	-0.016***	0.023***	0.028***	-0.034***	0.019***	0.0053***	-0.030***	0.0080***
	[0.001]	[0.004]	[0.002]	[0.003]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0039***	-0.0040***	0.0063***	0.0033**	-0.00071	0.0020	0.0015**	-0.0059***	0.0016**
	[0.0005]	[0.001]	[0.0008]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0008]	[0.0007]
IT	0.014***	-0.058***	0.010**	0.053***	-0.12***	0.038***	0.026***	-0.0052	0.038***
	[0.003]	[0.008]	[0.004]	[0.007]	[0.009]	[0.007]	[0.004]	[0.004]	[0.004]
CT	0.033***	0.027*	0.034***	-0.0050	0.050***	-0.059***	-0.011	-0.0081	-0.061***
	[0.005]	[0.02]	[0.009]	[0.02]	[0.02]	[0.01]	[0.007]	[0.009]	[0.007]
Obs					7053				
R^2	0.300	0.543	0.677	0.541	0.557	0.731	0.629	0.796	0.641
Hansen J statistic					6987.4				
Instruments					First, second, fifth lag of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C3: IT, CT and worker types by skill and by age (alternative normalisations of capital stocks)

Panel A: Real non-ICT, IT and CT capital stocks normalised by hours worked by persons engaged						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.026***	-0.066***	0.040***	0.0070**	0.00057	-0.0076***
	[0.003]	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]
K	-0.00000021	-0.0000015	0.0000017	0.0000019	-0.0000026	0.00000064
	[0.000004]	[0.000006]	[0.000005]	[0.000004]	[0.000004]	[0.000003]
IT_H1	0.0018***	-0.0029***	0.0011***	-0.0010***	0.00052***	0.00050***
	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0001]
CT_H1	0.00040***	0.00062***	-0.0010***	0.00072***	0.00014	-0.00086***
	[0.0001]	[0.0002]	[0.0001]	[0.0001]	[0.0001]	[0.00010]
Obs		7053			7053	
R^2	0.648	0.514	0.818	0.687	0.531	0.711
Hansen J statistic		1429.3			856.2	
Instruments	First and second lags of instrumented variables					
Panel B: Real non-ICT, IT and CT capital stocks normalised by hours worked by employees						
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.026***	-0.066***	0.040***	0.0073**	0.00015	-0.0075***
	[0.003]	[0.004]	[0.004]	[0.003]	[0.003]	[0.002]
K	-0.0000045	0.000012***	-0.0000074**	0.0000021	-0.00000028	-0.0000018
	[0.000003]	[0.000003]	[0.000003]	[0.000002]	[0.000003]	[0.000002]
IT_H2	0.0016***	-0.0026***	0.0010***	-0.00095***	0.00061***	0.00034***
	[0.0002]	[0.0002]	[0.0002]	[0.0001]	[0.0002]	[0.0001]
CT_H2	0.00040***	0.00057***	-0.00097***	0.00068***	0.000094	-0.00078***
	[0.0001]	[0.0002]	[0.0001]	[0.0001]	[0.0001]	[0.00009]
Obs		7053			7053	
R^2	0.648	0.513	0.818	0.687	0.532	0.710
Hansen J statistic		1356.1			839.0	
Instruments	First and second lags of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6) of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C4: IT, CT and worker types by age-skill (alternative normalisations of capital stocks)

Panel A: Real non-ICT, IT and CT capital stocks normalised by hours worked by persons engaged									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.0017*	-0.0099***	0.015***	0.019***	-0.035***	0.017***	0.0053***	-0.021***	0.0082***
	[0.0010]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.001]	[0.002]	[0.001]
K	-0.0000041***	0.0000033	0.0000027	-0.0000013	-0.0000031	0.0000018	0.0000052***	-0.0000016	-0.0000029*
	[0.000001]	[0.000004]	[0.000002]	[0.000004]	[0.000004]	[0.000003]	[0.000002]	[0.000002]	[0.000002]
IT_H1	0.000100**	-0.0013***	0.00020**	0.0015***	-0.0014***	0.00043***	0.00019***	-0.00019**	0.00050***
	[0.00005]	[0.0001]	[0.00008]	[0.0001]	[0.0002]	[0.0001]	[0.00007]	[0.00008]	[0.00007]
CT_H1	0.00031***	0.00032***	0.000091	0.00029***	0.00028**	-0.00043***	-0.00020***	0.000024	-0.00068***
	[0.00004]	[0.0001]	[0.00007]	[0.0001]	[0.0001]	[0.0001]	[0.00005]	[0.00006]	[0.00005]
Obs					7053				
R^2	0.288	0.545	0.670	0.548	0.546	0.731	0.625	0.794	0.640
Hansen J statistic					3744.3				
Instruments					First and second lags of instrumented variables				
Panel B: Real non-ICT, IT and CT capital stocks normalised by hours worked by employees									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var: Wsh	(15–29,HS)	(15–29,MS)	(15–29,LS)	(30–49,HS)	(30–49,MS)	(30–49,LS)	(50+,HS)	(50+,MS)	(50+,LS)
ln Y	0.0015	-0.0096***	0.015***	0.019***	-0.035***	0.016***	0.0054***	-0.021***	0.0080***
	[0.0010]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.001]	[0.002]	[0.001]
K	-0.0000031***	0.0000052**	0.000000036	-0.0000019	0.0000062**	-0.0000045**	0.00000053	0.00000053	-0.0000029***
	[0.0000008]	[0.000002]	[0.000001]	[0.000002]	[0.000003]	[0.000002]	[0.000001]	[0.000001]	[0.000001]
IT_H2	0.000099**	-0.0012***	0.00012	0.0014***	-0.0012***	0.00045***	0.00013*	-0.00024***	0.00045***
	[0.00005]	[0.0001]	[0.00008]	[0.0001]	[0.0002]	[0.0001]	[0.00006]	[0.00008]	[0.00006]
CT_H2	0.00030***	0.00029***	0.00010	0.00029***	0.00024*	-0.00043***	-0.00019***	0.000040	-0.00063***
	[0.00004]	[0.0001]	[0.00006]	[0.0001]	[0.0001]	[0.0001]	[0.00005]	[0.00006]	[0.00005]
Obs					7053				
R^2	0.288	0.544	0.670	0.547	0.546	0.731	0.625	0.794	0.639
Hansen J statistic					3706.0				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets of both panels. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C5: IT, CT and worker types by skill and by age (IHST)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var: Wsh	HS	MS	LS	15–29	30–49	50+
ln Y	0.039***	-0.098***	0.059***	-0.00015	0.020***	-0.020***
	[0.005]	[0.007]	[0.006]	[0.005]	[0.006]	[0.004]
ln K	0.022***	-0.066***	0.044***	-0.014**	0.030***	-0.016***
	[0.008]	[0.009]	[0.008]	[0.007]	[0.008]	[0.005]
ln IT	0.093***	-0.18***	0.087***	-0.032***	-0.037***	0.070***
	[0.01]	[0.01]	[0.01]	[0.009]	[0.01]	[0.007]
ln CT	0.0084	0.092***	-0.10***	0.11***	-0.018	-0.088***
	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]	[0.01]
Obs		7053			7053	
R^2	0.647	0.533	0.823	0.685	0.529	0.712
Hansen J statistic		622.6			694.5	
Instruments		First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6). Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C6: IT, CT and worker types by age-skill (IHST)

Dep. var: Wsh	(1) (15–29,HS)	(2) (15–29,MS)	(3) (15–29,LS)	(4) (30–49,HS)	(5) (30–49,MS)	(6) (30–49,LS)	(7) (50+,HS)	(8) (50+,MS)	(9) (50+,LS)
ln Y	-0.0022	-0.024***	0.026***	0.034***	-0.036***	0.022***	0.0074***	-0.039***	0.011***
	[0.002]	[0.004]	[0.003]	[0.004]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
ln K	-0.0094***	-0.026***	0.022***	0.023***	-0.0042	0.011*	0.0083***	-0.036***	0.011***
	[0.002]	[0.006]	[0.004]	[0.006]	[0.007]	[0.006]	[0.003]	[0.004]	[0.003]
ln IT	0.014***	-0.056***	0.0096**	0.052***	-0.13***	0.038***	0.027***	0.0033	0.040***
	[0.003]	[0.008]	[0.005]	[0.008]	[0.010]	[0.008]	[0.004]	[0.005]	[0.004]
ln CT	0.036***	0.035**	0.037***	-0.014	0.063***	-0.067***	-0.013*	-0.0048	-0.070***
	[0.006]	[0.02]	[0.010]	[0.02]	[0.02]	[0.02]	[0.008]	[0.010]	[0.008]
Obs					7053				
R^2	0.288	0.542	0.675	0.541	0.558	0.732	0.629	0.802	0.647
Hansen J statistic					2839.8				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets. Country-industry and country-year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C7: IT, CT and worker types by skill and by age (relative wages)

Dep. var: Wsh	(1) HS	(2) MS	(3) LS	(4) 15–29	(5) 30–49	(6) 50+
ln W^{HS}	0.10***	-0.035***	-0.070***			
	[0.007]	[0.009]	[0.009]			
ln W^{MS}	-0.13***	-0.015	0.15***			
	[0.008]	[0.01]	[0.01]			
ln W^{LS}	0.029***	0.050***	-0.079***			
	[0.003]	[0.004]	[0.004]			
ln W^{29}				0.061***	-0.051***	-0.011
				[0.007]	[0.008]	[0.007]
ln W^{49}				0.012*	0.073***	-0.085***
				[0.007]	[0.009]	[0.007]
ln W^{50}				-0.073***	-0.022***	0.095***
				[0.006]	[0.007]	[0.006]
ln Y	0.0044	-0.046***	0.042***	0.016***	-0.027***	0.012***
	[0.004]	[0.005]	[0.005]	[0.003]	[0.004]	[0.003]
K	0.0012	0.0031	-0.0043**	0.0061***	-0.0089***	0.0028**
	[0.001]	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]
IT	0.050***	-0.18***	0.13***	-0.070***	0.013	0.057***
	[0.008]	[0.01]	[0.01]	[0.007]	[0.009]	[0.007]
CT	0.077***	0.067**	-0.14***	0.098***	-0.044**	-0.054***
	[0.02]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]
Obs		7053			7053	
R^2	0.582	0.262	0.657	0.592	0.228	0.414
Own-wage elasticity	-0.249	-0.444	-1.098	-0.502	-0.302	-0.327
Hansen J statistic		765.8			504.1	
Instruments		First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6). Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C8: IT, CT and worker types by age-skill (relative wages)

Dep. var: Wsh	(1) (15–29,HS)	(2) (15–29,MS)	(3) (15–29,LS)	(4) (30–49,HS)	(5) (30–49,MS)	(6) (30–49,LS)	(7) (50+,HS)	(8) (50+,MS)	(9) (50+,LS)
ln $W^{29,HS}$	0.0052**	-0.020***	0.025***	0.00089	-0.032***	-0.018***	0.040***	-0.025***	0.025***
	[0.002]	[0.006]	[0.003]	[0.005]	[0.007]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{29,MS}$	0.014***	-0.015*	0.0020	0.072***	-0.11***	0.018**	-0.031***	0.029***	0.017***
	[0.003]	[0.009]	[0.005]	[0.008]	[0.01]	[0.009]	[0.004]	[0.006]	[0.004]
ln $W^{29,LS}$	-0.0068***	0.027***	0.027***	-0.017***	0.022***	0.030***	-0.017***	-0.049***	-0.017***
	[0.001]	[0.004]	[0.002]	[0.003]	[0.004]	[0.004]	[0.002]	[0.003]	[0.002]
ln $W^{49,HS}$	0.017***	0.015*	-0.027***	0.11***	-0.079***	-0.020**	-0.0045	0.012*	-0.022***
	[0.003]	[0.009]	[0.005]	[0.008]	[0.01]	[0.009]	[0.004]	[0.006]	[0.004]
ln $W^{49,MS}$	-0.038***	0.024**	0.039***	-0.19***	0.23***	-0.0016	-0.028***	-0.048***	0.018***
	[0.003]	[0.010]	[0.006]	[0.009]	[0.01]	[0.01]	[0.005]	[0.007]	[0.005]
ln $W^{49,LS}$	0.0037*	-0.049***	-0.030***	-0.0065	0.0084	0.019***	0.025***	0.041***	-0.013***
	[0.002]	[0.005]	[0.003]	[0.005]	[0.006]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{50,HS}$	-0.00070	-0.014***	-0.012***	-0.0022	0.096***	-0.019***	-0.014***	-0.012***	-0.022***
	[0.002]	[0.005]	[0.003]	[0.005]	[0.006]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{50,MS}$	0.0085***	-0.058***	-0.0025	0.033***	-0.13***	0.11***	0.027***	0.023***	-0.0053
	[0.003]	[0.008]	[0.005]	[0.007]	[0.010]	[0.009]	[0.004]	[0.006]	[0.004]
ln $W^{50,LS}$	-0.0030	0.090***	-0.022***	0.0017	-0.0029	-0.11***	0.0018	0.029***	0.020***
	[0.002]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.004]	[0.005]	[0.004]
ln Y	-0.0027**	-0.014***	0.030***	0.0019	-0.036***	0.0043	0.0019	0.011***	0.0045***
	[0.001]	[0.003]	[0.002]	[0.003]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0023***	-0.0015	0.0082***	0.0028**	-0.0032**	-0.0096***	0.0024***	0.0068***	-0.0038***
	[0.0004]	[0.001]	[0.0008]	[0.001]	[0.001]	[0.001]	[0.0006]	[0.0009]	[0.0006]
IT	0.021***	-0.065***	-0.014***	0.051***	-0.12***	0.086***	-0.0096***	-0.017***	0.070***
	[0.002]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.003]	[0.005]	[0.004]
CT	0.011*	0.027	0.062***	0.038***	0.0047	-0.12***	0.044***	-0.016	-0.055***
	[0.006]	[0.02]	[0.010]	[0.01]	[0.02]	[0.02]	[0.008]	[0.01]	[0.009]
Obs					7053				
R^2	0.084	0.413	0.552	0.530	0.415	0.583	0.460	0.566	0.437
Own-wage elasticity	-0.797	-0.950	-0.391	0.0489	0.0106	-0.721	-1.338	-0.670	-0.642
Hansen J statistic					3624.6				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets. Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C9: IT, CT and worker types by skill and by age (trade openness)

Dep. var: Wsh	(1) HS	(2) MS	(3) LS	(4) 15–29	(5) 30–49	(6) 50+
ln W^{HS}	0.11***	-0.051***	-0.062***			
	[0.007]	[0.010]	[0.009]			
ln W^{MS}	-0.15***	0.011	0.14***			
	[0.008]	[0.01]	[0.01]			
ln W^{LS}	0.035***	0.040***	-0.075***			
	[0.003]	[0.004]	[0.004]			
ln W^{29}				0.059***	-0.076***	0.017***
				[0.007]	[0.008]	[0.006]
ln W^{49}				0.012	0.14***	-0.15***
				[0.008]	[0.009]	[0.007]
ln W^{50}				-0.070***	-0.066***	0.14***
				[0.006]	[0.007]	[0.006]
ln Y	-0.0063*	-0.032***	0.039***	0.011***	-0.027***	0.016***
	[0.004]	[0.005]	[0.005]	[0.003]	[0.004]	[0.003]
K	-0.00080	0.0061***	-0.0053**	0.0046***	-0.0049***	0.00030
	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]
IT	0.052***	-0.18***	0.13***	-0.068***	0.034***	0.034***
	[0.008]	[0.01]	[0.01]	[0.007]	[0.009]	[0.007]
CT	0.082***	0.065**	-0.15***	0.11***	-0.056***	-0.051***
	[0.02]	[0.03]	[0.03]	[0.02]	[0.02]	[0.02]
E_GDP	-0.0060	-0.050	0.056	-0.11***	-0.55***	0.67***
	[0.03]	[0.04]	[0.04]	[0.02]	[0.03]	[0.02]
I_GDP	-0.18***	0.36***	-0.18***	0.066	1.27***	-1.33***
	[0.05]	[0.07]	[0.06]	[0.05]	[0.05]	[0.04]
Obs		7053			7053	
R^2	0.583	0.274	0.659	0.595	0.297	0.506
Own-wage elasticity	-0.200	-0.400	-1.084	-0.515	-0.181	-0.122
Hansen J statistic		718.7			600.3	
Instruments	First and second lags of instrumented variables					

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6). Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C10: IT, CT and worker types by age-skill (trade openness)

Dep. var: Wsh	(1) (15–29,HS)	(2) (15–29,MS)	(3) (15–29,LS)	(4) (30–49,HS)	(5) (30–49,MS)	(6) (30–49,LS)	(7) (50+,HS)	(8) (50+,MS)	(9) (50+,LS)
ln $W^{29,HS}$	0.0038*	-0.020***	0.027***	0.0021	-0.037***	-0.024***	0.043***	-0.022***	0.027***
	[0.002]	[0.006]	[0.003]	[0.005]	[0.007]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{29,MS}$	0.014***	-0.016*	0.0019	0.072***	-0.082***	0.024***	-0.042***	0.016**	0.012***
	[0.003]	[0.009]	[0.005]	[0.008]	[0.01]	[0.009]	[0.005]	[0.006]	[0.005]
ln $W^{29,LS}$	-0.0088***	0.023***	0.032***	-0.018***	-0.0025	0.022***	-0.0039*	-0.034***	-0.0094***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
ln $W^{49,HS}$	0.014***	0.012	-0.022***	0.11***	-0.073***	-0.026***	-0.0036	0.010	-0.020***
	[0.003]	[0.009]	[0.005]	[0.008]	[0.010]	[0.009]	[0.004]	[0.006]	[0.005]
ln $W^{49,MS}$	-0.032***	0.033***	0.027***	-0.19***	0.26***	0.019*	-0.047***	-0.069***	0.0042
	[0.004]	[0.01]	[0.006]	[0.009]	[0.01]	[0.01]	[0.005]	[0.007]	[0.005]
ln $W^{49,LS}$	0.0071***	-0.046***	-0.037***	-0.0030	0.026***	0.031***	0.014***	0.028***	-0.020***
	[0.002]	[0.006]	[0.003]	[0.005]	[0.006]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{50,HS}$	0.00063	-0.019***	-0.013***	-0.0017	0.070***	-0.016***	-0.0050*	0.00077	-0.017***
	[0.002]	[0.006]	[0.004]	[0.005]	[0.007]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{50,MS}$	0.0043	-0.061***	0.0059	0.030***	-0.15***	0.088***	0.042***	0.040***	0.0045
	[0.003]	[0.009]	[0.005]	[0.008]	[0.010]	[0.009]	[0.004]	[0.006]	[0.004]
ln $W^{50,LS}$	-0.0037	0.094***	-0.021***	0.0011	-0.0031	-0.12***	0.0025	0.030***	0.020***
	[0.002]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.004]	[0.005]	[0.004]
ln Y	-0.0057***	-0.019***	0.035***	-0.0037	-0.025***	-0.00062	0.0018	0.0095***	0.0072***
	[0.001]	[0.003]	[0.002]	[0.003]	[0.004]	[0.003]	[0.002]	[0.002]	[0.002]
K	-0.0029***	-0.0026*	0.0092***	0.0025**	0.00084	-0.010***	0.0017**	0.0053***	-0.0037***
	[0.0005]	[0.001]	[0.0008]	[0.001]	[0.002]	[0.001]	[0.0007]	[0.0010]	[0.0007]
IT	0.022***	-0.063***	-0.018***	0.055***	-0.11***	0.091***	-0.015***	-0.024***	0.066***
	[0.002]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.004]	[0.005]	[0.004]
CT	0.012**	0.037**	0.059***	0.041***	0.011	-0.12***	0.038***	-0.021*	-0.061***
	[0.006]	[0.02]	[0.01]	[0.01]	[0.02]	[0.02]	[0.008]	[0.01]	[0.008]
E_GDP	-0.066***	-0.14***	0.13***	-0.039*	-0.27***	-0.16***	0.19***	0.20***	0.15***
	[0.009]	[0.03]	[0.02]	[0.02]	[0.03]	[0.03]	[0.01]	[0.02]	[0.01]
I_GDP	0.056***	0.12**	-0.14***	0.038	0.79***	0.24***	-0.39***	-0.48***	-0.24***
	[0.02]	[0.05]	[0.03]	[0.04]	[0.06]	[0.05]	[0.03]	[0.04]	[0.03]
Obs					7053				
R^2	0.087	0.416	0.552	0.530	0.464	0.585	0.467	0.596	0.449
Own-wage elasticity	-0.845	-0.956	-0.299	0.0458	0.0973	-0.621	-1.097	-0.488	-0.644
Hansen J statistic					3792.2				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets. Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C11: IT, CT and worker types by skill and by age (labour market programmes)

Dep. var: Wsh	(1) HS	(2) MS	(3) LS	(4) 15–29	(5) 30–49	(6) 50+
ln W^{HS}	0.093***	-0.084***	-0.0095			
	[0.007]	[0.008]	[0.008]			
ln W^{MS}	-0.10***	0.039***	0.064***			
	[0.008]	[0.010]	[0.010]			
ln W^{LS}	0.010***	0.045***	-0.055***			
	[0.003]	[0.004]	[0.004]			
ln W^{29}				0.057***	-0.050***	-0.0073
				[0.006]	[0.008]	[0.007]
ln W^{49}				-0.028***	0.12***	-0.095***
				[0.008]	[0.01]	[0.009]
ln W^{50}				-0.030***	-0.073***	0.10***
				[0.006]	[0.008]	[0.006]
ln Y	0.0014	-0.036***	0.034***	0.012***	-0.00070	-0.012***
	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]	[0.003]
K	0.0016	0.00018	-0.0018	0.0031***	0.0011	-0.0042***
	[0.001]	[0.001]	[0.001]	[0.0010]	[0.001]	[0.001]
IT	0.040***	-0.19***	0.15***	-0.059***	-0.043***	0.10***
	[0.007]	[0.009]	[0.009]	[0.007]	[0.009]	[0.007]
CT	0.031**	0.13***	-0.16***	0.094***	-0.10***	0.0063
	[0.02]	[0.02]	[0.02]	[0.01]	[0.02]	[0.01]
LMP_1	-1.79***	3.84***	-2.04***	1.41***	0.28	-1.69***
	[0.3]	[0.4]	[0.4]	[0.3]	[0.4]	[0.3]
LMP_2	0.65***	-1.88***	1.23***	-0.60***	-0.11	0.71***
	[0.10]	[0.1]	[0.1]	[0.09]	[0.1]	[0.09]
Obs		5689			5689	
R^2	0.573	0.316	0.652	0.643	0.209	0.462
Own-wage elasticity	-0.310	-0.351	-0.997	-0.520	-0.215	-0.291
Hansen J statistic		1498.0			933.5	
Instruments		First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets in columns (1)–(3) and columns (4)–(6). Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C12: IT, CT and worker types by age-skill (labour market programmes)

Dep. var: Wsh	(1) (15–29,HS)	(2) (15–29,MS)	(3) (15–29,LS)	(4) (30–49,HS)	(5) (30–49,MS)	(6) (30–49,LS)	(7) (50+,HS)	(8) (50+,MS)	(9) (50+,LS)
ln $W^{29,HS}$	0.013***	0.0025	0.028***	0.0038	-0.027***	-0.017**	0.026***	-0.031***	0.0028
	[0.003]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.004]	[0.005]	[0.004]
ln $W^{29,MS}$	0.013***	-0.024***	-0.014***	0.061***	-0.093***	-0.0084	-0.023***	0.060***	0.028***
	[0.003]	[0.008]	[0.005]	[0.007]	[0.010]	[0.008]	[0.004]	[0.006]	[0.004]
ln $W^{29,LS}$	-0.0073***	0.024***	0.020***	-0.014***	0.032***	0.032***	-0.015***	-0.051***	-0.021***
	[0.001]	[0.004]	[0.002]	[0.004]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
ln $W^{49,HS}$	0.017***	-0.016*	-0.025***	0.11***	-0.12***	0.039***	0.0027	-0.015**	-0.000039
	[0.003]	[0.008]	[0.005]	[0.008]	[0.01]	[0.009]	[0.004]	[0.006]	[0.005]
ln $W^{49,MS}$	-0.052***	0.030***	0.035***	-0.19***	0.25***	-0.0057	-0.034***	-0.065***	0.026***
	[0.004]	[0.01]	[0.006]	[0.009]	[0.01]	[0.01]	[0.006]	[0.007]	[0.006]
ln $W^{49,LS}$	-0.0020	-0.047***	-0.012***	-0.018***	-0.014**	0.037***	0.023***	0.037***	-0.0047
	[0.002]	[0.006]	[0.003]	[0.005]	[0.007]	[0.006]	[0.003]	[0.004]	[0.003]
ln $W^{50,HS}$	-0.0014	-0.0022	-0.0013	-0.0061	0.087***	-0.025***	-0.012***	-0.011***	-0.029***
	[0.002]	[0.005]	[0.003]	[0.005]	[0.006]	[0.005]	[0.003]	[0.004]	[0.003]
ln $W^{50,MS}$	0.012***	-0.042***	-0.0027	0.036***	-0.12***	0.062***	0.030***	0.050***	-0.024***
	[0.003]	[0.008]	[0.005]	[0.007]	[0.01]	[0.009]	[0.004]	[0.006]	[0.005]
ln $W^{50,LS}$	0.0070***	0.074***	-0.028***	0.0089	0.0025	-0.11***	0.0021	0.026***	0.022***
	[0.003]	[0.007]	[0.004]	[0.006]	[0.008]	[0.007]	[0.004]	[0.005]	[0.004]
ln Y	0.0010	-0.0053**	0.016***	0.0033*	-0.019***	0.012***	-0.0050***	-0.0060***	0.0029**
	[0.0008]	[0.002]	[0.001]	[0.002]	[0.003]	[0.002]	[0.001]	[0.002]	[0.001]
K	-0.0025***	-0.0018**	0.0064***	0.0032***	-0.0023**	-0.0030***	0.0022***	0.00028	-0.0025***
	[0.0003]	[0.0009]	[0.0005]	[0.0008]	[0.001]	[0.0010]	[0.0005]	[0.0007]	[0.0005]
IT	0.012***	-0.063***	-0.0023	0.036***	-0.13***	0.061***	0.0044	0.0046	0.080***
	[0.002]	[0.006]	[0.004]	[0.006]	[0.008]	[0.007]	[0.003]	[0.005]	[0.003]
CT	-0.0037	0.035***	0.046***	-0.0015	0.019	-0.13***	0.049***	0.025***	-0.041***
	[0.005]	[0.01]	[0.008]	[0.01]	[0.02]	[0.01]	[0.007]	[0.009]	[0.007]
LMP_1	0.71***	0.42	0.019	0.056	0.27	0.53*	-1.28***	0.67***	-1.39***
	[0.1]	[0.3]	[0.2]	[0.3]	[0.4]	[0.3]	[0.2]	[0.2]	[0.2]
LMP_2	-0.15***	-0.66***	0.20***	0.33***	-0.58***	0.25***	0.56***	-0.40***	0.44***
	[0.03]	[0.09]	[0.05]	[0.08]	[0.1]	[0.09]	[0.05]	[0.06]	[0.05]
Obs					5689				
R^2	0.072	0.481	0.535	0.508	0.340	0.538	0.507	0.599	0.364
Own-wage elasticity	-0.529	-1.015	-0.532	0.0967	0.0858	-0.571	-1.296	-0.387	-0.613
Hansen J statistic					5111.8				
Instruments					First and second lags of instrumented variables				

Notes: Iterated Three-Stages Least Squares (I3SLS) with asymptotic standard errors in square brackets. Country-industry and year fixed effects included in all equations. All equations are weighted by the share of each industry's employment in country-wide employment in 1982. Asterisks denote significance at 1% (***), 5% (**), and 10% (*). For the description of the variables, see Table C13.

Table C13: Description of variables

Variable	Description	Source
Wsh^{HS}	Wage bill share of high-skilled workers	EU KLEMS
Wsh^{MS}	Wage bill share of medium-skilled workers	EU KLEMS
Wsh^{LS}	Wage bill share of low-skilled workers	EU KLEMS
Wsh^{15-29}	Wage bill share of workers aged 15–29	EU KLEMS
Wsh^{30-49}	Wage bill share of workers aged 30–49	EU KLEMS
Wsh^{50+}	Wage bill share of workers aged 50+	EU KLEMS
$Wsh^{15-29,HS}$	Wage bill share of high-skilled workers aged 15–29	EU KLEMS
$Wsh^{15-29,MS}$	Wage bill share of medium-skilled workers aged 15–29	EU KLEMS
$Wsh^{15-29,LS}$	Wage bill share of low-skilled workers aged 15–29	EU KLEMS
$Wsh^{30-49,HS}$	Wage bill share of high-skilled workers aged 30–49	EU KLEMS
$Wsh^{30-49,MS}$	Wage bill share of medium-skilled workers aged 30–49	EU KLEMS
$Wsh^{30-49,LS}$	Wage bill share of low-skilled workers aged 30–49	EU KLEMS
$Wsh^{50+,HS}$	Wage bill share of high-skilled workers aged 50+	EU KLEMS
$Wsh^{50+,MS}$	Wage bill share of medium-skilled workers aged 50+	EU KLEMS
$Wsh^{50+,LS}$	Wage bill share of low-skilled workers aged 50+	EU KLEMS
Esh^{HS}	Employment share of high-skilled workers	EU KLEMS
Esh^{MS}	Employment share of medium-skilled workers	EU KLEMS
Esh^{LS}	Employment share of low-skilled workers	EU KLEMS
Esh^{15-29}	Employment share of workers aged 15–29	EU KLEMS
Esh^{30-49}	Employment share of workers aged 30–49	EU KLEMS
Esh^{50+}	Employment share of workers aged 50+	EU KLEMS
$Esh^{15-29,HS}$	Employment share of high-skilled workers aged 15–29	EU KLEMS
$Esh^{15-29,MS}$	Employment share of medium-skilled workers aged 15–29	EU KLEMS
$Esh^{15-29,LS}$	Employment share of low-skilled workers aged 15–29	EU KLEMS
$Esh^{30-49,HS}$	Employment share of high-skilled workers aged 30–49	EU KLEMS
$Esh^{30-49,MS}$	Employment share of medium-skilled workers aged 30–49	EU KLEMS
$Esh^{30-49,LS}$	Employment share of low-skilled workers aged 30–49	EU KLEMS
$Esh^{50+,HS}$	Employment share of high-skilled workers aged 50+	EU KLEMS
$Esh^{50+,MS}$	Employment share of medium-skilled workers aged 50+	EU KLEMS
$Esh^{50+,LS}$	Employment share of low-skilled workers aged 50+	EU KLEMS
E^{HS}	Hours worked by high-skilled workers	EU KLEMS
E^{MS}	Hours worked by medium-skilled workers	EU KLEMS
E^{LS}	Hours worked by low-skilled workers	EU KLEMS
E^{15-29}	Hours worked by workers aged 15–29	EU KLEMS
E^{30-49}	Hours worked by workers aged 30–49	EU KLEMS
E^{50+}	Hours worked by workers aged 50+	EU KLEMS
$E^{15-29,HS}$	Hours worked by high-skilled workers aged 15–29	EU KLEMS
$E^{15-29,MS}$	Hours worked by medium-skilled workers aged 15–29	EU KLEMS
$E^{15-29,LS}$	Hours worked by low-skilled workers aged 15–29	EU KLEMS
$E^{30-49,HS}$	Hours worked by high-skilled workers aged 30–49	EU KLEMS
$E^{30-49,MS}$	Hours worked by medium-skilled workers aged 30–49	EU KLEMS
$E^{30-49,LS}$	Hours worked by low-skilled workers aged 30–49	EU KLEMS
$E^{50+,HS}$	Hours worked by high-skilled workers aged 50+	EU KLEMS
$E^{50+,MS}$	Hours worked by medium-skilled workers aged 50+	EU KLEMS
$E^{50+,LS}$	Hours worked by low-skilled workers aged 50+	EU KLEMS
W^{HS}	Relative real hourly wage of high-skilled workers	EU KLEMS
W^{MS}	Relative real hourly wage of medium-skilled workers	EU KLEMS
W^{LS}	Relative real hourly wage of low-skilled workers	EU KLEMS
W^{15-29}	Relative real hourly wage of workers aged 15–29	EU KLEMS
W^{30-49}	Relative real hourly wage of workers aged 30–49	EU KLEMS
W^{50+}	Relative real hourly wage of workers aged 50+	EU KLEMS
$W^{15-29,HS}$	Relative real hourly wage of high-skilled workers aged 15–29	EU KLEMS
$W^{15-29,MS}$	Relative real hourly wage of medium-skilled workers aged 15–29	EU KLEMS
$W^{15-29,LS}$	Relative real hourly wage of low-skilled workers aged 15–29	EU KLEMS
$W^{30-49,HS}$	Relative real hourly wage of high-skilled workers aged 30–49	EU KLEMS
$W^{30-49,MS}$	Relative real hourly wage of medium-skilled workers aged 30–49	EU KLEMS
$W^{30-49,LS}$	Relative real hourly wage of low-skilled workers aged 30–49	EU KLEMS
$W^{50+,HS}$	Relative real hourly wage of high-skilled workers aged 50+	EU KLEMS
$W^{50+,MS}$	Relative real hourly wage of medium-skilled workers aged 50+	EU KLEMS
$W^{50+,LS}$	Relative real hourly wage of low-skilled workers aged 50+	EU KLEMS
Y	Real gross value added	EU KLEMS
K	Ratio of real non-ICT capital stock to real gross value added	EU KLEMS
IT	Ratio of real IT capital stock to real gross value added	EU KLEMS
CT	Ratio of real CT capital stock to real gross value added	EU KLEMS
IT_Y	Ratio of real IT capital stock to real gross output	EU KLEMS
CT_Y	Ratio of real CT capital stock to real gross output	EU KLEMS
IT_H1	Ratio of real IT capital stock to total hours worked by persons engaged	EU KLEMS
CT_H1	Ratio of real CT capital stock to total hours worked by persons engaged	EU KLEMS
IT_H2	Ratio of real IT capital stock to total hours worked by employees	EU KLEMS
CT_H2	Ratio of real CT capital stock to total hours worked by employees	EU KLEMS
IT2	Ratio of real gross fixed IT capital formation to real gross value added	EU KLEMS
CT2	Ratio of real gross fixed CT capital formation to real gross value added	EU KLEMS
UD	Ratio of union members to the total number of employees	OECD
LPROD	Ratio of value added to total hours worked	EU KLEMS
E_GDP	Ratio of value of country-level exports to GDP	WB WDI
I_GDP	Ratio of value of country-level imports to GDP	WB WDI
LMP_1	Ratio of government expenditures on active labour market programmes to GDP	OECD
LMP_2	Ratio of government expenditures on passive labour market programmes to GDP	OECD

Notes: Author's notation.

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Governor of the National Bank of Belgium

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