

The moderating role of IPR on the relationship between country-level R&D and individual-level entrepreneurial performance

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Abstract

Using recent data drawn from the *European Working Conditions Survey* for 32 European countries, we explore the relationship between country-level expenditures on R&D, Intellectual Property Rights (IPR), and individual-level entrepreneurial performance as measured by earnings. Our results show that both R&D expenditures and IPR are positively associated with earnings (and hence the quality) of individual entrepreneurs. However, we also find an intriguing moderation effect in the sense that IPR reduces the positive relationship between country R&D and entrepreneurial earnings. This suggests that too strict IPR legislation may hamper the diffusion of knowledge created by R&D. Hence, governments need to carefully consider the level of IPR they want to install, especially in countries with high R&D expenditures.

JEL codes: L25; L26, O30, O52.

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1. Introduction

Technological progress and innovation are generally considered the main determinants of economic progress and play a key role in theories of endogenous growth (Romer 1986, 1990; Aghion and Howitt 1998). In particular, in endogenous growth models, economic output is not only determined by physical capital and labour, but also by knowledge capital. Aggregate Research & Development (R&D) expenditures are often used as an empirical indicator of a country's or region's investments in the stock of knowledge capital. The higher R&D investments, the bigger the knowledge stock, the higher the chance of innovations taking place, the higher the rate of technological progress, and ultimately, the higher economic output and growth. Unfortunately, innovation is subject to market failures (e.g., lack of full appropriability)¹ and, therefore, firms' R&D investments may be lower than what is socially desirable (Aerts and Schmidt 2008; European Commission 2017). As a consequence, governments around the world have established public support programs to stimulate innovation activities of firms, where R&D subsidies and tax credits are the most common forms, along with Intellectual Property Rights (IPR) policies (Takalo 2012; Krieger et al. 2018).

However, even if economies succeed in reaching considerable levels of R&D, higher R&D investments and a larger stock of knowledge do not automatically translate in higher economic growth. In order for a given knowledge stock to result in high rates of economic growth, it is crucial that knowledge spillovers, including imitation (Schmitz 1989), occur. Entrepreneurs play an important role in creating such knowledge spillovers, for instance by leaving an incumbent firm and starting their own new firms, while exploiting the new knowledge obtained in the incumbent firm (Audretsch and Keilbach 2004; Acs et al. 2013; Erken et al. 2018). However, the ease with which such knowledge spillovers may occur will depend on the strictness of IPR. Hence, although strict IPR increases the incentives to innovate, as it enhances appropriation of the returns to innovation, it may restrict the amount of knowledge spillovers. If the law makes it very difficult to re-use knowledge in different firms from where the knowledge was created (e.g. imitation), knowledge will less easily be diffused, thereby hampering economic progress. This may be especially relevant in countries with high R&D levels, as a bigger knowledge stock implies a higher level of potential spillovers.

All in all, although higher levels of R&D and stricter IPR are generally considered to be benign circumstances to achieve high rates of technological and economic progress (at the macro level) as well as strong entrepreneurial performance (at the individual level), it is not straightforward that the performance of all individual entrepreneurs is positively related to R&D and IPR. This is because strict IPR may be favourable for innovative entrepreneurs but unfavourable for imitative entrepreneurs (Burke and Fraser 2012). Thus, as the quality of the entrepreneurship sector (as approximated by average entrepreneurial performance) is important for achieving economic growth (Acs 2006), it is important to know more about the relationship between these variables. However, an analysis of how country-level R&D, the strictness of IPR, and their interaction relate to the performance of individual entrepreneurs is lacking to date.

Addressing this research gap is precisely the main aim of this work—that is, analysing how the interplay between country R&D and IPR laws affects the performance of individual entrepreneurs by using (i) a generally accepted measure of entrepreneurial performance such as earnings; (ii) macro-level measures of R&D investments and IPR protection; (iii) a geographical coverage as wide as 32 European countries, including the EU-28 member states; and (iv) the most recent international microdata available (5th and 6th waves of the *European Working Conditions Survey* for 2010 and 2015).

The contribution of our paper is as follows. Although it is widely recognised that entrepreneurship and innovation are strongly related (Erken et al. 2018), the two topics are still often investigated

¹ Other market failures (in the form of entry barriers) include high risks and sunk costs, scientific, technological and market uncertainty, and unavailability of appropriate financing (European Commission 2017).

separately. This is especially true when different units of observation are concerned. In the present paper we bring together two strongly related streams of research which are still typically investigated in isolation. These are the (macro-level) literature on national systems of innovation and the (micro-level) entrepreneurship literature focusing on the individual. Regarding the former stream, we focus on macro-level R&D (which in this paper is used as a measure of entrepreneurial innovation), IPR (as a measure of technology transfer policy), and individual earnings from entrepreneurship. The last measure is an established indicator of the success and quality of entrepreneurship (Van Praag 2005; Millán et al. 2014). High-quality entrepreneurship is increasingly deemed important in policy circles as it becomes more and more clear that only a minority of entrepreneurs are of considerable quality in the sense of contributing significantly to macro-economic development and job creation (Acs 2006; Shane 2009; Henrekson and Sanandaji 2018). Hence, the current paper contributes to extant literature by investigating how entrepreneurial innovations at the macro level (as measured by R&D expenditures) influence the quality of entrepreneurship at the micro level (as measured by entrepreneurial earnings), and how this relationship is moderated by technology transfer policy (as measured by the strictness of IPR legislation). To the best of our knowledge, this paper is the first to investigate how technology transfer policy influences the quality of individual entrepreneurs in a country, and how the effectiveness of such policy depends on the level of investments in a country's knowledge stock.

The following set-up is used in the paper. In Section 2 we first describe the general context of entrepreneurial innovation policy in Europe, including IPR policy. Next, we discuss the impact of the strictness of IPR legislation on the economy and finally we derive hypotheses regarding the relationship between country-level expenditures on R&D, IPR legislation and individual-level entrepreneurial performance. We then test these hypotheses making use of the 2010 and 2015 waves of the *European Working Conditions Survey*. This database and the variables that we employ from it are discussed in Section 3. Section 4 describes our methods of analysis while Section 5 describes the empirical results. Section 6 discusses implications for various stakeholders while Section 7 concludes.

2. Background and hypotheses

2.1 Contextualization: fostering entrepreneurial innovations in the European context

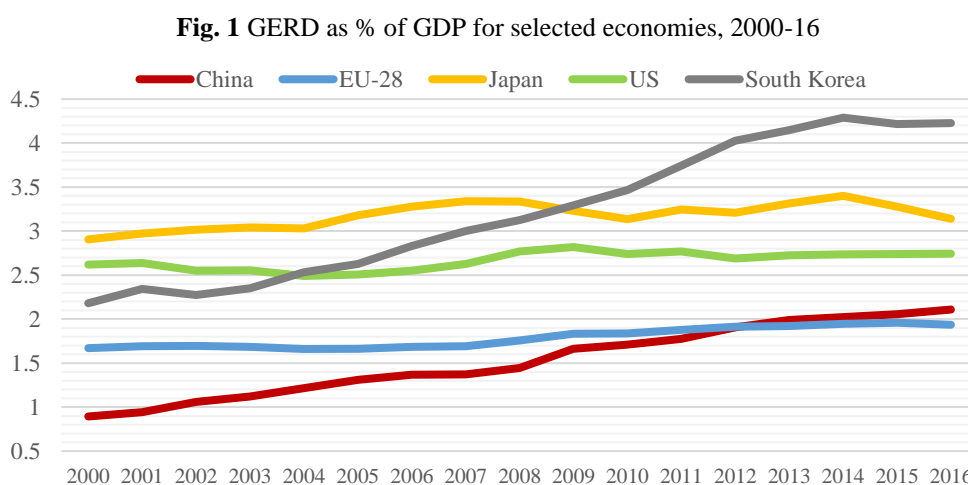
Maintaining a considerable level of R&D expenditures is crucial for economies. In this sense, the most common programs to activate innovation in firms are R&D subsidies, R&D tax credits and IPR policies. R&D subsidies encourage innovation directly (i.e., via direct investments) or indirectly (i.e., via loans). The effect comes through two channels. First, the subsidy itself reduces financial costs to carry out the innovation. Second, the observation that an entrepreneur has received a subsidy for an innovation project provides an informative signal to the market-based financier (Takalo and Tanayama 2009). As regards R&D tax credits, this incentive should raise the cash flow in the period R&D is undertaken by reducing the tax due in the specific period (Elschner et al. 2011). Finally, IPR is aimed to provide protection to innovators by guaranteeing their economic rents (Acs and Sanders 2012). Other policies like prizes and contests, and public procurement and production are also used but to a lesser extent (Takalo 2012).

Public support to R&D investment in the European context has experienced substantial increases since 2007 when the European Commission launched its 7th *Framework Programme for Research and Technological Development*, or abbreviated FP7.² Thus, with a total budget of over € 50 billion and covering the period 2007-13, the programme has provided grants to research actors all over Europe and beyond, in order to co-finance research, technological development and demonstration projects. The 8th programme's name has been modified to *Framework Programme for Research and Innovation*, or abbreviated *Horizon 2020*, which covers the period 2014-20. The budget has raised to about € 77 billion and the focus is now on innovation, delivering economic

² More information about FP7 is available at https://ec.europa.eu/research/fp7/index_en.cfm.

growth faster and delivering solutions to end users that are often governmental agencies.³ Some illustrative projects within these framework are *Copernicus*, i.e., the *European Earth Observation Programme*;⁴ *IMPETUS*, i.e., the *Information Management Portal to Enable the integration of Unmanned Systems*;⁵ or *OpenAIRE*, i.e., a network of open access repositories, archives and journals that support Open Access policies.⁶ Finally, the research initiative meant to succeed the current Horizon 2020 program is the 9th programme *Horizon Europe*, which has drafted to raise spending levels by 50% to approximately €100 billion over the years 2021-2027.⁷ As part of its challenges, this new framework will support programs to encourage disruptive innovation and technology diffusion.

Indeed, the EU-28 Gross Domestic Expenditure on R&D (GERD) accounted for about 1.9% of its GDP in 2016 (OECD 2018).⁸ Figure 1 below shows the international evolution of GERD for selected economies.



Source: OECD Science, Technology and R&D Statistics: Main Science and Technology Indicators.

We can observe that the EU lags behind its major competitors when it comes to investment in knowledge generation. In addition, productivity growth has slowed down in Europe while investment in R&D has remained relatively stable in most countries (i.e., the R&D-Productivity nexus seems weaker), with a deceleration in the diffusion of innovation from productivity leading companies to lagging companies as one of its plausible drivers (OECD 2015; European Commission 2017).

Therefore, the existing evidence on the European productivity slowdown calls for a better understanding of the knowledge diffusion processes and its potential obstacles, including the existing IPR laws, as a fundamental piece of the technology transfer policy.

2.2. IPR and its effects on the economy

Similar to what was observed for R&D investment, the strictness of IPR protection varies severely across geographies and also seems closely related to countries' levels of economic development.⁹

³ More information about Horizon 2020 is available at <https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>.

⁴ More information about Copernicus is available at https://ec.europa.eu/growth/sectors/space/copernicus_en.

⁵ More information about IMPETUS is available at <http://impetus-research.eu>.

⁶ More information about OpenAIRE is available at <https://www.openaire.eu>.

⁷ More information about Horizon Europe is available at https://ec.europa.eu/info/designing-next-research-and-innovation-framework-programme/what-shapes-next-framework-programme_en.

⁸ This figure varies substantially across European countries and is correlated with the level of economic development of the country's economy. Thus, this figure rises above 2.5% in countries like Sweden, Austria, Germany, Denmark, and Finland. By contrast, this figure lies below 1% in countries such as Poland, Turkey, and Slovakia, Romania and Latvia (OECD 2018). This large cross-country variation can also be observed in Table 1 in Section 3.3.

⁹ See Table 1 in Section 3.3.

However, although stronger levels of IPR protection should encourage technological and economic progress by stimulating the creation of knowledge, it can also limit the spread of new ideas and encourage monopoly (Falvey et al. 2006). Otherwise stated, the effect of stricter IPR on relevant economic outcomes such as growth, productivity, and innovation is not straightforward. Indeed, the impact of IPR protection on these outcomes is likely to vary with a country's income level.

Concerning economic progress, Thompson and Rushing (1996) find a positive and significant relationship between IPR protection and growth in countries with a level of GDP above a certain threshold whereas the relationship is not significant for countries below this level. In a later study, Thompson and Rushing (1999) obtain similar results when analysing the relationship between IPR and total factor productivity. However, Falvey et al. (2006) observe how stronger IPR protection significantly improves growth for high income countries and low income countries but such relationship is not found for middle-income countries. Falvey et al. consider results for high-income countries largely as expected; these countries undertake the vast majority of innovation and strong IPR protection should encourage further innovation by allowing innovators to profit from their inventions. However, technology transfer occurs through other channels for middle-income countries; strong IPR protection encourages imports and inward foreign direct investment from advanced countries that would enhance economic growth without adversely affecting domestic imitative activities.

As regards innovation, Park and Ginarte (1997) find that strictness of IPR explains only the physical and research capital investment behavior of the top 30 economies whereas this relationship is not significant for the lower developed countries. These authors suggest that IPR affects economic growth by stimulating the accumulation of factor inputs like research and development capital and physical capital. This implies that countries not conducting innovative research or conducting a limited amount would enjoy few, if any, of the benefits of IPR protection because an innovation sector through which IPR affects economic growth is absent. The same result is obtained by Schneider (2005) for developed countries. However, the positive impact turns to a negative impact for developing countries, possibly because an innovation sector is lacking while at the same time imitation is hampered. Finally, Furman et al. (2002) and Xu and Chiang (2005) concentrate on the relationship between IPR protection and the inflow of foreign patents, which is also observed to be stronger for high-income countries.

2.3. Hypotheses derivation

Now that the scenario of policies fostering entrepreneurial innovations has been presented and its complex relationships have been discussed, this section is aimed at deriving three hypotheses regarding the interrelations between country-level R&D investment (as our proxy of entrepreneurial innovation), the strictness of IPR (as a measure of technology transfer policy) and individual entrepreneurial performance in terms of earnings (as indicator of the success and quality of entrepreneurship).

In this sense, higher R&D investments at country level are associated with a higher rate of technological progress of the economy. If entrepreneurs have the possibility to work with more sophisticated technology, it will be easier for them to make profits, for instance if unit costs are lower as a result of labour-saving technological progress. In this regard, Deeds (2001) observes how the R&D intensity of a high technology venture is positively related to the amount of entrepreneurial wealth created by the venture. Similarly, Hall et al. (2010) observe how for every 100 euros a company invests in R&D, the net benefit it obtains is between 10 and 30 euros for every year the R&D investment is considered not to have become obsolete.

In addition, the rate of return on R&D investment for an economy (i.e., the social rate of return) has been estimated to be much larger (up to two to three times higher) than the return a company achieves due to positive spillover effects (Coe and Helpman 1995; Kao et al. 1999). In this sense, higher R&D levels are associated with a bigger knowledge stock entrepreneurs can draw from.

The bigger knowledge stock implies a higher level of potential knowledge spillovers which also increase entrepreneurial opportunities to make profits. Venture capitalists, for instance, look out for such entrepreneurial opportunities and the concentration of knowledge in a region due to the positive effects on start-ups (Mueller 2007). In this sense, the presence of venture capital financing is associated with the acceleration of the innovation and commercialization process accompanied by better firm performance (i.e., greater growth in wages and scale; Kelly and Kim 2018). All in all, governments and policy makers are interested in building innovation clusters to attract entrepreneurial firms, due to the value added and the positive knowledge spillover effects for the regions concerned (Colombelli and Quatraro 2018; Lehmann and Menter 2018). The above arguments lead to the following hypothesis:

Hypothesis 1: *Country-level R&D expenditures are positively related to individual-level entrepreneurial earnings*

Turning our attention to IPR, its impact on entrepreneurial earnings is twofold. Stricter IPR is positively related to innovation *creation* as it will make it easier for entrepreneurs to appropriate the returns to their innovations. This, in turn, will have a positive effect on earnings of (innovative) entrepreneurs. Previous research suggests that this positive relationship holds in particular for high-income countries (Thompson and Rushing 1996, 1999; Falvey et al. 2006).¹⁰ On the other hand, stricter IPR is negatively related to innovation *access* as such strict legislation will make it more difficult for entrepreneurs to make use of innovations created elsewhere (Burke and Fraser 2012). This, in turn, will have a negative effect on earnings of (imitative) entrepreneurs. Policy, then, must solve a difficult trade-off between incentives for innovation and the need to encourage diffusion (Denicolò and Franzoni 2012). In this regard, the study by Burke and Fraser (2012) is informative as they estimate the effects of various IPR-related variables on self-employment rates (as a rough indicator of entrepreneurial opportunities) across a sample of predominantly high-income countries. Although they find that patent activity has a negative effect on self-employment, overall they find that more extensive and strong IPR laws have a net positive effect on self-employment activity. According to Burke and Fraser (2012), this indicates that “positive market opportunity creation effects outweigh negative technology cost/access effects for most of the self-employed sector” (p. 830). Based on their analysis, we expect the positive effects of IPR to dominate. Hence, we hypothesize the following:

Hypothesis 2: *Stricter IPR legislation is positively related to individual-level entrepreneurial earnings*

Too strict IPR legislation may hamper the diffusion of knowledge created by R&D. This may be especially harmful in countries with high R&D levels, as a bigger knowledge stock implies a bigger flow of potential knowledge spillovers. In such circumstances, a lower level of IPR may be instrumental in actually realising these potential spillovers, i.e. less strict IPR may facilitate not only (earnings from) imitative entrepreneurship but also innovative entrepreneurship that wishes to build further on the earlier innovations made in other firms (Burke and Fraser 2012). Furthermore, under these circumstances, entrepreneurs possessing valuable intellectual property are pushed to grow their ventures quickly as a way to combat misappropriation (Autio and Acs 2010). In contrast, for countries with lower R&D levels, i.e. smaller knowledge stocks, potential spillovers are also smaller and hence the amount of potential spillovers foregone by high IPR, is also smaller. Based on the foregoing reasoning, we suggest the following hypothesis:

Hypothesis 3: *The positive relationship between country-level R&D expenditures and individual-level entrepreneurial earnings is weaker in economies with strict IPR than in economies with weak IPR.*

¹⁰ Note that the present paper focuses on high-income (i.e. European) countries.

To the best of our knowledge, however, a conditional analysis on the relationship between country expenditures on R&D, the level of IPR and individual entrepreneurial performance does not exist to date. Addressing this drawback of the literature is the main aim of this work—that is, filling the existing research gap by particularly analysing the moderating role of the strictness of IPR legislation on the relationship between country-level expenditures on R&D and individual-level entrepreneurial earnings by using (i) a generally accepted measure of performance: earnings; (ii) a wide geographical coverage of many European countries, including the EU-28; and (iii) the most recent international microdata available (5th and 6th waves of the *European Working Conditions Survey* for 2010 and 2015).

3. Data and variables

3.1. Data and sample

We use data from the Fifth and Sixth waves of the *European Working Conditions Survey* –EWCS 2010 and 2015– (Eurofound 2012, 2016, 2018). This survey is carried out every five years by the EU Agency *Eurofound* (*European Foundation for the Improvement of Living and Working Conditions*)¹¹ and offers key work-related information on 44,000 workers (including both employees and self-employed individuals) covering 35 European countries.¹² These workers are interviewed about several working condition aspects, including physical environment, workplace design, working hours, work organization and social relationships in the workplace. Depending on country size and national arrangements, the sample ranges from 1,000 to 4,000 workers per country.

Our final sample includes men and women aged 18 to 65 who are classified as self-employed individuals within the EU-28 territory, 2 candidate countries (Serbia and Turkey) and 2 EFTA countries (Norway and Switzerland). All individuals working part-time, i.e., working under 15 hours per week, are excluded. The final dataset, after removing cases with missing data for any of the relevant variables, yields 6,300 observations.

3.2. Dependent variable

We are interested in explaining how country-level R&D and IPR affect the business performance of entrepreneurs in terms of earnings. To this end, we employ the variable ‘net monthly earnings’. Workers in the EWCS are asked to refer to his/her average net earnings in recent months and, in case he/she doesn’t know, are asked to give an estimate.¹³ The variable is defined in PPP dollars of 2015 and converted to natural logarithms.

3.3. Main independent variables

EXPENDITURE ON R&D

The fundamental role of technological activities, as drivers of entrepreneurial success and hence of economic development, urges countries to promote innovation in their economies (Van Stel et al. 2014). Therefore, in order to capture the presence and commitment to technological effort and innovation activities in each of the considered economies, our regressions include the Gross Domestic Expenditure on R&D (GERD) for the periods 2010 and 2015. This indicator includes expenditures by business enterprises, higher education institutions, as well as government and private non-profit organisations. In order to make fairer comparisons between countries, Eurostat

¹¹ This Foundation is an autonomous body of the European Union, created to assist in the formulation of future policy on social and work-related matters. Further information can be found at www.eurofound.europa.eu.

¹² This set includes the EU-28 together with 5 candidate countries (Albania, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Turkey) and 2 EFTA countries (Norway and Switzerland).

¹³ The interviewer is asked to explain, if necessary, that net monthly earnings are the earnings at one’s disposal after taxes and social security contributions.

provides this information expressed as *Purchasing Power Standards* –PPS– per inhabitant at constant 2005 prices.¹⁴

INTELLECTUAL PROPERTY RIGHTS

The quality of institutions has a strong bearing on competitiveness and growth (Easterly and Levine 1997; Acemoglu et al. 2001, 2002). Thus, it influences investment decisions and the organization of production and plays a key role in the ways in which societies distribute the benefits and bear the costs of development strategies and policies. For example, owners of land, corporate shares, or intellectual property are unwilling to invest in the improvement and upkeep of their property if their rights as owners are not protected (De Soto 2000). With the purpose of capturing the strictness of IPR protection in each economy in our sample, our specifications incorporate the *Intellectual Property Protection* indicator (IPP) for periods 2010 and 2015 from the *World Economic Forum's Executive Opinion Survey* (WEF-EOS; Browne et al. 2014).¹⁵ IPP is evaluated on a scale of 1 to 7, from extremely weak to extremely strong protection.

Table 1 below shows figures as regards these macroeconomic indicators for countries and periods in our sample. Information about national unemployment rates is also provided.

--- Insert Table 1 about here ---

3.4. Control variables

In order to isolate the effect of our hypotheses-related variables, the empirical models also include a set of explanatory variables that are known to influence self-employment earnings (see e.g. Hamilton 2000; Millán et al. 2014; Van Stel et al. 2018; Parker 2018): a distinction between self-employed with and without employees, educational attainment, job-related aspects (tenure, working hours, business sector) and some demographic indicators (gender, immigrant, age, cohabitation status, children, health status). Furthermore, in order to control for the business cycle and some structural differences between countries, the empirical models also include the national unemployment rates for periods 2010 and 2015, which we collect from Eurostat and the World Bank, and a period 2015 (vs. 2010) dummy. We refer to the Appendix for all variable descriptions.

4. Methodology

Regarding earnings from self-employment, a considerable proportion of observations are zeros in some human population surveys (see e.g. Van Stel et al. 2018). In these cases the entrepreneur either only earns just enough to cover business expenses or might suffer losses (which are censored). This feature violates the linearity assumption so that the least squares method is inappropriate. As usual under these circumstances, earnings equations are estimated by means of tobit models (Tobin 1958). This feature does not occur in our sample though and, hence, OLS regressions are used in order to estimate earnings from self-employment.

¹⁴ PPS is the technical term used by Eurostat for the common (artificial) currency in which national accounts aggregates are expressed when adjusted for price level differences using PPPs. Thus, PPPs can be interpreted as the exchange rate of the PPS against the €.

¹⁵ The WEF-EOS draws on the views of over 14,000 executives in over 140 economies and captures valuable information on a broad range of factors that are critical for a country's competitiveness and sustainable development, and for which data sources are scarce or, frequently, non-existent on a global scale. Among several examples of otherwise unavailable data are the quality of the educational system, indicators measuring business sophistication, and labor market variables such as flexibility in wage determination. The Survey results are used in the calculation of the *Global Competitiveness Index* (GCI) and other indexes of the WEF. Further information about WEF can be found at <https://www.weforum.org>. Further information about the GCI can be found at <https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018>.

5. Results

5.1. Descriptive analysis

We aim to explore how self-employed workers compare depending on the country-level GERD and IPP. Table 2 below compares self-employed workers in countries which' GERD and IPP are above and below the unweighted average levels for the 32 countries in our sample during the periods 2010 and 2015 (these benchmarks are 425 for GERD and 4.62 for IPP).

--- Insert Table 2 about here ---

We first explore earnings. We observe how earnings for self-employed are far higher in countries with high GERD than in countries with low GERD, which supports our Hypothesis 1. Similarly, earnings from self-employment are also far higher in countries with strict IPP than in countries with weak IPP, which is consistent with our Hypothesis 2.

We also observe in our sample that, compared with self-employed in countries with low GERD and weak IPP, self-employed in countries with high GERD and strict IPP, respectively, have more often employees, higher levels of educational attainment, and they work shorter hours. Furthermore, they work more often in construction, financial services, education and health. Finally, they are also more often immigrants, older, with partner, and feeling healthier.

5.2. Multivariate analysis

Although our univariate analysis seems to support the validity of some of our hypotheses, a conditional analysis is needed to draw robust conclusions. Table 3 in subsection 5.2.1 shows the results from 6 models as regards net monthly earnings and their main predictors, with special focus on country-level GERD and IPP. These results are presented as follows. Average predicted earnings are indicated at the top of each specification. These predicted earnings help to understand the relative importance of our marginal effects presented below. Thus, each specification is presented in a two-column format. The first column shows semi-elasticities in the form of $[(dy/dx)/y]\%$, i.e., percentage changes of earnings caused by unit changes of the respective explanatory variables, whereas t-statistics associated with these effects are presented in the second column. Finally, section 5.2.2 presents some robustness checks which are part of the analysis.

5.2.1 Results

Table 3 shows the estimation results from 6 specifications, Models 1 to 6, which are aimed to test our earnings-related hypotheses.

--- Insert Table 3 about here ---

Overall, our empirical tests support most of the hypotheses advanced in this article. Model 1 serves as our baseline model and includes country dummies. Models 2 to 6 substitute country dummies by our hypotheses-related variables and some controls for aggregated conditions, i.e., the unemployment rate and a period dummy. In particular, Model 2 is aimed to test Hypothesis 1 and includes GERD as main explanatory variable. This model shows that each additional hundred PPS per inhabitant in R&D effort increases earnings from self-employment by about 6.2%, in concordance with Hypothesis 1. Model 3 is intended to test Hypotheses 2 and IPP is included as its main predictor. We observe that each unitary increase in the IPP scale (from 1 to 7) raises earnings from self-employment by about 14.8%, supporting Hypothesis 2.

Model 4 focuses on testing our Hypothesis 3, i.e., the moderating effect of IPP on the relationship between GERD and earnings from self-employment. Hence, the main predictors are (i) GERD; (ii) a dummy equalling 1 for strict IPP, that is, when the IPP indicator is above 4.62; and (iii) an interaction term intended to capture the differentiated effect of GERD on those economies with strict and weak IPP. Thus, when the IPP is *below* this benchmark, we find that earnings from self-employment increases by about 7.5% for each additional hundred PPS per inhabitant in GERD.

When the IPP is *above* this benchmark, however, we observe that each additional hundred PPS per inhabitant in GERD only increases earnings from self-employment by 3.3%.¹⁶ These results are, therefore, coherent with Hypothesis 3.

Models 5 and 6 are separate regressions for countries with strict and weak IPP in order to check the robustness of the different role of GERD on earnings from self-employment we just identified in Model 4. In this sense, we observe how this effect is indeed stronger for countries with weak IPP, in accordance with Hypothesis 3. In particular, we observe how earnings from self-employment increases in countries with strict and weak IPP, respectively, by about 1.7% and 8.6% for each additional hundred PPS per inhabitant in GERD. Note that Models 5 and 6 also support Hypothesis 2 since average predicted earnings are much higher in the strong-IPP sample (2,944 \$) compared to the weak-IPP sample (1,758 \$).

As regards the results for our control variables, having employees, education, tenure and the number of working hours increase earnings from entrepreneurship, as expected. As regards tenure, however, the quadratic term begins to dominate the linear term when self-employed reach 29 years of experience, indicating that, beyond this number of years of experience, additional experience does not report additional earnings. Similarly, results as regards working hours indicate that, beyond 64 working hours per week, additional entrepreneurial efforts are no longer productive. We also find that females and immigrants earn less than their male and native counterparts, respectively. Regarding the age of the entrepreneur, we find a non-linear, inverted U-shaped impact on earnings where the turning point is reached when the entrepreneur is 47 years old. Cohabiting individuals report higher earnings than those living without partner whereas no effect of children on earnings is observed. Reporting good health also seems to be positively associated with earnings from entrepreneurship. Finally, higher unemployment rates are associated with lower earnings, which is also expected.

5.2.2 Robustness checks

We performed several robustness checks. *First*, although we present only a few models in Table 3, a complete stepwise regression approach (in which models incorporate covariates one-by-one) was followed, which serves as a robustness check for the results obtained in previous models. *Second*, our findings are also robust to the use of alternative operationalisations of hypotheses-related variables such as (i) GERD expressed as a percentage of GDP and (ii) the *Protection of Property Rights* indicator from the *Economic Freedom of the World Index* (EFW; Fraser Institute, Canada).¹⁷ *Third*, we also obtain similar results when using median (instead of mean) IPP to calculate the benchmark which distinguishes strict from weak IPP countries. *Fourth*, the robustness of our t-statistics was verified by re-estimating them from variance-covariance matrices of the coefficients obtained by bootstrapping. All results as regards these robustness checks are available upon request.

6. Implications

The results of our empirical analysis have implications for various stakeholders. For policy makers, it is important to strike a balance between the level of R&D in their countries and the strictness of IPR laws. If total R&D expenditures in a country (the sum of public and private R&D) is relatively low, governments may directly increase R&D by increasing public R&D. However, it may also stimulate (primarily private) R&D indirectly by installing stricter IPR laws. This will increase the incentives for private firms to conduct R&D as the strict IPR makes it easier to appropriate the returns to their R&D efforts. On the other hand, if R&D is already at a relatively high level, it may be wise to exploit such a big knowledge stock by lowering the strictness of IPR, which will in turn stimulate knowledge spillovers. As we have shown, the association of country-

¹⁶ Results concerning the situation when the IPP indicator is above 4.62 can be achieved by adding marginal effects associated with GERD and the interaction term in Model 4 (i.e. 7.49-4.21).

¹⁷ Further information about the EFW index can be found at <https://www.fraserinstitute.org/economic-freedom/approach>. Further information about the Fraser Institute can be found at <https://www.fraserinstitute.org>.

level R&D with average entrepreneurial income is stronger in a weak-IPR regime, hence installing less strict IPR laws will be especially beneficial to entrepreneurs in countries with high R&D investments.

For innovative entrepreneurs with an international orientation, it may be wise to consider the strictness of IPR in various countries as part of their decision in which country to locate. Nevertheless, this is not just a matter of choosing a country with a strict IPR regime: although this will help appropriating the returns to their innovations, innovative entrepreneurs will find it harder to use existing innovations on which they may wish to build further. Hence, whereas innovative entrepreneurs pursuing *radical* innovations are likely to benefit from a strict IPR regime, innovative entrepreneurs pursuing *incremental* innovations (building further on earlier innovations made in other firms) as well as imitative entrepreneurs will be better off in a country that combines high R&D levels with a low IPR regime, facilitating knowledge spillovers. In such countries entrepreneurs will have easy access to a big knowledge stock, which benefit incremental innovation and imitation.

Finally, our work also has implications for researchers as we show that the impact of R&D and IPR on entrepreneurial outcomes should be considered in tandem with each other rather than in isolation.

7. Conclusions

Using recent data drawn from the *European Working Conditions Survey* for 32 European countries, we have explored the relationship between country-level expenditures on R&D, Intellectual Property Rights (IPR), and individual-level entrepreneurial performance as measured by earnings. Our results show that both R&D expenditures and IPR are positively associated with earnings of individual entrepreneurs. However, we have also found an intriguing moderation effect in the sense that IPR reduces the positive relationship between country R&D and entrepreneurial earnings.

Our results suggest that too strict IPR may hamper the diffusion of knowledge created by R&D, including imitation. Current entrepreneurship research has a tendency to strongly emphasise (if not overemphasise) the role of the innovative or Schumpeterian entrepreneur (e.g. Henrekson and Sanandaji 2018). It goes without saying that these entrepreneurs are very important for achieving economic growth as they contribute strongly to increasing a country's knowledge stock, and hence technological progress. However, knowledge diffusion and imitation may be equally important for achieving high rates of economic growth, i.e. many imitative entrepreneurs are also to be considered high-quality in the sense of contributing significantly to macro-economic development and job creation (Schmitz 1989). Results of the current paper suggest that high-R&D countries may (unintentionally) hamper economic progress by setting too strict IPR levels which discourage high-quality imitative entrepreneurship and the associated diffusion of knowledge.

In conclusion, the present paper has contributed to our knowledge of how country levels of R&D and IPR play out for the earnings of individual entrepreneurs, and hence, the average quality of a country's entrepreneurs. To the best of our knowledge, this paper is the first to investigate how technology transfer policy influences the quality of individual entrepreneurs in a country, and how the effectiveness of such policy depends on the level of investments in a country's knowledge stock. A limitation of this study is that we are unable to distinguish empirically between innovative and imitative entrepreneurs. It is likely that the interaction between R&D and IPR plays out differently for the earnings of these two types of entrepreneurs. We consider the identification of these two types a fruitful direction for future research. Future research may also focus on investigating the relationship between R&D, IPR and earnings outside of the European context as used in this paper. Especially in low- and middle-income countries, the relationship might be different (Thompson and Rushing 1996, 1999; Falvey et al. 2006).

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Tables (to be inserted in the text)

Table 1: GERD, IPP and unemployment rates for 32 European countries

Country	GERD PPS per inhabitant				IPP				Unemployment Rate			
	Rank#	2010	Rank#	2015	Rank#	2010	Rank#	2015	Rank#	2010	Rank#	2015
Austria	5	852	3	987	4	6.07	9	5.51	3	4.8	6	5.7
Belgium	9	602	9	733	13	5.27	12	5.29	14	8.3	16	8.5
Bulgaria	31	60	27	114	32	2.63	31	3.02	20	10.3	19	9.2
Croatia	27	99	28	114	28	3.51	28	3.61	23	11.8	29	16.1
Cyprus	26	108	29	103	14	4.75	17	4.35	6	6.3	28	15.0
Czech Republic	18	275	15	428	21	4.02	20	3.92	11	7.3	4	5.1
Denmark	6	838	5	880	5	5.99	13	5.28	12	7.5	8	6.2
Estonia	19	221	18	252	16	4.61	14	4.94	28	16.7	9	6.2
Finland	2	1034	8	784	2	6.09	1	6.19	15	8.4	20	9.4
France	10	574	11	597	8	5.81	6	5.60	18	9.3	24	10.4
Germany	7	790	4	929	9	5.72	11	5.41	7	7.0	3	4.6
Greece	21	126	25	171	20	4.14	21	3.86	25	12.7	32	24.9
Hungary	20	165	21	221	23	3.88	26	3.69	22	11.2	12	6.8
Ireland	12	518	12	545	11	5.57	7	5.60	27	14.6	22	10.0
Italy	17	301	16	313	22	3.91	25	3.69	16	8.4	26	11.9
Latvia	29	74	30	96	26	3.65	19	4.00	31	19.5	21	9.9
Lithuania	24	108	23	187	24	3.80	22	3.83	29	17.8	18	9.1
Luxembourg	4	911	7	798	6	5.93	2	6.08	2	4.6	10	6.5
Malta	22	124	22	191	18	4.39	16	4.52	9	7.3	7	5.9
Netherlands	11	573	10	680	7	5.84	5	5.70	5	5.0	13	6.9
Norway	8	668	6	802	10	5.66	8	5.57	1	3.5	2	4.3
Poland	25	108	24	174	27	3.58	24	3.75	19	9.7	15	7.5
Portugal	16	303	19	240	15	4.61	15	4.57	24	12.0	27	12.6
Romania	32	45	32	57	29	3.38	30	3.35	8	7.0	11	6.8
Serbia	30	64	31	78	30	2.77	32	2.88	30	19.2	30	17.9
Slovakia	23	109	20	235	25	3.73	23	3.78	26	14.5	25	11.5
Slovenia	14	446	14	482	17	4.49	18	4.06	10	7.3	17	9.0
Spain	15	315	17	282	19	4.31	29	3.58	32	19.9	31	22.1
Sweden	3	971	2	1050	1	6.11	10	5.46	17	8.6	14	7.4
Switzerland	1	1052	1	1090	3	6.08	3	6.04	4	4.8	1	4.1
Turkey	28	89	26	129	31	2.68	27	3.66	21	10.7	23	10.2
United Kingdom	13	453	13	485	12	5.33	4	5.94	13	7.8	5	5.3
EU-32 (unweighted)		405		445		4.63		4.59		10.1		9.6

Notes: Countries are ranked from higher to lower GERD, from strict to weak IPP legislation and from lower to higher unemployment rate; Data sources: Eurostat, World Economic Forum and World Bank.

Table 2. Descriptive statistics

Countries	<i>All</i>		<i>High GERD</i>		<i>Low GERD</i>		<i>Strict IPP</i>		<i>Weak IPP</i>	
# observations	N = 6,300		N = 2,484		N = 3,816		N = 2,409		N = 3,891	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Dependent variable</i>										
Net monthly earnings - PPP \$ of 2015 (<i>1 – 55,211</i>)	2,211	2,032	2,882	2,458	1,775	1,549	2,944	2,464	1,758	1,545
<i>Entrepreneurship types</i>										
Self-employed with employees ^a	0.311		0.348		0.287		0.359		0.281	
Own-account self-employed worker ^a	0.689		0.652		0.713		0.641		0.719	
<i>Educational attainment</i>										
Basic education ^a	0.110		0.028		0.163		0.044		0.151	
Secondary education ^a	0.608		0.584		0.623		0.557		0.639	
Tertiary education ^a	0.283		0.388		0.214		0.400		0.210	
<i>Job aspects</i>										
Tenure (<i>1 – 53</i>)	12.8	10.5	12.6	10.7	12.9	10.3	12.8	10.7	12.8	10.3
Working hours (<i>15 – 98</i>)	47.0	15.3	45.0	14.2	48.3	15.8	44.8	14.2	48.4	15.8
<i>Business sector dummies</i>										
Agriculture ^a	0.170		0.105		0.213		0.099		0.214	
Industry ^a	0.100		0.088		0.108		0.080		0.112	
Construction ^a	0.108		0.129		0.095		0.136		0.091	
Commerce and hospitality ^a	0.267		0.215		0.301		0.222		0.295	
Transport ^a	0.043		0.040		0.045		0.039		0.045	
Financial services ^a	0.029		0.038		0.024		0.038		0.024	
Public administration and defence ^a	0.002		0.003		0.002		0.002		0.002	
Education ^a	0.015		0.019		0.012		0.020		0.012	
Health ^a	0.047		0.085		0.022		0.087		0.022	
Other services ^a	0.219		0.279		0.179		0.277		0.182	
<i>Demographic characteristics</i>										
Female ^a	0.339		0.340		0.339		0.342		0.337	
Immigrant ^a	0.105		0.174		0.061		0.171		0.065	
Age (<i>18-65</i>)	44.2	11.2	45.7	10.8	43.3	11.3	46.0	10.8	43.2	11.3
Cohabiting ^a	0.729		0.725		0.731		0.729		0.729	
Children under 14 ^a	0.319		0.328		0.314		0.323		0.317	
Health (<i>1-5</i>)	3.98	0.76	4.09	0.76	3.91	0.76	4.09	0.76	3.92	0.76

Notes: ^a Dummy variable. Data source: EWCS 2010, 2015

Table 3. Determinants of net monthly earnings –OLS Linear regressions–

# Model	1		2		3		4		5		6	
Countries	All		All		All		All		Strict IPP		Weak IPP	
Average predicted earnings (y) –in PPP \$ of 2015– ^a	2,211		2,211		2,211		2,211		2,944		1,758	
Independent variables (x)	$\frac{dy/dx}{y}$ %	t-statistic	$\frac{dy/dx}{y}$ %	t-statistic	$\frac{dy/dx}{y}$ %	t-statistic	$\frac{dy/dx}{y}$ %	t-statistic	$\frac{dy/dx}{y}$ %	t-statistic	$\frac{dy/dx}{y}$ %	t-statistic
Hypotheses related variables												
GERD PPS per inhab. (°00) ^b (0.45 – 10.90)			6.23	17.2***			7.49	7.10***	1.73	2.58***	8.58	8.20***
IPP (2.63 – 6.19)					14.8	14.8***						
Strict IPP (> 4.62) ^c							28.4	5.69***				
GERD x Strict IPP							-4.21	-3.50***				
Entrepreneurship types												
Self-employed with employees ^c	30.7	16.6***	30.6	15.8***	31.1	16.0***	30.4	15.8***	29.4	9.44***	29.4	12.00***
Own-account self-employed worker ^c (ref.)												
Educational attainment												
Basic education ^c (ref.)												
Secondary education ^c	28.2	8.99***	17.7	5.85***	19.1	6.31***	17.6	5.83***	54.3	7.44***	5.98	1.81*
Tertiary education ^c	52.3	14.7***	43.0	12.3***	42.5	12.0***	41.6	11.9***	75.2	9.99***	31.9	7.71***
Job aspects												
Tenure (1 – 53)	1.18	4.38***	1.53	5.43***	1.62	5.71***	1.58	5.61***	1.09	2.40**	1.80	5.11***
Tenure (squared)	-0.02	-3.00***	-0.02	-3.00***	-0.02	-3.31***	-0.02	-3.30***	-0.01	-1.22	-0.03	-3.28***
Working hours (15 – 98)	2.96	11.8***	2.96	11.3***	3.05	11.5***	3.00	11.4***	3.19	6.96***	3.09	9.61***
Working hours (squared)	-0.02	-9.40***	-0.02	-9.06***	-0.02	-9.18***	-0.02	-9.07***	-0.03	-5.66***	-0.02	-7.92***
Business sector dummies												
Agriculture ^c	-46.2	-13.3***	-52.7	-14.8***	-51.0	-14.2***	-50.4	-14.1***	-35.3	-5.66***	-54.2	-12.1***
Industry ^c	-14.0	-3.83***	-16.1	-4.22***	-13.2	-3.44***	-14.6	-3.82***	-21.5	-3.36***	-10.7	-2.26**
Construction ^c (ref.)												
Commerce and hospitality ^c	-17.6	-5.71***	-17.9	-5.60***	-15.9	-4.91***	-16.7	-5.21***	-28.7	-5.69***	-10.8	-2.61***
Transport ^c	-0.75	-0.16	1.16	0.24	1.79	0.36	1.98	0.40	0.87	0.11	2.61	0.43
Financial services ^c	18.8	3.42***	23.1	4.01***	26.2	4.53***	24.1	4.20***	22.0	2.62***	25.6	3.28***
Public administration and defence ^c	-45.4	-2.59***	-50.6	-2.74***	-46.8	-2.52**	-50.4	-2.73***	0.27	0.01	-86.5	-3.66***
Education ^c	-7.48	-1.02	0.61	0.08	0.18	0.02	0.98	0.13	0.14	0.01	-5.27	-0.49
Health ^c	21.6	4.42***	21.2	4.16***	25.6	4.99***	22.3	4.37***	21.5	3.14***	23.4	2.84***
Other services ^c	-3.33	-1.03	-4.11	-1.21	-1.11	-0.32	-2.91	-0.86	-5.54	-1.10	-2.09	-0.46
Demographic characteristics												
Female ^c	-26.3	-13.8***	-29.2	-14.8***	-29.5	-14.9***	-29.0	-14.7***	-31.8	-9.71***	-26.5	-10.9***
Immigrant ^c	-6.24	-2.19**	-7.51	-2.61***	-7.40	-2.55**	-8.28	-2.88***	-3.70	-0.96	-11.7	-2.67***
Age (18 – 65)	2.12	3.46***	1.52	2.38**	1.27	1.98**	1.36	2.13**	4.33	3.89***	0.22	0.28
Age (squared)	-0.02	-3.24***	-0.02	-2.48**	-0.02	-2.09**	-0.02	-2.26**	-0.04	-3.37***	-0.01	-0.83
Cohabiting ^c	5.91	2.84***	5.94	2.72***	5.49	2.50**	5.98	2.75***	9.37	2.70***	4.54	1.64
Children under 14 ^c	1.19	0.57	2.51	1.14	3.07	1.38	2.21	1.00	4.30	1.19	0.03	0.01
Health (1 – 5)	7.81	6.78***	10.1	8.52***	9.82	8.20***	9.72	8.18***	5.58	2.89***	12.45	8.34***
Business cycle												
Unemployment rate (3.5 – 24.9)			-0.45	-2.13**	-0.72	-3.39***	-0.21	-0.97	-2.11	-3.34***	0.25	1.08
Wave												
2015 ^c	-4.39	-2.49**	-4.53	-2.52**	-0.88	-0.49	-3.49	-1.92*	1.00	0.33	-9.10	-4.01***
Country dummies												
	Yes		No		No		No		No		No	

Notes: N = 6,300 for models 1-4; N = 2,409 for model 5; N = 3,891 for model 6; ^a Our dependent variable is the natural logarithm of monthly net earnings. Accordingly, we interpret the regression coefficients as semi-elasticities in the form of [(dy/dx)/y]%, i.e., they show the percentage changes of earnings caused by unit changes of the respective explanatory variables. In the context of dummy variables, these reflect the impact for a discrete change of the dummy variable from 0 to 1; ^b In hundreds of PPS per inhabitant at constant 2005 prices. ^c Dummy variable; * 0.1 > p ≥ 0.05; ** 0.05 > p ≥ 0.01; *** p < 0.01; The maximum correlation is 0.559 (between age and tenure), and the VIF values (from model 2) range from 1.05 to 1.84. Thus, multicollinearity does not pose a concern, especially in consideration of the large size of our sample.

Appendix. Variable definitions

Variable	Description
Dependent variables	
<i>Earnings</i>	
Net monthly earnings - PPP \$ of 2015 (logs)	Average net earnings in recent months. The variable is defined in PPP \$ of 2015 and converted to natural logarithms.
Main independent variables	
<i>Hypotheses related variables</i>	
GERD PPS per inhab.	Gross Domestic Expenditure on R&D by business enterprises, higher education institutions, as well as government and private non-profit organisations. Data for periods 2010 and 2015 are used. The variable is expressed as Purchasing Power Standards –PPS– per inhabitant at constant 2005 prices (Data source: Eurostat).
IPP	Intellectual Property Protection indicator. Data for periods 2010 and 2015 are used. The variable is evaluated on a scale of 1 to 7, from extremely weak to extremely strong protection (Data source: World Economic Forum’s Executive Opinion Survey).
Strict IPP	Dummy equals 1 for observations corresponding to countries which’ IPP is above 4.62, this benchmark being the unweighted average IPP for the 32 countries in our sample during the periods 2010 and 2015 (Data source: World Economic Forum’s Executive Opinion Survey).
Control variables	
<i>Entrepreneurship types</i>	
Self-employed with employees	Dummy equals 1 for workers who declare being self-employed with employees.
Own-account self-employed worker	Dummy equals 1 for individuals who declare being self-employed without employees
<i>Educational attainment</i>	
Basic education	Dummy equals 1 for workers with less than lower secondary education (ISCED-1997, 0-1).
Secondary education	Dummy equals 1 for workers with, at least, lower secondary education but non-tertiary education (ISCED-1997, 2-4).
Tertiary education	Dummy equals 1 for workers with tertiary education (ISCED-1997, 5-6).
<i>Job aspects</i>	
Tenure	Years of experience in the company or organization.
Working hours	Working hours per week.
<i>Business sector dummies</i>	
Agriculture	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is A = Agriculture, forestry and fishing.
Industry	Dummy equals 1 for workers whose codes of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) are B = Mining and quarrying, C = Manufacturing, D = Electricity, gas, steam and air conditioning supply, and E = Water supply; sewerage, waste management and remediation activities.
Construction	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is F = Construction.
Commerce and hospitality	Dummy equals 1 for workers whose codes of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) are G = Wholesale and retail trade; repair of motor vehicles and motorcycles, and I = Accommodation and food service activities.
Transport	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is H = Transportation and storage.
Financial services	Dummy equals 1 for workers whose codes of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) are K = Financial and insurance activities, and L = Real estate activities.
Public administration and defence	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is O = Public administration and defence; compulsory social security.
Education	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is P = Education.
Health	Dummy equals 1 for workers whose code of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) is Q = Human health and social work activities.
Other services	Dummy equals 1 for workers whose codes of main activity of the local unit of the business, by means of the Nomenclature of Economic Activities (NACE rev. 2, 2008) are J = Information and communication, M = Professional, scientific and technical activities, N = Administrative and support service activities, R = Arts, entertainment and recreation, S = Other service activities, T = Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use, and U = Activities of extraterritorial organisations and bodies.
<i>Demographic characteristics</i>	
Female	Dummy equals 1 for females.
Immigrant	Dummy equals 1 for citizens of a different country from that of residence.
Age	Age reported by the workers.
Cohabiting	Dummy equals 1 for individuals cohabiting with spouse/partner.
Children under 14	Dummy equals 1 for individuals cohabiting with any son or daughter aged under 14.
Health	Variable ranging from 1 to 5. The scale refers to the level of health declared by the worker. It equals 1 for individuals whose health is very bad and 5 for individuals whose health is very good.

Business cycle

Unemployment rate

National annual unemployment rate for periods 2010 and 2015 (source: Eurostat, World Bank).

Wave

2015

Dummy equals 1 for observations corresponding to the EWCS 2015 and 0 for observations corresponding to the EWCS 2010.

Country dummies

32 dummies equaling 1 for individuals living in the named country: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Notes: Data source: EWCS.