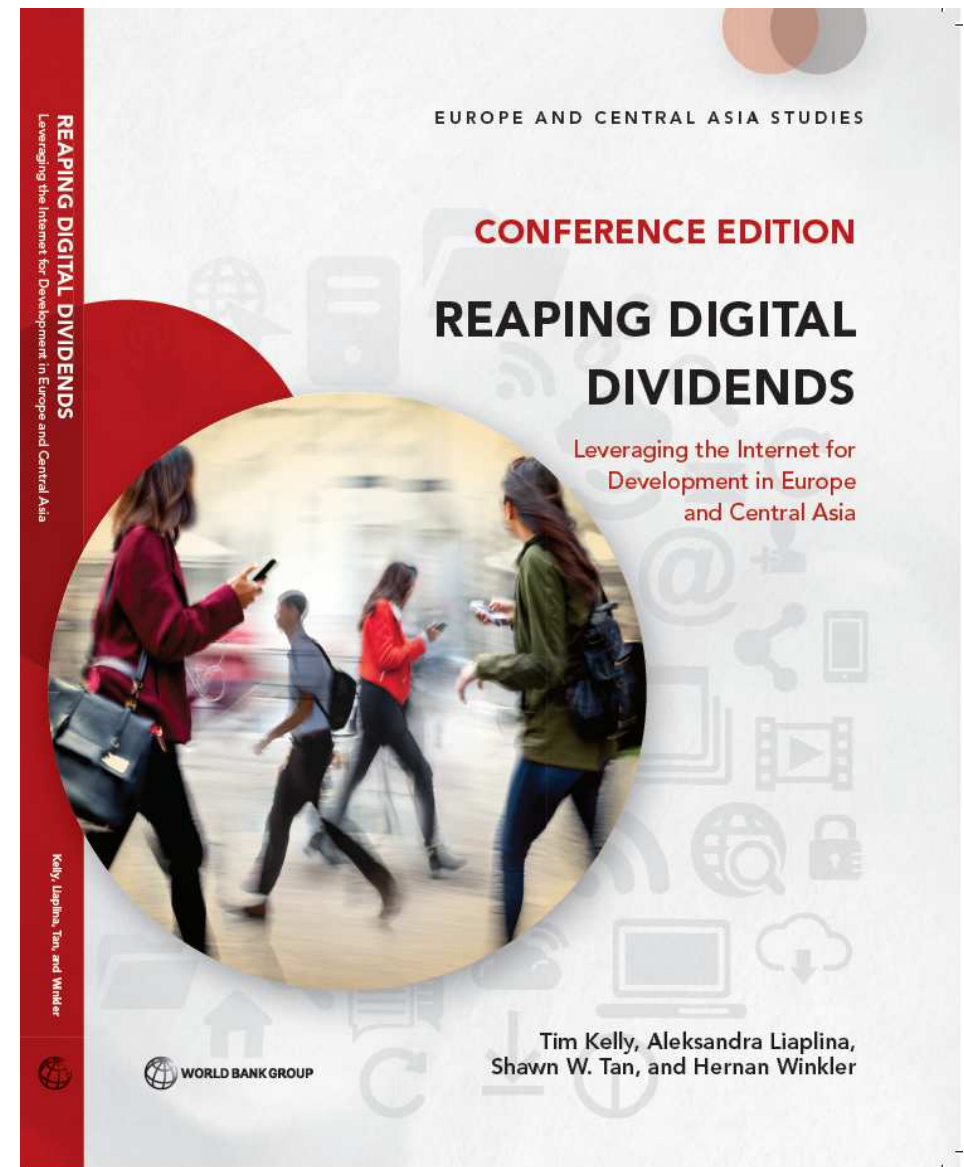


How Is the Internet Changing Labor Market Arrangements? Evidence from Telecommunications Reforms in Europe

Emmanuel Vazquez (CEDLAS) and Hernan Winkler (World Bank)

Background paper for World Bank Regional Report

Reaping Digital Dividends



Outline of the presentation

- Motivation
- Econometric Model and Data
- Econometric Results
- Conclusions

Main Research Questions

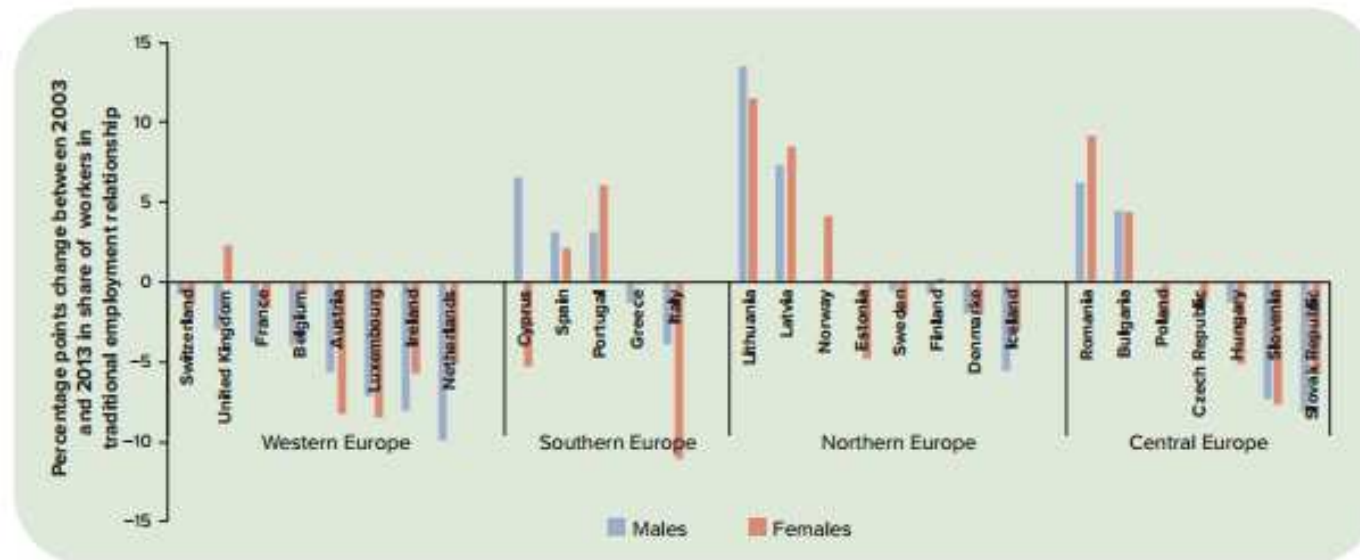
- Is the internet changing the nature of jobs?
- What is the role of the internet behind the decline of traditional jobs across Europe?

What are, exactly, alternative work arrangements?

- Alternative work arrangements tend to include jobs that are not full-time, permanent and salaried jobs.
- Alternative work arrangements include several forms of employment, such as part-time work, working from home, temporary work, on-call jobs, and self-employment or freelancing.
- Unlike traditional wage employment, alternative work arrangements are associated with greater schedule flexibility and less job security.
- Individuals in alternative work arrangements are also less likely to have access to health or unemployment insurance, as well as old-age pensions, as these are typically covered by employers (Eurofound [2015]).

Motivation

- In Europe, the share of workers in full-time, permanent salaried jobs has decreased for most countries since 2003 (World Bank [2016]).



Source: Own calculations based on microdata from LFS, Eurostat. Workers in traditional employment are those with a salaried job, in a permanent and full-time position and without a second job.

- At the same time, 17 percent of Europeans have used online platforms, with 23 percent of them also providing services through these new technologies (European Commission [2016]).
- In the United States, all the net employment growth between 2005 and 2015 occurred in alternative work arrangements (Katz and Krueger [2016]).

How can Internet affect labor market arrangements?

- The rise of information and communications technologies (ICT) - which allow for better monitoring, remote work, standardization of job tasks and making information on workers' reputations more widely available – may have contributed to the observed increase in alternative work arrangements in the United States (see, for instance, Katz and Krueger [2016]).
- These aspects of ICT would facilitate the rise of self-employment as well as more flexible forms of work — such as temporary and part-time work— as firms can more easily break jobs down into smaller tasks.

Why do we care?

- Understanding the drivers of alternative work arrangements is important for several reasons.
 - First, from the point of view of the worker, greater schedule flexibility and lower job security are likely to affect job satisfaction and compensating wage differentials (Mas and Pallais [2016]).
 - Second, both greater schedule flexibility and working from home may boost the labor force participation of individuals with family-care responsibilities or mobility constraints, such as the elderly and the disabled.
 - Finally, a rising share of non-wage employment may increase the portion of the population uninsured against unemployment and health risks, as well as poverty in old-age – factors that may add additional strain to social protection systems.

Why focus on Europe?

- First, many European countries have witnessed a dramatic increase in alternative work arrangements, and while there is a large body of literature examining the drivers of these trends, there is no empirical evidence on the role played by the Internet.
- Second, while telecommunications reforms may be a noisy measure of policy-driven Internet adoption when considering countries at very different levels of economic development, we expect that this concern would be attenuated when restricting the analysis to European economies.
- Finally, it allows us to use harmonized labor force surveys with detailed information on alternative work arrangements for 29 countries over a time span covering almost twenty years.

Identifying the impact of the internet on labor market arrangements

- It is challenging as there is a host of omitted factors that may be correlated with internet use and changes in the labor market.
 - For example, skills' upgrading may raise internet use and the share of people telecommuting.
 - Labor market reforms may affect firms' hiring decisions and also firms' adoption of digital technologies.
 - Sector-level shocks may affect both their labor market outcomes and the adoption of digital technologies

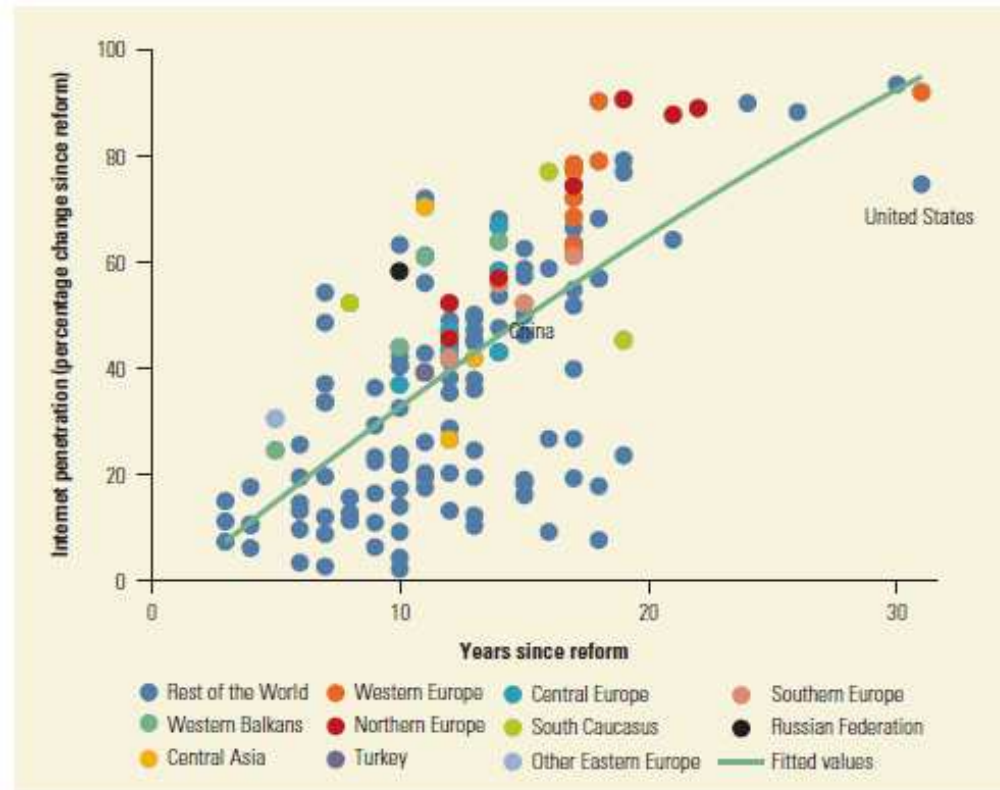
Our approach

- We acknowledge that finding a source of exogenous variation for internet adoption is difficult.
- Thereby, we construct the following test:
 - If the internet is affecting labor market arrangements, then we should witness faster and larger changes in the labor market outcomes of sectors of economic activity that are more prone to adopt the internet.

How do we measure internet adoption?

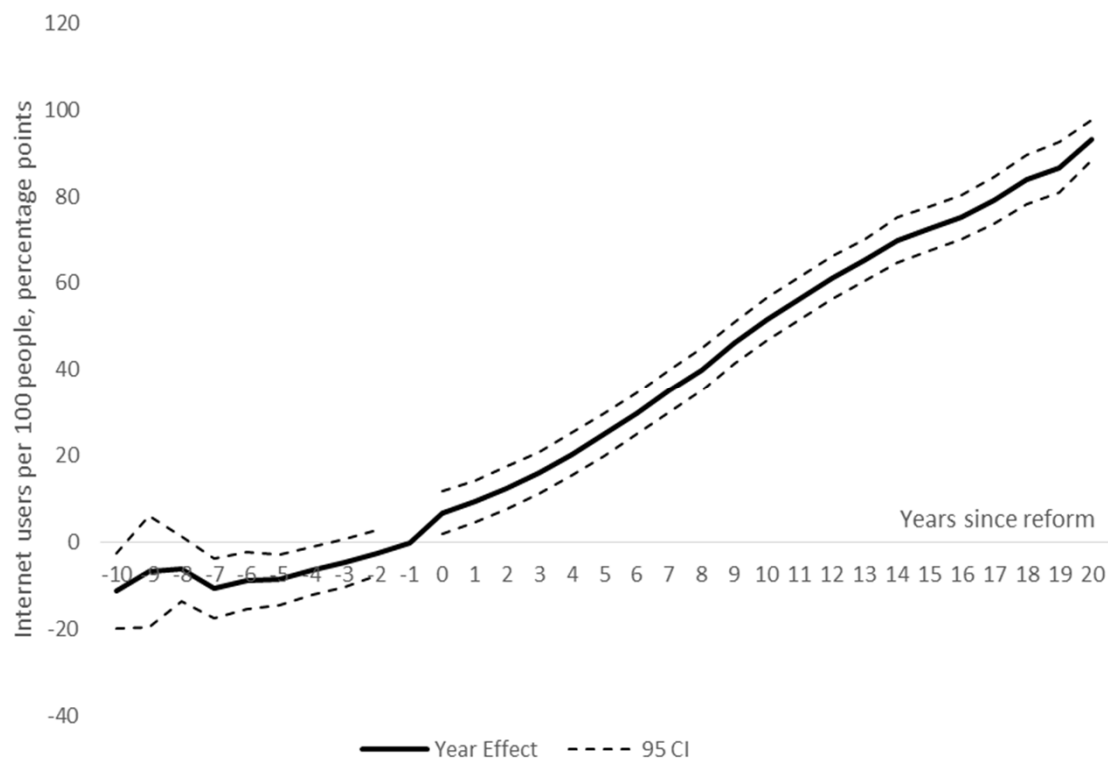
- Instead of using actual measures of internet use, we exploit the variation in the timing of the introduction of telecommunications reforms across Europe.
- These reforms were intended to increase the availability and affordability of internet access in the region.
- However, while they are plausibly more exogenous to labor market developments than actual levels of internet use, it is important to mention the caveat that they are not completely exogenous since earlier reformers already experienced higher levels of internet adoption before the introduction of these reforms.

Early reformers experienced larger increases in internet penetration



Source: Calculation based on data from Telegeography and World Bank 2016b.
Note: Internet penetration is the number of Internet users per 100 people. The reform is the liberalization of the international segment of the telecommunications sector.

In Europe, there was a sustained increase in internet penetration after the introduction of telecommunications reforms



Note: Sample includes European countries listed in the Appendix, for the years 1990 to 2013. The solid lines show the OLS coefficients of a regression of Internet use per 100 people on a set of dummy variables denoting the number of years after the introduction of the first reform to the telecommunications sector, while controlling for country fixed effects. The dashed lines are the associated 95% confidence intervals. The number of Internet users per 100 people comes from the World Development Indicators.

Econometric Model and Data

Econometric Model

$$y_{s,c,t} = \alpha + \beta ICT_intensity_s \times Reform_{c,t} + \mu_{s,t} + \mu_{s,c} + \mu_{c,t} + \varepsilon_{s,c,t}$$

- the dependent variable y refers to several sector-level variables of interest,
- s , c , and t stand for sector, country, and year, respectively,
- $ICT_intensity$ is an index of ICT intensity of the sector, and
- $Reform$ is a dummy variable that is equal to one when the country introduces a telecommunication reform.
- We also control for sector-year ($\mu_{s,t}$), sector-country ($\mu_{s,c}$) and country-year pairs fixed effects ($\mu_{c,t}$).
- Thereby, the equation is equivalent to a differences-in-differences-in-differences model, where the coefficient β would measure the time change in the average labor market outcome y for high ICT-intensive sectors in a country that has introduced the reform, minus the time change in the mean of y for high ICT-intensive sectors in a country that has not yet introduced the reform, minus the time change in the mean of y for low ICT-intensive sectors in a country that has introduced the reform.

Measuring sectoral ICT intensity

- To identify which sectors are more likely to adopt the internet, we use data from EUKLEMS on ICT capital per hour worked.
- Following the empirical strategy of Rajan and Zingales (1996), we use data from a relatively frictionless environment, i.e. where firms face very low constraints to adopt ICT capital.
- More specifically, we use data for the United States.
- Assuming that such sectoral dependence on ICT carries over across countries, we applied those sector-level coefficients to every European country.
- Why not use actual levels of ICT-dependence for each country?
 - This would be an endogenous measure that would also reflect other factors that may affect labor market changes (for example, such as changes in skills' supply).

ICT-dependence by sector

(ICT capital per hour worked)

	Mean	Standard Deviation
Agriculture	0.007	
Mining and Quarrying	0.079	
Manufacturing	0.060	
Electricity and Water	0.241	
Construction	0.017	
Wholesale and retail	0.049	
Transportation and accommodation	0.037	
Information and communication	0.348	
Finance	0.300	
Real Estate and personal services	0.139	
Arts and other services	0.013	
Education	0.018	
Health	0.018	
Total	0.102	0.114

Telecommunications Reforms Dataset

- **Liberalization:** Aimed at improving competition among internet providers
- **Depoliticization:** regulatory authority is judged to be fully autonomous from the executive branch
- **Privatization:** the year in which the government first sells a majority stake in the relevant state-owned telecommunication provider
- **Regulatory Separation:** the regulatory authority is separated from direct political oversight.
 - To facilitate the presentation of the results, our preferred estimates are those where we use the first year any of these telecommunications reforms was introduced.

Country	Type of reform			
	Liberalization	Regulatory depoliticization	Privatization	Regulatory separation
Austria	1998	1997	2000	1997
Belgium	1998	1993	1995	1993
Bulgaria	2003	.	.	1998
Switzerland	1998	.	1992	1992
Cyprus	2003	.	.	2001
Czech Republic	2001	.	.	1994
Denmark	1996	1997	1998	1991
Estonia	2001	.	1998	1998
Greece	2001	.	1996	1992
Spain	1998	1996	1997	1987
Finland	1994	1998	2002	1998
France	1998	1997	.	1997
Croatia	2003	2003	2001	2003
Hungary	2002	.	1993	1990
Ireland	1999	1997	1996	1997
Iceland	1998	1997	.	1997
Italy	1998	1997	1997	1997
Lithuania	2003	.	1998	2000
Luxembourg	1998	1997	.	1997
Latvia	2003	2001	.	2001
Netherlands	1997	1997	1995	1997
Norway	1998	1998	.	1987
Poland	2003	.	2000	1990
Portugal	2000	1989	1997	1989
Romania	2003	.	2003	2002
Sweden	1993	1992	2002	1992
Slovenia	2001	2001	.	2001
Slovakia	2003	2003	2000	1993
United Kingdom	1982	1984	1984	1984

Source: Howard and Mazaheri (2009)

Labor Market Indicators

- Using data for 29 countries from the LFS 1995-2013 we construct the following indicators at the NACE Rev 1 level:
 - Log(total Employment)
 - Share of part-time workers:
 - Share of people working from home
 - Share of temporary workers
 - Share of self-employers
 - Share of workers with a second job
- We also estimate these indicators disaggregated by gender and age.
- Sample excludes Germany.

Labor Market Indicators

Descriptive Statistics

		Initial year	2013	Change
log(employed)	<i>mean</i>	11.4	11.6	0.2
	<i>sd</i>	1.9	1.9	
share temporary workers	<i>mean</i>	0.095	0.112	0.017
	<i>sd</i>	0.136	0.134	
share part-time workers	<i>mean</i>	0.131	0.155	0.024
	<i>sd</i>	0.156	0.160	
share working from home	<i>mean</i>	0.126	0.154	0.028
	<i>sd</i>	0.143	0.146	
share self-employed	<i>mean</i>	0.159	0.164	0.004
	<i>sd</i>	0.169	0.167	
share second job	<i>mean</i>	0.051	0.045	-0.006
	<i>sd</i>	0.046	0.042	

Econometric Results

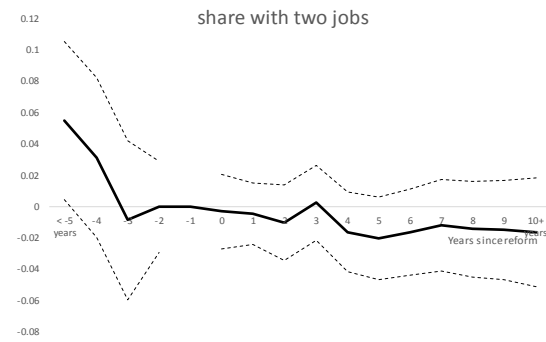
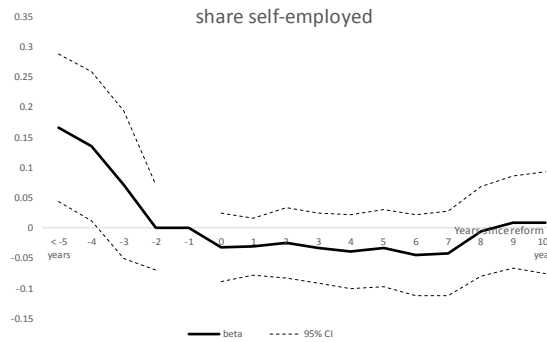
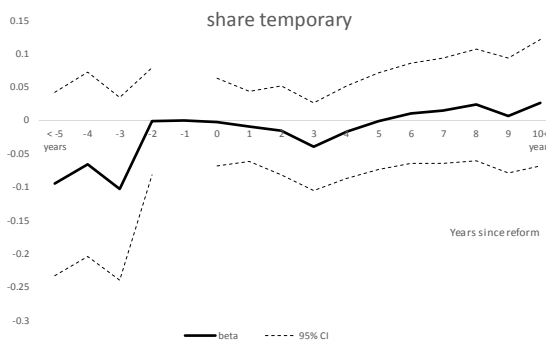
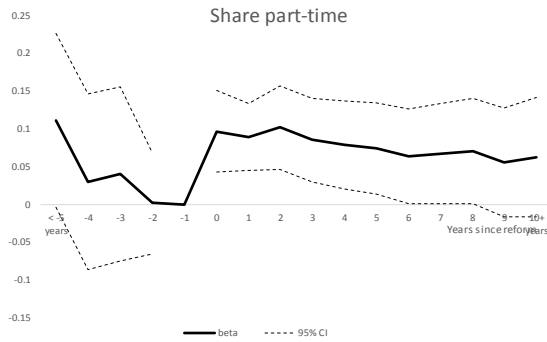
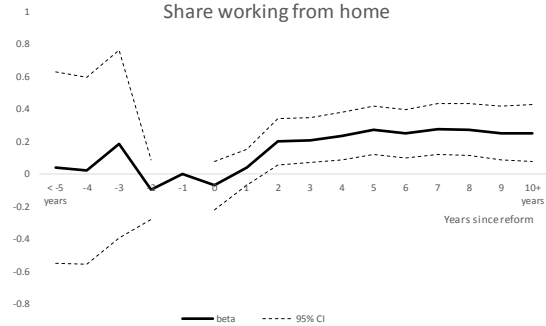
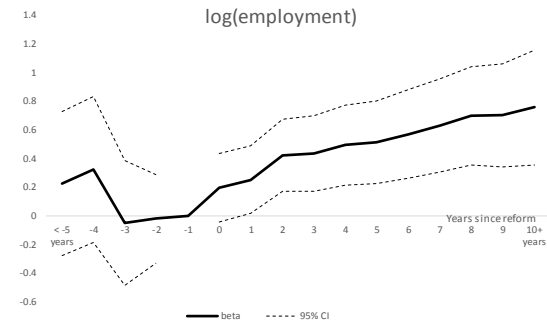
Estimation Results

	log(employment)	share temporary	share part-time	share working from home	share self-employed	share with two jobs
ICT x Reform (any)	0.186** (0.0743)	-0.000847 (0.0166)	0.0857*** (0.0139)	0.0127 (0.0335)	-0.0626*** (0.0147)	-0.00771 (0.00609)
	6,653 0.001	6,613 0.000	6,614 0.006	6,081 0.000	6,653 0.003	6,653 0.000

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Each cell shows the OLS estimate of β in equation (1). The reform variable is a dummy variable equal to one after the country introduced its first telecommunications reform.

- Column (1) shows that after the introduction of a reform, employment grew, on average, 2 percentage points more among ICT-intensive sectors than in the rest of the economy (we arrive to this figure multiplying the coefficient by the standard deviation of the ICT intensity (i.e. $0.186 \times 0.114 = 0.02$)).
- We also find statistically significant results for part-time employment, where its share increased approximately an additional 1 percentage point after the introduction of the reform among ICT-intensive sectors than in the rest of the economy. This estimated effect is roughly half of the average observed change in part-time employment at the sector level during this period in Europe

Estimation Results: Lead and Lag Effects



Common trend assumption seems to hold for total employment, working from home and part-time work

Results by gender and age

	By gender			By age		
	All	Women	Men	25-34	35-49	50-64
log(employment)	0.186** (0.0743)	0.0800 (0.107)	0.276*** (0.0813)	0.0775 (0.116)	0.149* (0.0847)	0.358*** (0.0985)
share temporary	-0.000847 (0.0166)	-0.0174 (0.0203)	-0.0115 (0.0179)	0.00874 (0.0226)	-0.0346* (0.0188)	0.0144 (0.0239)
share part-time	0.0857*** (0.0139)	0.106*** (0.0189)	0.0269** (0.0106)	0.0565*** (0.0160)	0.0833*** (0.0164)	0.116*** (0.0229)
share working from home	0.211*** (0.0319)	0.166*** (0.0283)	0.230*** (0.0340)	0.158*** (0.0247)	0.145*** (0.0279)	0.236*** (0.0376)
share self-employed	-0.0626*** (0.0147)	-0.00902 (0.0159)	-0.0816*** (0.0184)	-0.0564*** (0.0182)	-0.0913*** (0.0179)	-0.0569** (0.0237)
share with two jobs	-0.00771 (0.00609)	-0.0101 (0.00718)	-0.00413 (0.00829)	-0.0105 (0.00874)	0.00879 (0.00791)	-0.0360*** (0.0114)

Robustness Checks

	Baseline	Excluding Agriculture	Excluding Manufacturing	Without weighting by employment
log(employment)	0.186** (0.0767)	0.153* (0.0802)	0.174** (0.0793)	
share part-time	0.0857*** (0.0152)	0.0534*** (0.0147)	0.0810*** (0.0150)	0.0441*** (0.0140)
share working from home	0.211*** (0.0319)	0.0203 (0.0221)	0.188*** (0.0317)	0.0157 (0.0234)

Robustness Checks: Men

	Baseline	Excluding Agriculture	Excluding Manufacturing	Without weighting by employment
log(employment)	0.276*** (0.0850)	0.275*** (0.0894)	0.268*** (0.0878)	
share part-time	0.0269** (0.0116)	0.0159 (0.0109)	0.0286** (0.0118)	0.0450*** (0.0140)
share working from home	0.230*** (0.0340)	0.0453* (0.0252)	0.208*** (0.0338)	0.00153 (0.0263)

Conclusions

- To our knowledge, this is the first paper to analyze the impact of the internet on changing labor market arrangements
- Using a DiDiD approach, we find that after the introduction of telecommunications reforms, ICT-intensive sectors experienced a disproportionate increase in total employment, part-time work and working from home.
- These results are robust to different specifications.
- Moreover, the common trend assumption of DiDiD specifications seems to hold.
- We do not find any effects for temporary work, second job holding and self-employment.
- However, standard labor force surveys may not be suitable to capture some of the new work arrangements allowed by the internet, such as multiple job holding or online freelancing (Katz and Krueger, 2016).

Thanks!

