The impact of public services for innovation on company innovation

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Outline of presentation

1. Introduction
2. Literature review
3. Data description
4. Methodology
5. Results
6. Conclusion
7. Limitations

1. Introduction

- **Research question:** *What is the impact of public services for innovation on company innovation?*

- *Functional definition*: in this case the public services include all organizations in the field of law and order, education, health care, and social and cultural services, irrespective of their funding source and the legal form of the supplier.

- Company innovation refers to the introduction of a new or significantly improved product innovation, process innovation, marketing and/or organizational innovation. The company can develop itself the innovation or can acquire it.

2. Literature review

- There is a wide literature in economics analyzing the impact of procurement, regulations, knowledge spillovers from universities, R&D subsidies and tax credits *on* innovation [Aschhof and Sofka, 2009, Crespi et al., 2011, Paraskevopoulou, 2012, Wren and Storey, 2002].

- These studies use treatment evaluation techniques to study the impact of a particular programme on company innovation. The literature emphasizes that services and policies can have direct and indirect effects.

- There is also an emerging literature that studies the effect of public sector innovations by asking public administration agencies [Arundel, 2012; Arundel and Hollanders, 2011 (Innobarometer 2010); Bugge et al, 2011 (MEPIN); NESTA, 2010].

- Different from the existing literature, our study focuses on the overall aggregate impact of various public services for innovation on private company innovation and we use firm level data to investigate about its effects.

3. Data Description

- INNOBAROMETER 2011- data collected on the perception of the impact of innovations in public services by European companies

- 33 European countries: all EU Member States, Turkey, Iceland and the Former Yugoslav Republic of Macedonia, Croatia, Norway and Switzerland

- 100-500 companies per country depending on country size
    - 100 for smaller countries like Cyprus, Luxembourg and Malta to 500 for larger countries like France, Germany, Italy, Netherlands, Romania, Spain and the UK.

- 10112 observations – due to missings sample reduced to 8276 observations

3. Data Description

- The 2011 Innobarometer measures:
  - the perception of companies regarding innovations in **public administration procedures** (Q5),
  - the **use of certain public services** such as:
    - training programmes for employees,
    - applying for business support via research or innovation subsidies, applying for starting a business and legal advice,
    - applying for patents and trademarks, conformity certification
    - obtaining work permits for foreign workers,
    - health and safety issues
    - environmental permits and obligations (Q3)

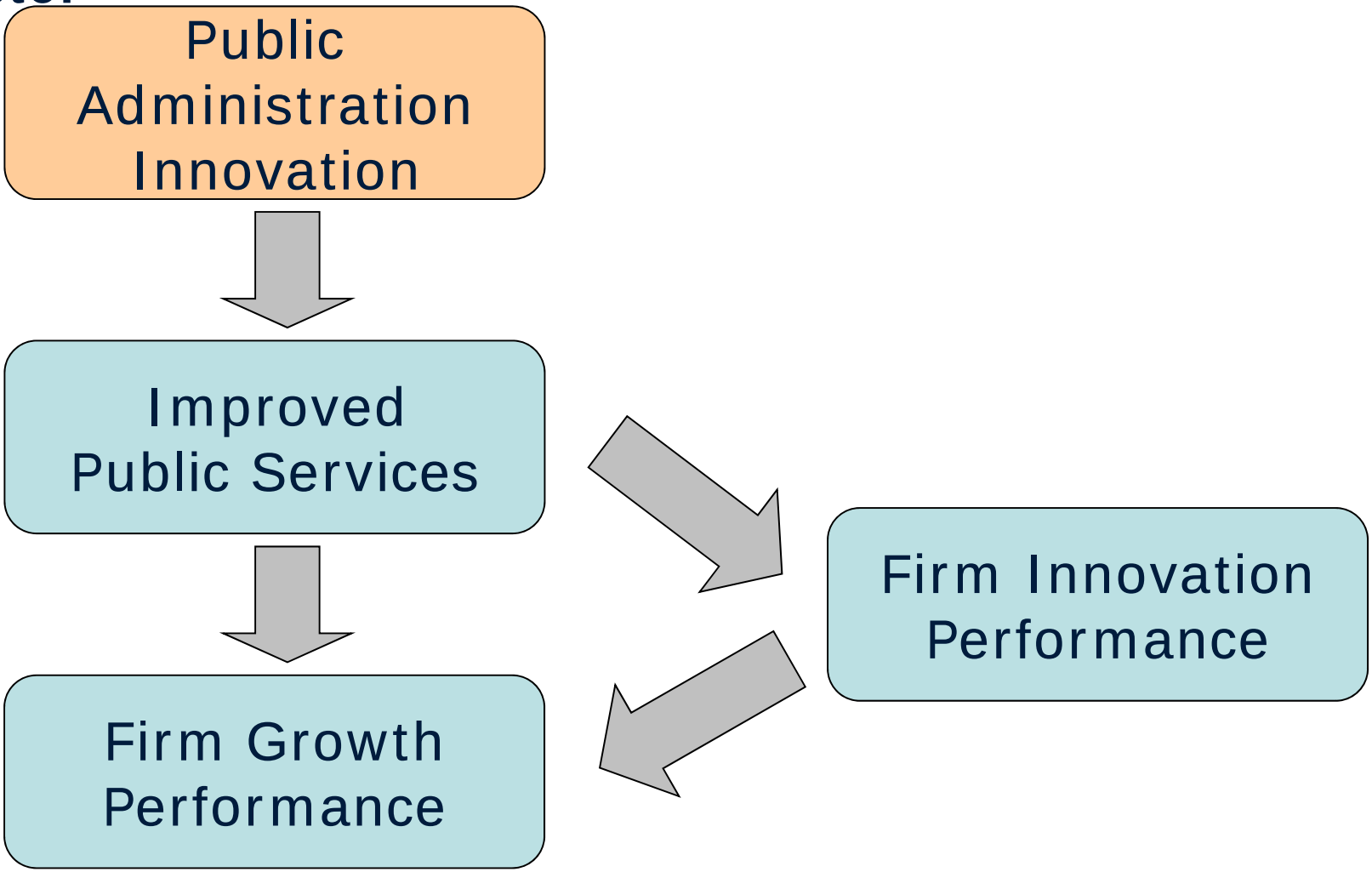
4. Methodology

- 1) **Research question:** *What is the impact of public services for innovation on company innovation?*

- **Hypotheses**

  1. Public services for innovation are expected to have a high positive impact on company innovation.
  2. Companies that innovate are more likely to experience an increase in sales.

4. Methodology: Testing the importance of the public sector



4. Methodology (cont.)

Estimations:

1) Linear Instrumental variables, Two Stage Least Squares

$$y_1 = \alpha_1 + \beta_1 \hat{y}_2 + \delta_1 x_j + \varepsilon_1$$

$$y_2 = \alpha_2 + \delta_2 x_j + \delta_3 z_1 + v_1$$

2) Non-linear Instrumental Variables, Bivariate Probit

$$y_1^* = 1[\beta_1 y_2 + \delta_1 x_j + \varepsilon_1 > 0]$$

$$y_2^* = 1[\delta_2 x_j + \delta_3 z_1 + v_1 > 0]$$

5. Results

5.1 The impact of using public services for innovation on company innovation

	Company innovation	Not controlling for endogeneity		Controlling for endogeneity		
1		*LPM OLS*	*Probit MLE*	*LPM 2SLS*	*Bivariate probit MLE IV*	*Bivariate probit MLE: no IV*
2						
3	Coefficient	**0.21**	**0.58**	**0.66**	**0.76**	-0.10
4	Marginal effect of the use of services for innovation	**0.21**	**0.19**	**0.66**	**0.27**	-0.03
5	Controls	YES	YES	YES	YES	YES
6	Rho				-0.10	0.40
7	Number of observations	8276	8276	8276	8276	8276

Notes:
1. The table presents average marginal effects for probit and bivariate probit which are calculated using the margins option in Stata.
2. Significant results are highlighted in bold.
3. 2SLS is estimated using ivreg2.
4. We use the index of improved public administration procedures as an instrument.
5. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies.

5. Results

5.2 Impact of company innovation on sales growth

Linear Probability Model

		Positive Sales Growth	
		Not controlling for endogeneity	**Controlling for endogeneity**
		LPM OLS	*Bivariate Probit MLE IV*
1	**Company innovates**	**0.085**	0.012
2	Public services have improved (ref: Public services remained the same)	**0.035**	**0.057**
3	Public services have deteriorated (ref: Public services remained the same)	**-0.055**	**-0.013**
4	Index of improved public administration procedures	0.010	
5	Controls	YES	YES
6	Rho		0.10
7	Number of observations	**7285**	**7285**

Notes:
1. The table provides estimates from a linear probability model estimated by linear regression. Significant results highlighted in bold, significance at 95% confidence interval.
2. Average marginal effects are calculated using the margins option in Stata. We use the index of improved public administration procedures as an instrument.
3. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies.

6. Conclusions

H1: We find that companies that use services for innovation are 27% more likely to innovate.

H2: Using an instrument we find that company innovation does not have a significant impact increasing sales.

7. Limitations

- Further testing is needed to test the impact of using public sector services on company innovation and testing the impact of innovation on sales growth as we only dispose of one instrument

- Sample size too small for within country analyses. It is expected that there are differences between countries in the effectiveness of the government apparatus and public policies for innovation. The estimations are controlling for country dummies.

- Thank you!

- For questions or comments, please contact:

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5. Descriptives

	Company is an innovator		Company has increasing sales		Company uses services for innovation	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Company is an innovator	--	--	52.5%	37.7%	64.8%	33.0%
Sales of company have increased	49.3%	34.8%	--	--	50.5%	36.3%
Sales of company have decreased	25.9%	35.3%	--	--	25.9%	33.9%
Sales of company have remained the same	24.9%	29.9%	--	--	23.6%	29.8%
Use of services for innovation	50.3%	21.3%	41.8%	28.6%	--	--
Applying for research or innovation subsidies	*23.4%*	*5.9%*	*17.5%*	*10.8%*	--	--
Applying for patents or trademarks	*20.2%*	*6.0%*	*16.5%*	*9.2%*	--	--
Conformity certification for new products	*24.0%*	*8.6%*	*18.8%*	*12.9%*	--	--
Other (such as starting a new business)	*22.3%*	*9.0%*	*18.8%*	*12.0%*	--	--
Training programs for employees	42.5%	30.9%	38.1%	34.5%	--	--
Obtaining work permits for foreign workers	14.2%	8.0%	12.6%	9.3%	--	--
Health and safety issues	48.4%	36.8%	43.8%	40.5%	--	--
Environment related permits and obligations	44.9%	27.9%	40.2%	32.0%	--	--

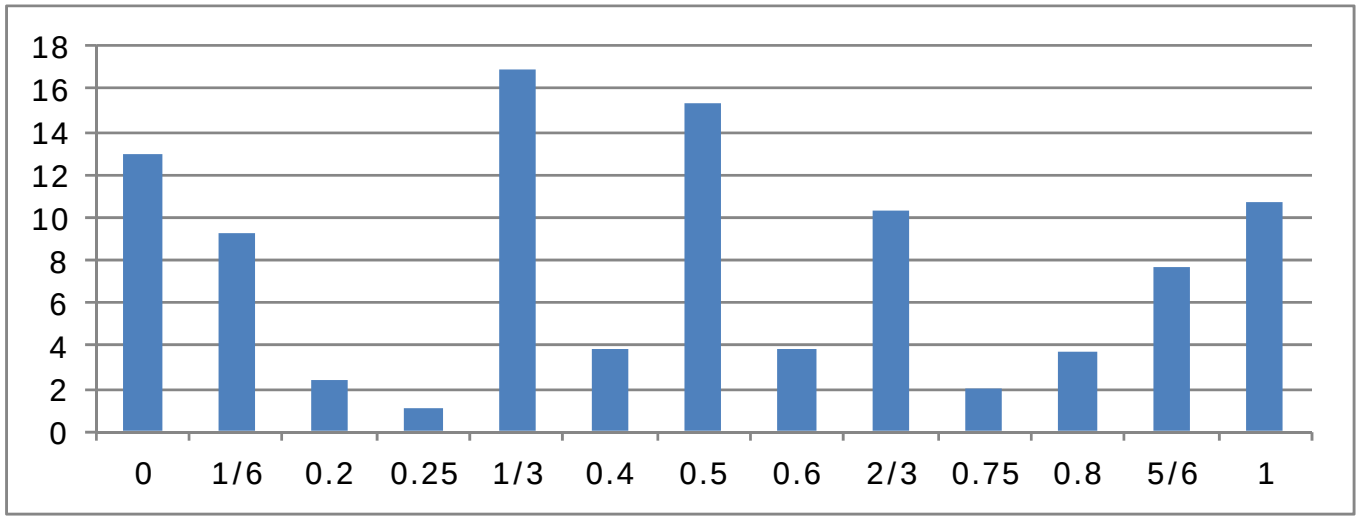
5. Descriptives (cont.)

	Company is an innovator		Company has increasing sales		Company uses services for innovation	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Index of improved public administration procedures	50.6%	45.7%	49.9%	46.4%	52.6%	45.4%
Option to complete government forms over the internet	*80.8%*	*72.9%*	*79.0%*	*74.6%*	*81.1%*	*73.9%*
Reduction in the time and effort for filling forms	*48.3%*	*44.8%*	*47.5%*	*45.5%*	*51.1%*	*43.8%*
Access to information on government services over the internet	*78.1%*	*71.7%*	*76.5%*	*73.1%*	*80.5%*	*71.4%*
Reduction in the time required for permits or licenses	*30.5%*	*27.1%*	*29.9%*	*27.6%*	*34.6%*	*25.3%*
Faster response time for other government services	*36.2%*	*31.8%*	*36.4%*	*31.9%*	*38.5%*	*31.3%*
Reduction in financial costs to your company	*22.2%*	*18.1%*	*22.0%*	*18.4%*	*24.4%*	*17.6%*
General perception public services have improved	31.1%	23.5%	31.5%	23.7%	31.9%	24.1%
Public services must be more innovative to match business needs	92.9%	91.9%	92.6%	92.1%	93.6%	91.7%
Company won at least one procurement contract	28.7%	21.8%	26.4%	23.7%	30.7%	21.8%

5. Descriptives (cont.)

	Company is an innovator		Company has increasing sales		Company uses services for innovation	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
Company exports abroad	49.1%	28.6%	46.6%	31.3%	52.8%	29.7%
Company has been taken over or merged with another company	13.2%	7.8%	12.1%	8.8%	14.0%	8.1%
Firm Characteristics						
Company is less than 6 years old	13.2%	16.7%	17.8%	13.3%	13.5%	16.0%
Human capital						
High share of employees with a university degree	*11.4%*	*8.6%*	*10.6%*	*9.3%*	*10.7%*	*9.3%*
Average share of employees with a university degree	*63.7%*	*47.4%*	*60.5%*	*50.3%*	*68.2%*	*47.4%*
Low share of employees with a university degree	*25.0%*	*44.1%*	*28.9%*	*40.5%*	*21.1%*	*43.2%*
Firm size						
Very small firm: less than 10 employees	*33.3%*	*52.9%*	*34.7%*	*51.0%*	*27.3%*	*53.1%*
Small firm: between 10 and 50 employees	*32.9%*	*31.9%*	*34.7%*	*30.7%*	*34.6%*	*31.2%*
Medium-sized firm: between 50 and 250 employees	*23.8%*	*12.5%*	*22.3%*	*14.0%*	*25.9%*	*13.0%*
Large firm: more than 250 employees	*10.0%*	*2.8%*	*8.4%*	*4.2%*	*12.2%*	*2.7%*
Industry (10 NACE codes)						

Frequency distribution for the index of improved public administration procedures



6. Results

6.1 First stage IV

	Linear Probability Model	Company innovation		Use of services for innovation	
		Model 1	**Model 2**	**Model 1**	**Model 2**
1	**Index of improved public administration procedures**		**0.083**		**0.134**
2	*Option to complete government forms over the internet*	**0.039**		**0.050**	
3	*Reduction in the time and effort for filling forms*	-0.009		0.000	
4	*Access to information on government services over the internet*	**0.030**		**0.046**	
5	*Reduction in the time required for permits or licenses*	0.008		**0.054**	
6	*Faster response time for other government services*	0.027		0.017	
7	*Reduction in financial costs to your company*	**0.027**		0.031	
8	Controls	YES	YES	YES	YES

Notes:
1. The table provides estimates from a linear probability model estimated by linear regression. Significant results highlighted in bold, significance at 95% confidence interval.
2. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies.
3. Using a multinomial logit with three outcomes instead of linear regression for sales does not modify the results.

6. Results

6.1 Impact of public administration procedures

	Probit Model Average Marginal Effects	Company innovation		Positive Sales Growth		Use of services for innovation	
		Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
1	**Index of improved public administration procedures**		**0.092**		**0.052**		**0.136**
2	*Option to complete government forms over the internet*	**0.041**		0.027		**0.055**	
3	*Reduction in the time and effort for filling forms*	-0.007		-0.007		-0.000	
4	*Access to information on government services over the internet*	**0.031**		0.010		**0.051**	
5	*Reduction in the time required for permits or licenses*	0.011		-0.005		**0.052**	
6	*Faster response time for other government services*	0.026		0.013		0.016	
7	*Reduction in financial costs to your company*	0.027		0.023		0.027	
8	Controls	YES	YES	YES	YES	YES	YES

Notes:
1. The table provides estimates from a linear probability model estimated by linear regression. Significant results highlighted in bold, significance at 95% confidence interval.
2. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies.
3. Using a multinomial logit with three outcomes instead of linear regression for sales does not modify the results.

6. Results

6.2 The impact of innovations in public services

	Probit Model Average Marginal Effects	Company innovation	Positive Sales Growth	Use of services for innovation
1	Public services have improved (ref: Public services remained the same)	**0.087**	**0.042**	**0.062**
2	Public services have deteriorated (ref: Public services remained the same)	**0.028**	**-0.055**	0.015
3	Controls	YES	YES	YES

Notes:
1. The table provides estimates from a linear probability model estimated by linear regression. Significant results highlighted in bold, significance at 95% confidence interval.
2. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies.

6. Results
6.3 The impact of public services on company innovation by use of services for innovation

	Probit Model Average Marginal Effects	Company innovation	
		No use of services for innovation	**Use of services for innovation**
1	Public services have improved (ref: Public services remained the same)	**0.095**	**0.087**
2	Public services have deteriorated (ref: Public services remained the same)	-0.002	0.032
3	Public services providers are doing a good job in creating the right conditions for companies to innovate	0.011	-0.011
4	The regulatory and fiscal system promotes the ability for companies to innovate	0.020	0.020
5	Companies can work closely with public research organizations on innovation projects	0.012	**0.059**
6	The public education and training system has equipped companies' staff with the knowledge and skills needed to innovate	-0.014	-0.034
7	The provision of information and advice helping companies to innovate is of a high quality	-0.019	-0.009
8	The information and advice available to companies is easily available	**-0.078**	-0.049
9	The procedures to obtain financial support for companies to innovate (e.g. grants, tax reliefs) are simple-to-use	-0.043	-0.009
10	Government's programmes are well targeted to support innovation	0.021	0.042
11	Controls	YES	YES
12	Number of observations	2679	1842
13	Pseudo R2	0.103	0.123

Notes:
1. The table provides estimates from a linear probability model estimated by linear regression. Significant results highlighted in bold, significance at 95% confidence interval.
2. Control variables include: export, merger, human capital skills, firm size, sectors and country dummies