Measuring Healthcare System's Efficiency via Total Health Expenditure per capita. Evidence from 27 Selected Countries

SEMINAR: HEALTH ECONOMICS

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Outline

- Motivation & Literature Methods
- Methodology & Limitations
- Methodology & Results
- Conclusions & Policy Recommendations

Motivation & Literature Methods

- Health expenditure consumes a substantial share of resources so it is relevant to achieve higher efficiency on expenditure;
- Substantial variations *across* and *within* countries in terms of healthcare expenditure;
- Methods to estimate efficiency:
  - DEA (Non-parametric)
  - SFA (Sensitivity analysis);
- Orientations of efficiency measurements:
  1. Input
  2. Output
- A production function is needed to measure potential efficiency gains

Methodology & Limitations

- Both methods require complete data for a variety of variables:
  - Education, Lifestyle factors, Institutions etc.
- Complex techniques and advanced skills are required to replicate literature's approaches!
- Our empirical methodology is simpler and exploits fewer variables to replicate and construct the production function;
- Our model runs with unbalanced panel data
  - Reason: missing values across the dataset.
  - Restrict our dataset between 1995 and 2013
  - We are not able to include lags in our models due to the missing values

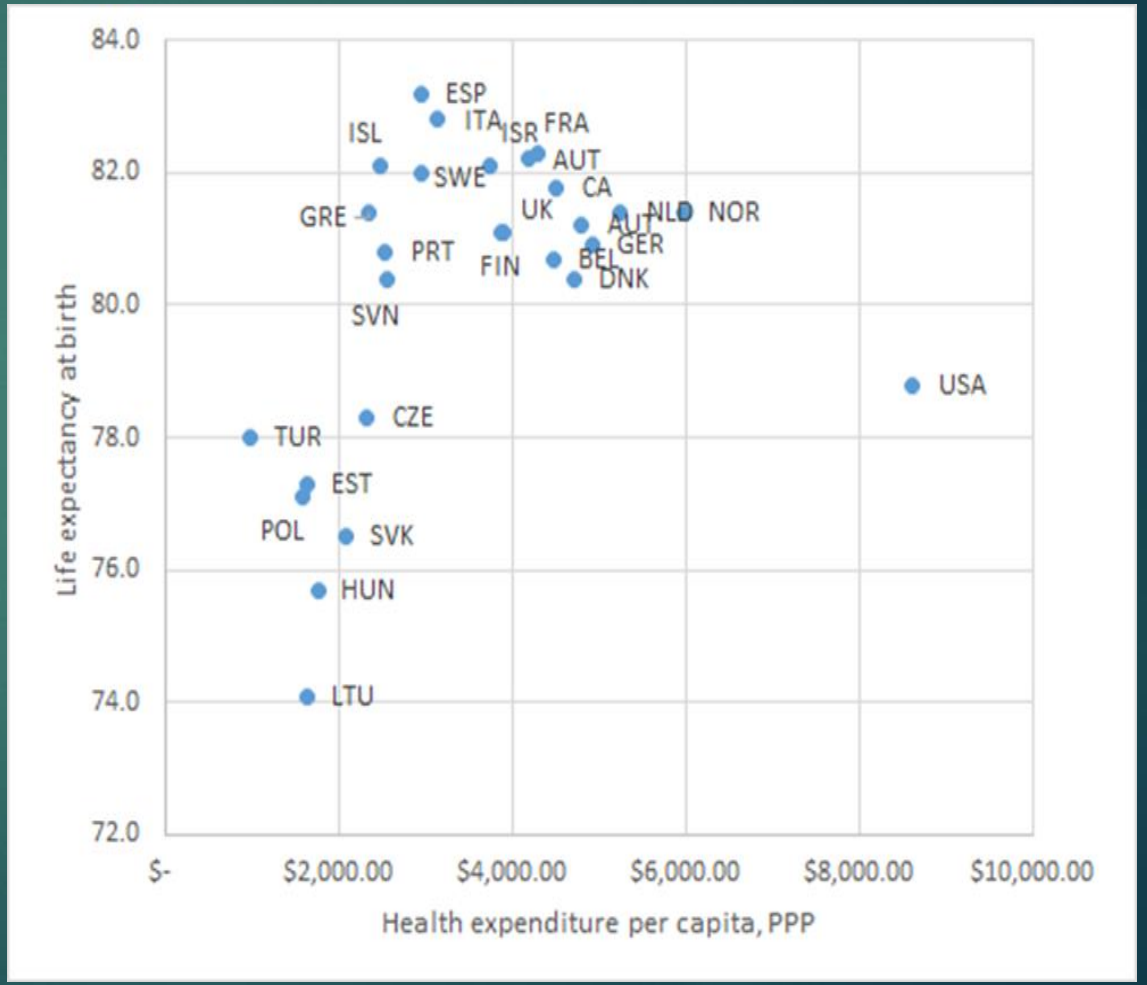
Selected Countries & Variables

Number	Country's Name	Number	Country's Name
1	Australia (AUS)	15	Italy (ITA)
2	Austria (AUT)	16	Lithuania (LTU)
3	Belgium (BEL)	17	Netherlands (NL)
4	Canada (CAN)	18	Norway (NOR)
5	Czech Republic (CZE)	19	Poland (POL)
6	Denmark (DEN)	20	Portugal (PRT)
7	Estonia (EST)	21	Slovak Republic (SVK)
8	Finland (FIN)	22	Slovenia (SVN)
9	France (FRA)	23	Spain (ESP)
10	Germany (DEU)	24	Sweden (SWE)
11	Greece (GRC)	25	Turkey (TUR)
12	Hungary (HUN)	26	United Kingdom (UK)
13	Iceland (ICL)	27	United States (US)
14	Israel (ISR)		

Variable's Name (in *Stata*)	Description	Source
lebirth	Life expectancy at birth, total population	OECD; Health Database
Mort_Risk	Average mortality rate, ages 15-65	The Human Mortality Database
totmedexp	Total health expenditure per capita, USD, PPP current prices	OECD; Health Database
phys	Physicians, Density per 1,000 population (head counts)	OECD; Health Database
medicalgrad	Medical graduates, Per 100,000 population	OECD; Health Database
alc	Alcohol consumption, Liters per capita (age 15+)	OECD; Health Database
percapita	GDP per capita (PPP) in $	World Bank
M_BMI	Mean BMI (kg/m2) (age standardized estimate)	World Health Organization (WHO)

Life expectancy at birth and healthcare expenditure per capita in 2013

- Significant variations in terms of life expectancy at birth;
- However, comparable levels of healthcare expenditures;
- US represents an outlier (Anderson F. and Frogner K., 2008);



Descriptive statistics, 1995-2013

- Main dependent variable: *lebirth;*
- Robustness check: *Mort_ Risk;*
- Inputs: *phys*, *medicalgrad;*
- Lifestyle factors: *M_BMI, alc*

Variable's Name (in *Stata*)	**Num. Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
lebirth	513	77.85497	3.130484	67.9	83.2
Mort_Risk	489	0.32596%	0.0013254	0.000456	0.0076713
totmedexp	507	2,388.158	1,380.477	1,727.806	8,617.429
phys	502	3.288466	1.091904	1.1	8.32
medicalgrad	509	9.804951	3.449131	3.84	22.12
alc	506	9.57668	2.974554	1.2	15.1
percapita	513	27,830.19	17,253.43	2,68.796	10,2910.4
M_BMI	513	25.694	0.7354374	24.55	28.75

Regression Table 1

Dependent Variable = Life expectancy at birth, total population (lebirth)							
Panels	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Variables	Model 1	Model 1	Model 1	Model 1	Model 2	Model 3	Model 3 (full interacted)
totmedexp	0.00155***	-0.000346*	0.000546***	-0.000194*	-0.000112	0.152***	0.000268
	(0.000212)	(0.000141)	(7.11e-18)	(0.0000935)	(0.000118)	(0.000166)	(0.000117)
percapita					0.00000598	0.00000457	0.00000671
					(0.0000106)	(0.00000654)	(0.0000107)
M_BMI					-0.348	-0.593	-0.218
					(0.464)	(0.562)	(0.455)
alc					-0.0805*	-0.0604	-0.0975**
					(0.0348)	(0.0389)	(0.0290)
phys						0.0286	-0.0387
						(0.141)	(0.134)
medicalgrad						-0.00781	0.00553
						(0.0138)	(0.0118)
medexp_AUS			0.00117***	0.000336**	0.000285	0.152***	0.000268
			(7.60e-18)	(0.000104)	(0.000169)	(0.0323)	(0.000173)
medexp_AUT			0.00110***	0.000343**	0.000214	0.107**	0.000232
			(7.91e-18)	(0.0000954)	(0.000147)	(0.0322)	(0.000146)
medexp_BEL			0.000831***	0.000154	0.0000641	0.00475	0.0000726
			(7.28e-18)	(0.0000847)	(0.000136)	(0.0214)	(0.000144)
medexp_CAN			0.000804***	0.0000812	0.0000528	0.0729***	0.0000571
			(7.32e-18)	(0.0000918)	(0.000135)	(0.0185)	(0.000132)
medexp_CZE			0.00247***	0.000639*	0.000473	-0.0562	0.000523
			(7.14e-18)	(0.000234)	(0.000339)	(0.0428)	(0.000314)
medexp_DEN			0.000957***	0.000402***	0.000199	-0.0233	0.000190
			(7.13e-18)	(0.0000703)	(0.000170)	(0.0253)	(0.000176)
medexp_EST			0.00496***	0.00319***	0.00347***	-0.224*	0.00350***
			(1.06e-17)	(0.000248)	(0.000267)	(0.0908)	(0.000238)
medexp_FIN			0.00111***	0.000330**	0.000239	0.0623*	0.000286
			(7.48e-18)	(0.0000986)	(0.000210)	(0.0264)	(0.000202)
medexp_FRA			0.00145***	0.000437**	0.000188	0.00270	0.000184
			(7.12e-18)	(0.000128)	(0.000202)	(0.0244)	(0.000191)
medexp_DEU			0.000986***	0.000290**	0.000171	0.00866	0.000177
			(7.23e-18)	(0.0000878)	(0.000110)	(0.0403)	(0.000104)
medexp_GRC			0.000912***	-0.000163	-0.000237	0.0499	-0.000224
			(7.16e-18)	(0.000145)	(0.000158)	(0.0414)	(0.000204)
medexp_HUN			0.00339***	0.00104**	0.000953**	0.104	0.000917**
			(9.86e-18)	(0.000295)	(0.000277)	(0.0519)	(0.000255)
medexp_ICL			0.00157***	0.000311	0.000380	0.233***	0.000416
			(8.19e-18)	(0.000156)	(0.000222)	(0.0227)	(0.000211)
medexp_ISR			0.00426***	0.000656	0.00120*	0.143	0.00111
			(7.15e-18)	(0.000440)	(0.000528)	(0.0790)	(0.000581)
medexp_ITA			0.00174***	0.000305	0.000156	0.132***	0.000128
			(7.12e-18)	(0.000180)	(0.000182)	(0.0265)	(0.000177)
medexp_LTU			0.00179***	-0.000402	0.000121	-0.984***	0.000160
			(9.72e-18)	(0.000278)	(0.000292)	(0.0782)	(0.000239)
medexp_NL			0.000562***	0.000277***	0.000167	0.0270*	0.000309*
			(7.11e-18)	(0.0000368)	(0.000108)	(0.0113)	(0.000121)
medexp_NOR			0.000459***	0.000252***	0.000162	-0.00570	0.000170
			(7.15e-18)	(0.0000255)	(0.000169)	(0.0131)	(0.000173)
medexp_POL			0.00328***	0.000770*	0.00101**	-0.0373	0.00103**
			(7.32e-18)	(0.000316)	(0.000319)	(0.0790)	(0.000309)
medexp_PRT			0.00251***	0.00112***	0.00109***	0.0736**	0.00108***
			(7.38e-18)	(0.000177)	(0.000165)	(0.0258)	(0.000144)
medexp_SVK			0.00138***	0.000207	0.000180	-0.171**	0.000149
			(7.14e-18)	(0.000166)	(0.000160)	(0.0541)	(0.000264)
medexp_SVN			0.00312***	0.00141***	0.00135***	-0.0748	0.00165***
			(7.11e-18)	(0.000214)	(0.000198)	(0.0490)	(0.000194)
medexp_ESP			0.00167***	0.000587***	0.000465**	-0.0258	0.000494**
			(7.11e-18)	(0.000139)	(0.000154)	(0.0262)	(0.000148)
medexp_SWE			0.000876***	-0.000206	-0.000189	0.0453	-0.000179
			(7.13e-18)	(0.000139)	(0.000168)	(0.0244)	(0.000163)
medexp_TUR			0.00734***	0.00320***	0.00347***	-0.102*	0.00340***
			(8.05e-18)	(0.000525)	(0.000514)	(0.0464)	(0.000491)
medexp_UK			0.00132***	0.000423**	0.000442***	0.0497*	0.000418***
			(7.11e-18)	(0.000115)	(0.000110)	(0.0217)	(0.000104)
medexp_US			Omitted	Omitted	Omitted	Omitted	Omitted
			-	-	-	-	-
constant	74.25***	76.03***	73.35***	75.30***	84.82***	24.56	81.64***
	(0.506)	(0.177)	(9.39e-15)	(0.314)	(11.71)	(165.1)	(11.47)
Year fixed effects	No	Yes***	No	Yes***	Yes***	Yes***	Yes*
Specific country-year fixed effects	No	No	No	No	No	No	Yes*;**;***
Trends	No	No	No	No	No	No	Yes*;**;***
N	507	507	507	507	500	486	486
R^2 –within	0.6893	0.930	0.938	0.968	0.971	0.971	0.983
R^2 –between	0.3431	0.393	0.113	0.114	0.970	0.069	0.024
R^2 –overall	0.4123	0.0758	0.290	0.0607	0.061	0.056	0.009

Robust standard errors in parentheses included

*** p<0.05, ** p<0.01,***p<0.001**

Country fixed effects are always

Regression Table 2

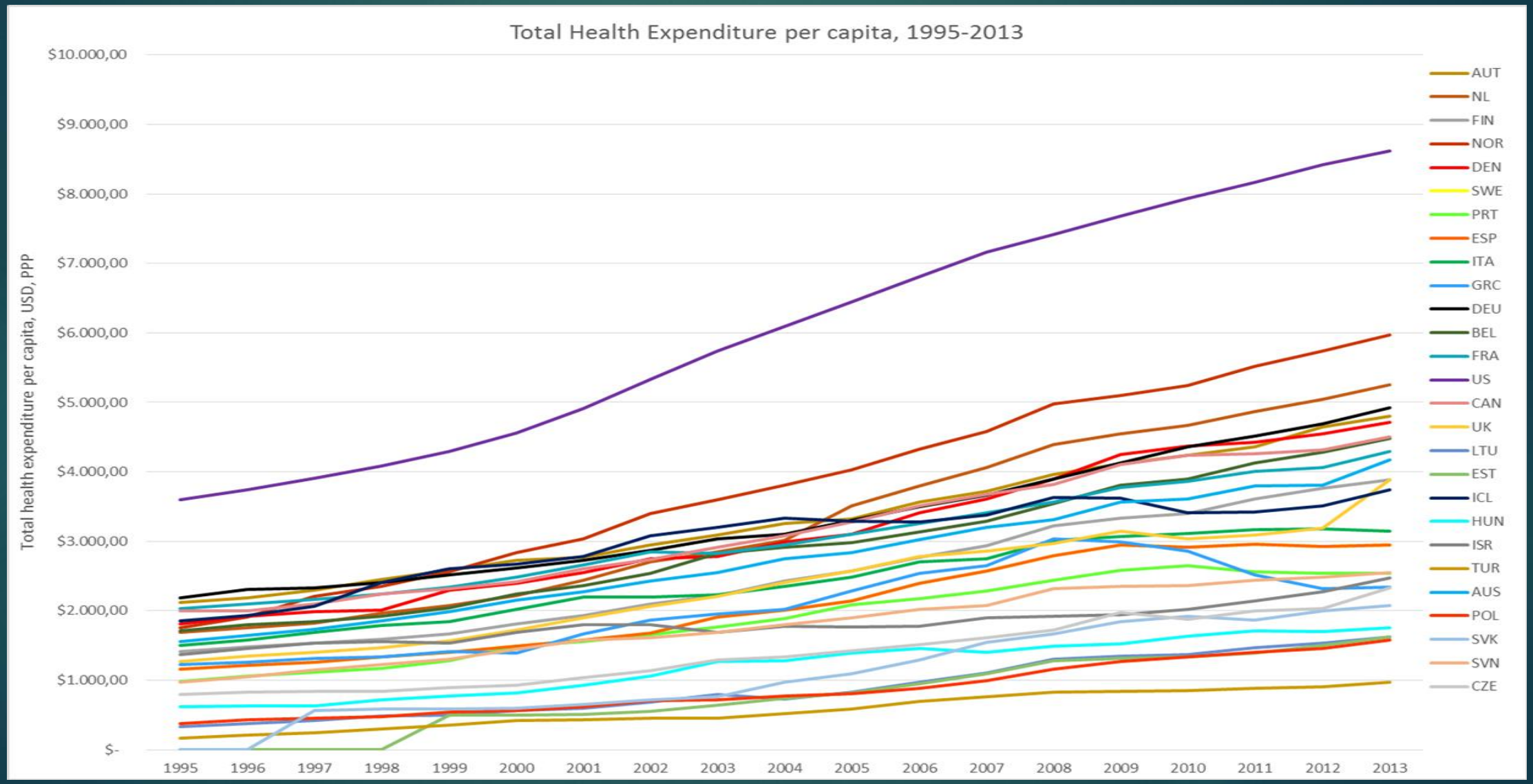
Dependent Variable = Average mortality rate, ages 15-65							
Panels	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Variables	Model 1	Model 1	Model 1	Model 1	Model 2	Model 3	Model 3 (full interacted)
totmedexp	-0.000000344***	0.000000112	-0.00000107***	-0.000000515	-0.000000901*	-0.000000620	0.000000105
	(5.68e-08)	(0.00000011 9)	(7.80e-20)	(0.000000399)	(0.000000420)	(0.000000434)	(0.000000386)
percapita					-1.40e-09	-1.00e-09	-8.58e-10
					(7.42e-09)	(7.56e-09)	(6.82e-09)
M_BMI					0.000886	0.000989	0.000395
					(0.000775)	(0.000816)	(0.00101)
alc					0.0000358	0.0000400	0.0000680*
					(0.0000230)	(0.0000224)	(0.0000290)
phys						0.0000495	-0.0000478
						(0.0000667)	(0.0000988)
medicalgrad						-0.0000172	0.00000157
						(0.00000944)	(0.0000154)
medexp_AUS			0.000000708***	0.000000353	0.000000629*	0.000000369	-0.0000648
			(7.80e-20)	(0.000000253)	(0.000000270)	(0.000000273)	(0.0000394)
medexp_AUT			0.000000667***	0.000000305	0.000000785*	0.000000516	-0.0000262
			(7.80e-20)	(0.000000261)	(0.000000351)	(0.000000397)	(0.0000312)
medexp_BEL			0.000000786***	0.000000416	0.000000875*	0.000000608	0.00000203
			(7.80e-20)	(0.000000269)	(0.000000353)	(0.000000361)	(0.0000263)
medexp_CAN			0.00000100***	0.000000614*	0.000000955**	0.000000685*	-0.0000747
			(7.80e-20)	(0.000000255)	(0.000000289)	(0.000000296)	(0.0000368)
medexp_CZE			6.68e-08***	-0.000000145	0.000000640	0.000000449	-0.00000282
			(7.80e-20)	(0.000000165)	(0.000000534)	(0.000000601)	(0.0000376)
medexp_DEN			0.000000609***	0.000000221	0.000000777	0.000000593	-0.0000309
			(7.80e-20)	(0.000000280)	(0.0000004)	(0.000000452)	(0.0000342)
medexp_EST			-0.00000154***	-0.00000171***	-0.00000162***	-0.00000184***	0.00000530
			(7.80e-20)	(0.000000206)	(0.000000213)	(0.000000194)	(0.000102)
medexp_FIN			0.000000737***	0.000000380	0.000000938*	0.000000683	0.00000534
			(7.80e-20)	(0.000000260)	(0.000000412)	(0.000000457)	(0.0000525)
medexp_FRA			0.000000969***	0.000000643*	0.00000128**	0.00000105*	0.0000175
			(7.80e-20)	(0.000000237)	(0.000000427)	(0.000000464)	(0.0000267)
medexp_DEU			0.000000947***	0.000000581*	0.00000101**	0.000000735	-0.00000129*
			(7.80e-20)	(0.000000269)	(0.000000336)	(0.000000364)	(0.000000553)
medexp_GRC			0.000000880***	0.000000538*	0.000000982**	0.000000652	-0.0000979
			(7.80e-20)	(0.000000216)	(0.000000316)	(0.000000398)	(0.0000610)
medexp_HUN				-0.000000673***	-0.000000828***	-0.000000300	-0.000000492	-0.000148
				(7.80e-20)	(0.000000107)	(0.000000306)	(0.000000341)	(0.0000769)
medexp_ICL				0.000000537***	0.000000211	0.000000634*	0.000000354	-0.0000538
				(7.80e-20)	(0.000000195)	(0.000000295)	(0.000000331)	(0.0000430)
medexp_ISR				Omitted	Omitted	Omitted	Omitted	Omitted
				-	-	-	-	-
medexp_ITA				0.000000493***	0.000000187	0.000000668*	0.000000411	-0.000102
				(7.80e-20)	(0.000000192)	(0.000000304)	(0.000000322)	(0.0000516)
medexp_LTU				0.00000155***	0.00000138***	0.000000313	0.000000112	0.000755***
				(7.80e-20)	(0.000000131)	(0.000000215)	(0.000000214)	(0.0000622)
medexp_NL				0.000000812***	0.000000382	0.000000816*	0.000000592	-0.0000166
				(7.80e-20)	(0.000000301)	(0.000000360)	(0.000000408)	(0.0000337)
medexp_NOR				0.000000849***	0.000000412	0.000000761*	0.000000478	-0.0000299
				(7.80e-20)	(0.000000310)	(0.000000320)	(0.000000325)	(0.0000234)
medexp_POL				-0.000000118***	-0.000000243*	5.23e-08	-0.000000188	-0.0000541
				(7.80e-20)	(0.000000106)	(0.000000203)	(0.000000214)	(0.0000604)
medexp_PRT				0.000000329***	3.87e-08	0.000000425	0.000000213	-0.0000933
				(7.80e-20)	(0.000000193)	(0.000000275)	(0.000000332)	(0.0000670)
medexp_SVK				0.000000312***	5.75e-08	0.000000430	0.000000229	0.0000386
				(7.80e-20)	(0.000000246)	(0.000000313)	(0.000000272)	(0.0000388)
medexp_SVN				-0.000000135***	-0.000000386*	1.57e-08	-0.000000228	-0.0000487
				(7.80e-20)	(0.000000165)	(0.000000252)	(0.000000276)	(0.0000586)
medexp_ESP				0.000000616***	0.000000292	0.000000757*	0.000000515	-0.0000345
				(7.80e-20)	(0.000000228)	(0.000000325)	(0.000000369)	(0.0000541)
medexp_SWE				0.000000726***	0.000000401	0.000000692*	0.000000401	-0.0000492
				(7.80e-20)	(0.000000228)	(0.000000253)	(0.000000269)	(0.0000492)
medexp_UK				0.000000941***	0.000000595*	0.000000829**	0.000000580*	0.0000541
				(7.80e-20)	(0.000000245)	(0.000000256)	(0.000000273)	(0.0000638)
medexp_US				0.000000945***	0.000000478	0.000000727*	0.000000433	-0.0000201
				(7.80e-20)	(0.000000328)	(0.000000318)	(0.000000312)	(0.0000218)
constant	0.00407***	0.00305***	0.00428***	0.00352***	-0.0191	-0.0219	0.00869
	(0.000138)	(0.000262)	(5.57e-18)	(0.000181)	(0.0198)	(0.0207)	(0.120)
Year fixed effects	No	Yes	No	Yes	Yes	Yes	Yes
Specific country-year fixed effects	No	No	No	No	No	No	Yes
Trends	No	No	No	No	No	No	Yes
N	483	483	483	483	476	462	462
R^2 –within	0.256	0.412	0.5309	0.5891	0.727	0.725	0.823
R^2 –between	0.301	0.345	0.0308	0.0862	0.09	0.071	0.0007
R^2 –overall	0.275	0.002	0.0014	0.0012	0.011	0.007	0.005

Robust standard errors in parentheses included

*** p<0.05, ** p<0.01,***p<0.001**

Country fixed effects are always

Potential Explanation of Coefficients' Behavior



Policy Recommendations

- **OECD (2010) there is still room for improvement even for the best performing countries in terms of efficiency and healthcare spending.**

Proposed Reforms to suppress excessive health care spending:

1. Increase the level of co-payments
   - Jointly with complementary policies for perishable societal groups
   - For instance, poorer or unhealthier citizens
2. Monitoring prices with prudency of inputs and outputs
   - E.g. doctors' wages & reference prices of medicines
3. Incorporation of market mechanisms
   - Higher Competition ➡ Lowers costs & increases investments
   - Excess Competition ➡ Deterioration of quality & "cream-skimming" phenomena
4. Structural reforms:
   - Additional decentralization
   - Impose budget limits
   - Stringent "gate-keeping"

End of the Presentation

Thanks you for your attention!!