Pharmaceutical Expenditure and Economic Growth

Mujaheed Shaikh
Frankfurt School of Finance & Management
m.shaikh@fs.de

Prof. Afschin Gandjour
Frankfurt School of Finance & Management

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A Quick Overview of the Result

Pharmaceutical health spending affects growth negatively.

Agenda

- Introduction
- Econometric Framework
- Data and Descriptive Statistics
- Results
- Test some Channels for the Result
- Validity of the Instrument
- Discussion
- Conclusion

Introduction

- Spending on health is imperative since it affects health and well-being.
- Often justified by reckoning the economic benefits due to good health.
- However, studies that look at health, health expenditure and growth present conflicting results.

Introduction

- "…health has a positive and statistically significant effect on economic growth." (Bloom, Canning & Sevilla 2004)

- "Overall, the increases in life expectancy (and the associated increases in population) appear to have reduced income per capita. There is no evidence that the increase in life expectancy led to faster growth of income per capita or output per worker." (Acemoglu & Johnson 2007)

Introduction

- "…, the period before any beneficial effects of an improvement in health are visible in GDP per capita can be quite long, on the order of a third of a century. It may take twice that long to achieve most of the long-run gains in income per capita resulting from increased health. Further, these gains are surprisingly small." (Ashraf, Lester & Weil 2008).

Introduction

- Scarce resources.
- Spending on one sector diverts resources away from another potentially more productive sector.
- Crowding out effects of government spending.
- Public investment has little relationship with growth and government consumption inversely related to growth (Barro 1991).

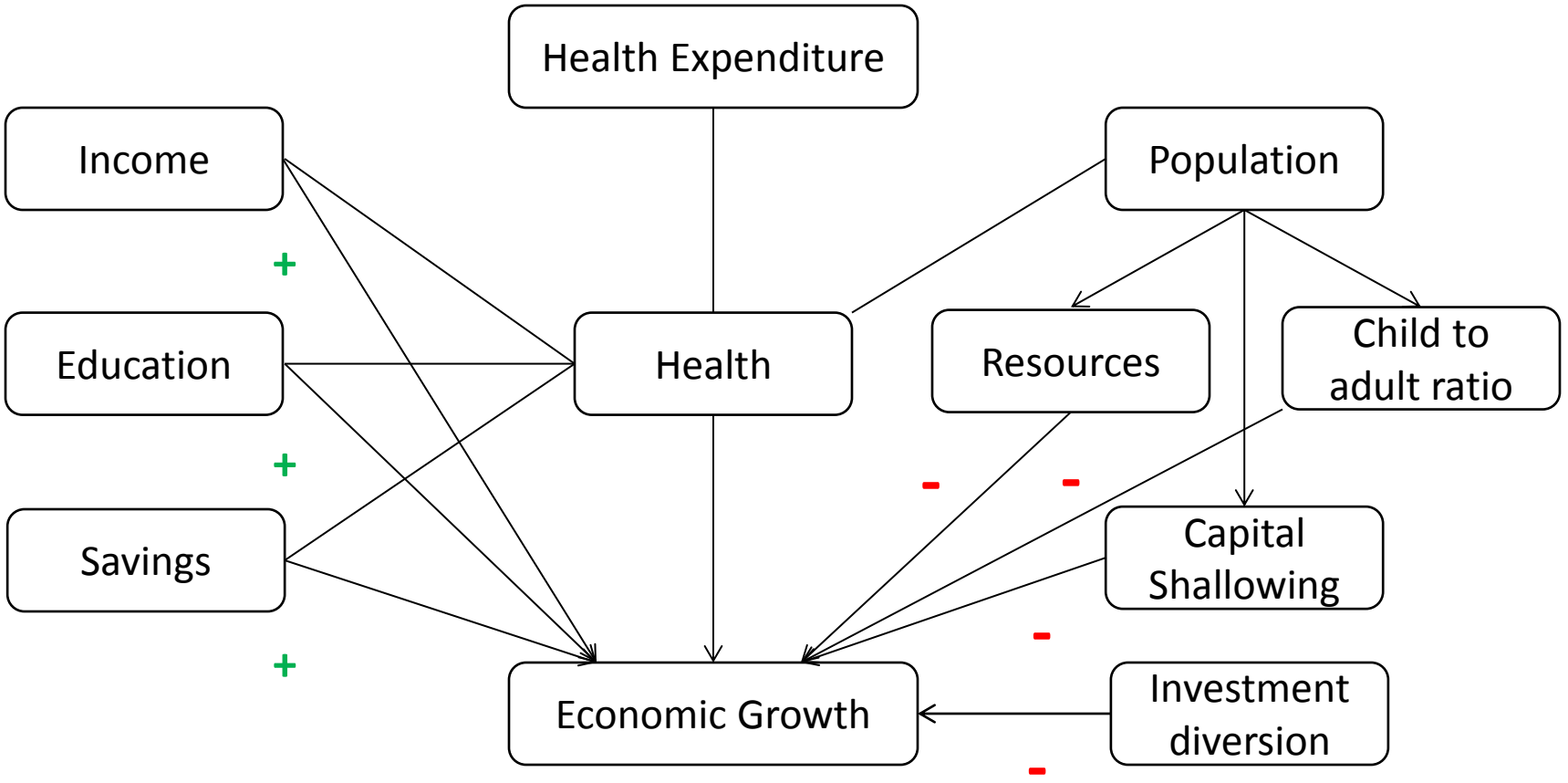
Introduction

- What does an increase in health spending mean for growth today?
- We try to answer this in our paper; specifically we look at the effect of pharmaceutical expenditure on economic growth.

Why Pharmaceutical Expenditure?

- Subject of great debate and excessively exposed to regulations and policies.
- Forms a large part of THE. 19% of current health spending in 2009 in OECD. Increased by almost 50% since 2000 (OECD, 2011).
- As we see it in our data, skyrocketed after 2000 and continues to place pressure in terms of budgetary constraints and evaluation of fiscal policies.
- Its relationship with GDP – Multiplier Effect in the economy and hence a positive impact on GDP other than through health.

Introduction



Econometric Framework

- Simple econometric model

$$Y_{it} = \beta C_{it} + \delta W_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

- Y_{it} is our measure for economic growth – GDP per capita.
- C_{it} is total pharmaceutical expenditure per capita.
- W_{it} is a vector of controls.
- α_i represents country fixed effects.
- γ_t represents time fixed effects.
- ε_{it} the usual error term.

$$\text{Cov}\,(C_{it}, \varepsilon_{it}) \neq 0.$$

Econometric Framework

- Our technique relies on Instrumental Variables except with a slight change.
- We first estimate the reverse causal effect of growth on pharmaceutical spending.
- Then subtract this reverse causal effect from the effect of pharmaceutical expenditure on growth.
- Method applied by Brückner (2011) - effect of foreign aid on economic growth.
- More recently by Moreno-Serra & Smith (2014) - effect of health coverage on mortality outcomes.

Econometric Framework

- *Step 1: Estimating the (reverse) causal effect of GDP on pharmaceutical expenditure.*

$$C_{it} = \beta Y_{it} + \delta W_{it} + \alpha_i + \gamma_t + \varepsilon_{it}$$

- As before, endogeneity present in this model.
- Here we use an instrument for GDP to account for endogeneity.
- The conditions for relevance and exogeneity apply as usual.

Econometric Framework

The Instrument

- We use International Tourist Receipts as a source of exogenous variation in GDP.
- International tourism receipts - expenditures by international inbound visitors.
- Receipts earned by the destination country and cover all receipts resulting from spending on lodging, food and drinks, fuel, transport, entertainment, shopping etc.

  (as defined by the United Nations World Tourism Organization – UNWTO).

Econometric Framework

- Relationship between tourism and the economy is intuitively straightforward.
- Tourism directly or indirectly generates an increase in economic activity.
- Should be positively related to GDP.
- Easily satisfies the relevance criteria as shown by the first stage results and F-statistics.
- The question is - if it is a valid instrument?

Econometric Framework

Validity of the Instrument

- Our Exclusion Restriction requires that

$$\text{Cov}\,(Z_{it}, \varepsilon_{it} | \, W_{it}, \alpha_i, \gamma_t) = 0$$

- Unless of course, medical tourism poses a threat to the exclusion restriction.

- Even then, no relationship with public pharmaceutical spending.

Econometric Framework

Step 2: Estimating the (causal) effect of pharmaceutical expenditure on GDP.

- If GDP has a significant causal effect on pharmaceutical spending then we have an obvious endogeneity bias.
- To adjust for this, we construct a pharmaceutical expenditure series where the response of pharmaceutical spending to GDP is partialled out, i.e.

$$C_{it}^{*} = C_{it} - \beta Y_{it}$$

- We then run our main regression using this adjusted pharmaceutical spending as our independent variable.

Data & Descriptives

- Data from the Health Systems Database of the Health Finance & Governance (HFG) Project and the World Bank Open Data.
- A panel of 184 countries from 1995 to 2006.
- GDP per capita is the main variable of interest and a measure of economic growth. Extensively used in the literature (Barro, 1991; Grossman & Krueger, 1995; Barro et al, 2003; Bloom et al, 2004).
- Independent variable of interest is total pharmaceutical expenditure per capita.

Data & Descriptives

Variable	Mean (S.D.)	Maximum	Minimum	Observations
GDP per capita	8745 (13355.9)	50.04	83575.9	2130
Pharmaceutical Expenditure	117.6 (168.7)	0.84	1015.3	1446

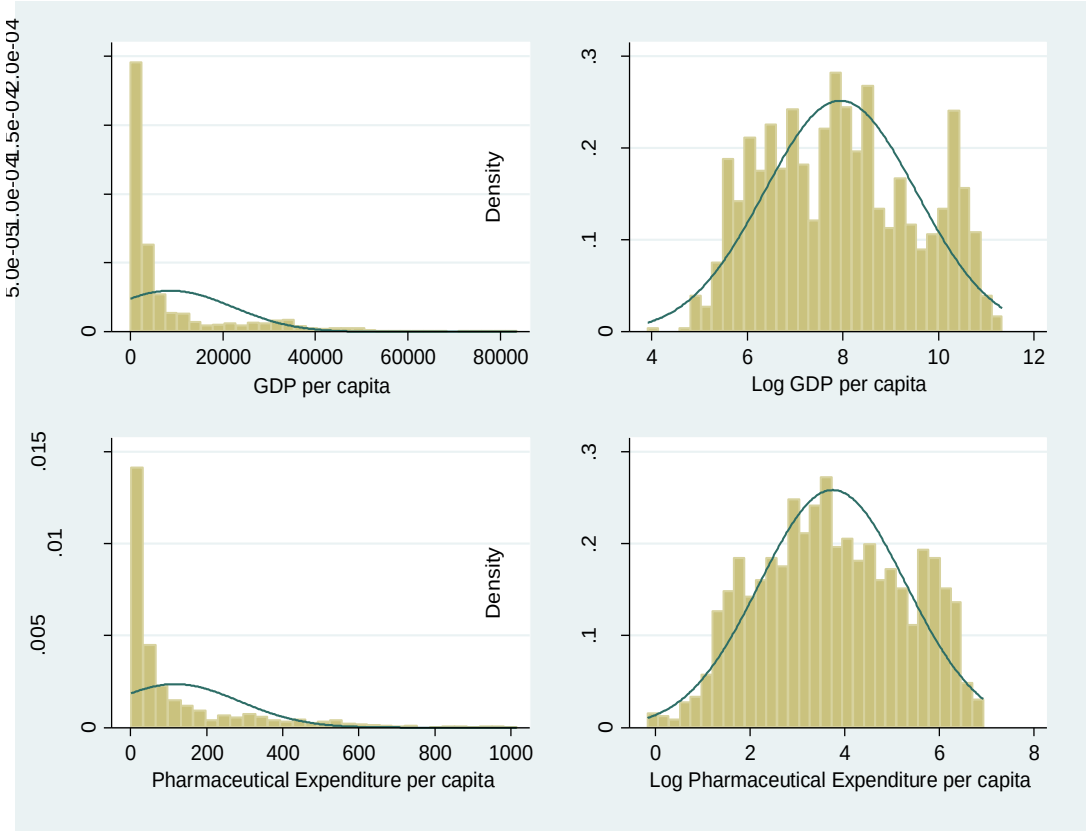
Variable	Mean (S.D.)	Maximum	Minimum	Observations
GDP per capita	26292.4 (14889.5)	1287.9	83575.9	578
Pharmaceutical Expenditure	283.0 (195.7)	2.88	1015.3	501

Variable	Mean (S.D.)	Maximum	Minimum	Observations
GDP per capita	2803.5 (2237.1)	365.7	13554.6	1176
Pharmaceutical Expenditure	34.2 (32.9)	1.7	199.5	803

Variable	Mean (S.D.)	Maximum	Minimum	Observations
GDP per capita	353.3 (140.7)	50.0	802	376
Pharmaceutical Expenditure	5.1 (3.0)	0.8	17.8	142

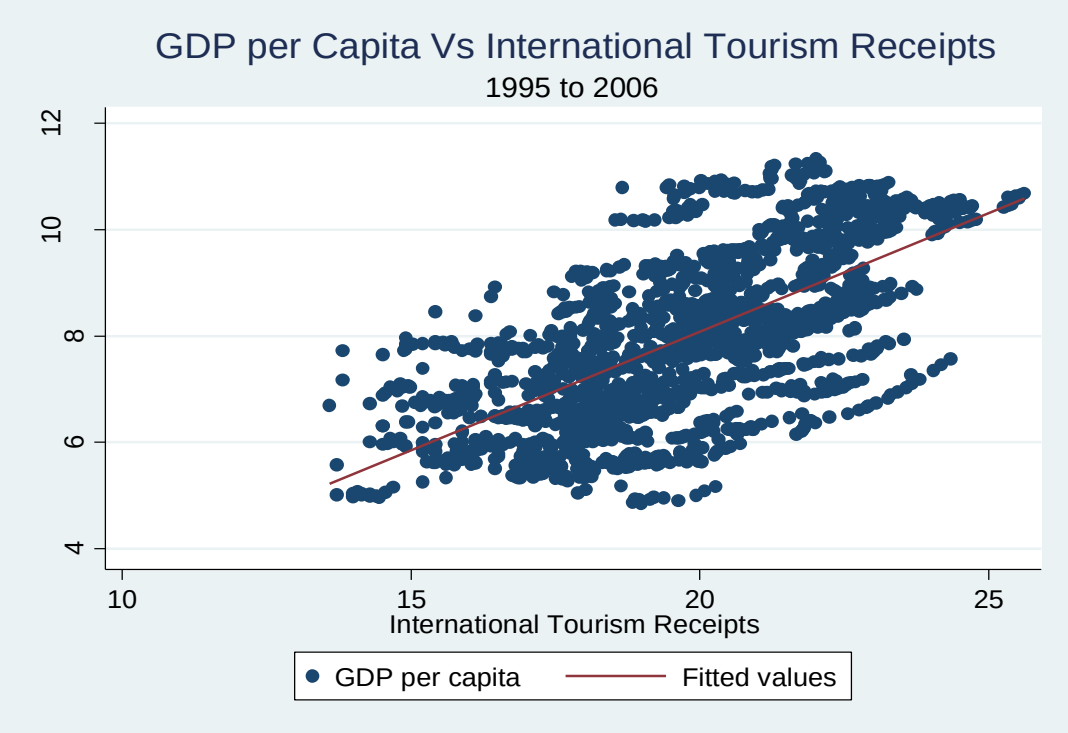
Data & Descriptives

- We use log forms of both GDP and pharmaceutical expenditure.



Data & Descriptives

- International tourism receipts, is expressed in millions of US-$. Both GDP per capita and international tourism receipts show a strong positive relationship.



Data & Descriptives

- Other control variables –

  Life expectancy as a measure of health.

  Under-5 mortality and Infant mortality as alternative measures of health.

  Remaining health expenditure.

  Indicators for Education – enrolment rates at primary, secondary and tertiary levels.

Results - GDP on pharmaceutical expenditure

	Full Sample	High Income countries	Middle Income countries	Low Income countries
	(1)	(2)	(3)	(4)
Panel A	***Dependent variable is pharmaceutical expenditure per capita***			
GDP per capita	2.376***	2.765***	2.305***	1.969*
	(0.266)	(0.554)	(0.319)	(1.016)
Observations	1,350	472	757	121
Countries	133	42	75	16
Panel B	***First stage estimates of GDP per capita***			
Int. tourism expenditures	0.205***	0.302***	0.202***	0.127***
	(0.018)	(0.050)	(0.018)	(0.035)
F-statistics	129.14	36.12	118.29	12.76
p-value	0.000	0.000	0.000	0.002
Observations	1,350	472	757	121
R-squared	0.454	0.473	0.480	0.526
Countries	133	42	75	16

Results – Pharmaceutical Expenditure on GDP

	Full Sample		High Income countries		Middle Income countries		Low Income countries	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable is GDP per capita							
Pharmaceutical expenditure	-0.210**	-0.182***	-0.535**	-0.642	-0.160*	-0.168*	-0.231**	-0.248*
	(0.0860)	(0.0690)	(0.273)	(0.435)	(0.0883)	(0.0921)	(0.103)	(0.134)
1st stage F-stat.	53.30	41.63	10.51	3.00	44.61	21.66	47.51	7.30
p-value	0.000	0.000	0.002	0.092	0.000	0.000	0.000	0.024
R-sq. first stage	0.622	0.713	0.621	0.730	0.651	0.659	0.810	0.785
Observations	1,350	782	472	361	757	366	121	55
Countries	133	98	42	37	75	51	16	10

Results – Robustness tests

	(1)	(2)	(3)
	Coefficients represent elasticity of GDP per capita to pharmaceutical expenditure		
Full Sample	-0.179***	-0.178***	-0.182***
	(0.0637)	(0.0631)	(0.0690)
High Income countries	-0.669	-0.689	-0.642
	(0.423)	(0.448)	(0.435)
Middle Income countries	-0.140**	-0.135**	-0.168*
	(0.0703)	(0.0686)	(0.0921)
Low Income countries	-0.336**	-0.309**	-0.248*
	(0.139)	(0.128)	(0.134)

Notes: The time period is 1995-2006. All regressions include country and time fixed effects. Column (1) replaces life expectancy with infant mortality/1000, column (2) replaces life expectancy with under-5 mortality/1000, column (3) excludes outliers. The dependent variable and the independent variable are in the log form, the coefficients therefore can be interpreted as elasticities for these. Standard errors are clustered at the country level and are heteroskedasticity robust. ***, **, * indicate significance at a 10%, 5% and 1% level respectively.

Exploring some of the Channels

	Population growth included as a control (1)	Age-dependency ratio included as a control (2)	Savings rate included as a control (3)	Pharmaceutical price index as control
Full Sample	-0.188***	-0.183***	-0.304***	-0.318***
	(0.0712)	(0.0642)	(0.102)	(0.0903)
High Income countries	-0.919	-0.735	-0.941	--
	(0.769)	(0.538)	(0.722)	
Middle Income countries	-0.181*	-0.167**	-0.268**	--
	(0.0986)	(0.0701)	(0.136)	
Low Income countries	-0.173*	-0.171*	-0.233*	--
	(0.0928)	(0.0884)	(0.127)	

Notes: The time period is 1995-2006. All regressions include country and time fixed effects and standard controls such as life expectancy, remaining health expenditure and education enrolment indicators. Standard errors are clustered at the country level and are heteroskedasticity robust. ***, **, * indicate significance at a 10%, 5% and 1% level respectively.

Public and Private expenditure

	Full Sample		High Income countries		Middle Income countries		Low Income countries	
	(1) Public exp	(2) Private exp	(3) Public exp	(4) Private exp	(5) Public exp	(6) Private exp	(7) Public exp	(8) Private exp
Pharmaceutical expenditure	-0.097*** (0.024)	-0.109* (0.059)	-0.309** (0.148)	-0.318 (0.218)	-0.104*** (0.036)	-0.099 (0.069)	-0.139*** (0.043)	-0.232 (0.144)
First stage F-statistic	315.68	30.93	8.19	4.07	134.78	21.68	31.57	5.84
p-value	0.000	0.000	0.007	0.051	0.000	0.000	0.000	0.038
R-sq. first stage	0.806	0.708	0.732	0.730	0.724	0.711	0.783	0.768
Observations	782	782	361	361	366	366	55	55
Countries	98	98	37	37	51	51	10	10

Support for Validity of the Instrument - I

	Independent variable: Total pharmaceutical expenditure	Independent variable: Public pharmaceutical expenditure	Independent variable: Total pharmaceutical expenditure	Independent variable: Public pharmaceutical expenditure	Independent variable: Total pharmaceutical expenditure	Independent variable: Public pharmaceutical expenditure
	(1)	(2)	(3)	(4)	(5)	(6)
Full sample	-0.279***	-0.176***	-0.166**	-0.0738***	-0.293***	-0.185***
	(0.0970)	(0.0438)	(0.0702)	(0.0221)	(0.102)	(0.0551)
High income countries	-0.642	-0.309**	-0.523	-0.227**	--	--
	(0.435)	(0.148)	(0.339)	(0.102)		
Middle income countries	-0.245***	-0.156***	-0.135	-0.0781**	--	--
	(0.0875)	(0.0449)	(0.0864)	(0.0307)		
Low income countries	-0.802***	-0.430**	-0.248*	-0.139***	--	--
	(0.253)	(0.197)	(0.134)	(0.0435)		

Notes: Coefficients represent elasticity of GDP per capita to pharmaceutical expenditure. The time period is 1995-2006. All regressions include country and time fixed effects. Columns (1) and (2) exclude observations that are in the lower quartile (25%) w.r.t instrument, columns (3) and (4) exclude countries popular for medical tourism. Columns (5) and (6) control for EU membership and full sample indicates only EU countries for these. Standard errors are clustered at the country level and are heteroskedasticity robust. ***, **, * indicate significance at a 10%, 5% and 1% level respectively.

Support for Validity of the Instrument - II

	Full Sample	High Income countries	Middle Income countries	Low Income countries
	(1)	(2)	(3)	(4)
		Dependent variable is International Tourism Receipts		
Log Life expectancy at birth	5.883***	5.510	10.98***	-4.727
	(2.204)	(3.612)	(3.252)	(8.148)
Log of remaining health expenditure	-0.436	-0.0959	-0.301	-0.137
	(0.267)	(0.221)	(0.286)	(0.302)
School enrolment primary	0.00569	0.00335	0.00901	0.00144
	(0.00519)	(0.0117)	(0.00721)	(0.0104)
School enrolment secondary	-0.000448	-0.00360	-0.00542	0.00256
	(0.00351)	(0.00247)	(0.00949)	(0.0198)
School enrolment tertiary	0.000591	0.00171	0.000947	0.0847***
	(0.00336)	(0.00320)	(0.00621)	(0.0141)
Log GDP per capita	2.130***	1.207**	1.916***	3.717*
	(0.394)	(0.491)	(0.451)	(1.958)
Constant	-20.67**	-13.11	-40.43***	15.09
	(8.295)	(13.02)	(11.86)	(22.04)
Observations	799	364	375	60
R-squared	0.544	0.505	0.614	0.803
Countries	115	40	60	15

Discussion

- Conventional wisdom in the health economic literature is that health expenditure leads to an increase in economic growth.
- We find that an increase in pharmaceutical health expenditure leads to a decrease in economic growth.
- Some reasons mentioned earlier – population growth, capital shallowing, savings, per capita resources decrease. Tested for these channels.

Discussion

- Other reasons -
- Circular flow of income being disrupted in an economy - countries being net exporters or importers of pharmaceuticals matters.
- Debt financed health care – especially for middle and low income countries.
- Inadequate returns to spending in terms of health, hence expenditures draw away a lot but contribute little.
- Inefficiency in public spending – a broad term.

Conclusion

- Results do not imply that pharmaceutical spending needs to be slashed or health spending in general should be cut down.
- Even if negative effect on growth, still reduces suffering due to ill-health and affects well-being in some way.
- Instead our results for instance should lead policy makers to make more efficient use of pharmaceutical spending, especially reduce wastage.

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