Connecting the dots: navigating pollution, health, climate and fiscal solutions

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The problem
Our understanding of global welfare cost of air pollution is improving... it is big

<table>
<thead>
<tr>
<th>Study</th>
<th>Domain</th>
<th>Year</th>
<th>I$ (PPP)</th>
<th>US$</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larsen (2014)</td>
<td>AAP</td>
<td>2012 in 2012 prices</td>
<td>1.7</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>World Bank and IHME (2016)</td>
<td>AAP</td>
<td>2013 in 2011 prices</td>
<td>3.6</td>
<td>3.5%</td>
<td></td>
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<tr>
<td>OECD (2016)</td>
<td>AAP</td>
<td>2015 in 2010 prices</td>
<td>3.4</td>
<td>6.0%</td>
<td></td>
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<tr>
<td>Larsen (2017) for the World Bank</td>
<td>AAP</td>
<td>2015 in 2015 prices</td>
<td>5.5</td>
<td>3.3</td>
<td>4.5%</td>
</tr>
<tr>
<td>World Bank 2018</td>
<td>AAP</td>
<td>2016 in 2016 prices</td>
<td>5.7</td>
<td>3.3</td>
<td>4.4%</td>
</tr>
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</table>

$ trillion per year

Note: AAP=ambient air pollution. HAP=household air pollution from the use of solid fuels. I$= international dollars at purchasing power parity (PPP) exchange rates. US$= US dollars at market exchange rates. * Gross national income.

Almost equal to 2016 GDP of India and Russia combined
People in low income countries are less exposed to air pollution than in HI non-OECD but die more often.

Population weighted ambient PM2.5 exposure (μg/m3)

Deaths from ambient PM2.5 exposure per 100,000 population

Source: World Bank from GBD 2016
The air pollution damages is also unevenly distributed geographically.

The three countries in each region…

with the highest deaths from ambient PM2.5 per 100,000 population in 2016.
The three countries in each region…

with the highest death rates from ambient PM2.5 as a percentage of total deaths

The three countries in each region…

with the highest welfare cost of ambient PM2.5 as a percentage of GDP

Both climate change and local air pollution are victims of major market failure.
Both climate change and local air pollution are victims of major market failure.
Solutions requires global and local collective action

Free riders’ problem

Source: MacKay et al. 2015
Some cheap interventions deliver quick health benefits but not necessarily climate change mitigation

$:$/tonne

**Low cost, quick & synergistic measures**
- improved maintenance, repairs, inspection regimes, better fuel quality in existing sources, behavioral nudges

**Medium cost measures: effective for AP, not always for climate**
- Retrofitting existing assets, installing end-of-pipe technologies: FGDs, EPS, catalytic converters, etc.

**High capital measures: high AP&CC synergy**
- Early retirement of old fossil fuel dependent assets and replacement by new assets (e.g. EV, RES, heat pumps, electrification and gasification, new cookstoves, etc)

**Systemic, structural and behavioral changes**
- New physical and institutional infrastructure to support increasing returns to scale for non-fossil fuel energy and transport systems; penetration of new social norms and habits

**Tons abated**

Capital intensive, systemic changes will deliver both local and global benefits
Interventions will be implemented if perceived benefits exceed perceived costs.

Total global external benefits (transboundary acid rain or CC)

Total local/national external benefits (air pollution)

Total private benefits

Local_Q_PM\_2.5

Econ_Q_PM\_2.5

Tons abated

100% removal from air

$/Ton

Global Economic P_PM

Local/national P_PM

Private/finsancial MB_PM\_2.5

Local/national MB_PM\_2.5

Economic/social MB_PM\_2.5

$\text{/Ton}$
Marginal costs and benefits of abating different pollutants differ.
Things get complicated with multiple pollutants…

- MB_CO2
- Q_CO2
- Q_NOx
- Q_SO2
- Q_PM

- P_CO2
- P_NOx
- P_SO2
- P_PM

- 100% removal form air
... and sources of pollution

Source apportionment of PM2.5 in Greater Cairo

But interventions needs to be prioritized (unless you have unlimited resources), e.g. by decreasing net benefits of reducing damages.
Priority fuels/sources can differ from air pollution and climate perspectives

Fuel contribution to ‘local’ and ‘global’ damages of PM10: average for six cities

Local pollution damages are dominated by health costs

Local damages by pollutant: average for six cities

Mumbai, Shanghai, Manila, Bangkok, Krakow, Santiago

Synergies and trade-offs between local air pollution and climate perspective
Synergies and trade-offs between interventions driven by AP and CC agendas

<table>
<thead>
<tr>
<th>Outcomes of policy interventions</th>
<th>Local air pollution</th>
<th>Climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel and modal switch (wind, solar power + electric transport)</td>
<td></td>
<td></td>
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<tr>
<td>Most energy and resource efficiency</td>
<td></td>
<td></td>
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<tr>
<td>Behavioral, lifestyle changes (e.g. plant-based diet)</td>
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<tr>
<td>Waste management (incl. open burning, methane)</td>
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<tr>
<td>Organic, low-cattle agriculture (methane, ammonia)</td>
<td></td>
<td></td>
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<tr>
<td>Nature based solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relocation of pollution source</td>
<td>Green</td>
<td>Blue</td>
</tr>
<tr>
<td>Increased recycling of waste</td>
<td>Orange</td>
<td>Yellow</td>
</tr>
<tr>
<td>Coal to biomass switch</td>
<td>Red</td>
<td>Green</td>
</tr>
<tr>
<td>Oil/gas to biofuels switch</td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td>Most technology-based end-of-pipe solutions, e.g.:</td>
<td></td>
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</tr>
<tr>
<td><em>Flue gas desulphurization</em></td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td><em>Some NOx abatement technologies</em></td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td><em>Switch from diesel to petrol engines</em></td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td><em>Particulate filters for diesel</em></td>
<td>Green</td>
<td>Red</td>
</tr>
<tr>
<td><em>Three-way catalysts for petrol cars</em></td>
<td>Green</td>
<td>Red</td>
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Source: World Bank (forthcoming)
Environmental costs rarely rarely covered by energy taxes on fuels

Effective tax rates on carbon emissions from energy use on each fuel in 2015

Source: OECD 2018
...and are underpriced mainly in stationary uses
Pollution tax gap: not only expenditure liability but also revenue raising opportunity

- Fiscal policy instruments can reduce pollution and deliver health benefits at the least cost to the economy
- Save public expenditure on health care and environmental administration
- Simpler to administer and cheaper to collect than income taxes or VAT;
- Particularly useful for fiscal reform agenda in developing countries with weak institutions, informal sector, tax evasion and low domestic resource mobilization.

Source: World Bank (forthcoming)
The takeaways
Some takeaways

• Priorities for policy interventions can differ if led by local health or global impacts;

• Policies need to build on synergies and manage tradeoffs between short-term and long-term air pollution and climate agendas;

• Forthcoming World Bank report draws on international experience and literature to provide practical guidelines on how to identify:
  • Overlaps and disparities between local and global damages across fuels, sources, technologies and locations;
  • Cost effective strategies to address priority air pollution issues, while minimizing long-term lock-in of carbon intensive technologies and infrastructure;
  • Environmental tax reform; an integral part of modern fiscal systems, especially in developing countries.
The WB 2018 report

Updated estimate of the global, regional and national cost of PM2.5 ambient air pollution in 2016 using the GBD 2016 estimates of mortality and morbidity from ambient PM2.5.

For AAP 25% higher in real terms than the joint estimate of AAP and HAP for 2013 in World Bank and IHME (2016).

The reasons for the higher cost estimate:

- Higher estimate of global ambient PM2.5 exposure (due to:
  - improved methodology and availability of data and
  - actual worsening of global ambient PM2.5 air quality from 2013 to 2016);

- Changes in health risk functions,

- Inclusion of a rough estimate of the cost of morbidity.