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The Fisc and India's Energy Transition

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The Fisc and India's Energy Transition¹

Dr. Rangarajan, Prof. Bhanumurthy, faculty members, dear students of Madras School of Economics, and friends

Thank you for inviting me to deliver this year's Dr. Raja J. Chelliah Memorial Lecture. I look back at the reputations of all those who are present here and who preceded me on this dias, and I am both deeply honoured and humbled. I have grown up as an economist learning from their immense knowledge, perceptions and insights.

Dr Rangarajan is one of those iconic figures who has inspired many of us who work on policy, I met him many years back for the first time and he left an indelible impression on him. Since then like Eklavya I have been observing him from a distance, and learning from his deep knowledge, insights and perhaps most importantly the wisdom and perseverance that mark his work.

Dr Raja Chelliah is an inspiration and a guiding light for many, and I am one among them. I never met him. But there are three things I have in common with Dr Chelliah. Like him, I returned to India after completing my PhD. Like him, I started my career at NCAER as a Senior Economist. Like him, I have also found myself grappling with the environmental challenge towards the latter part of my journey as a policy economist.

Dr Chelliah grappled with a serious challenge that India needs to address in his joint work with Paul Appasamy, U Sankar and Rita Pandey, titled Ecotaxes on Polluting Inputs and Outputs. This study, whose foreword was penned by Dr Rangarajan, focused on pollution and not climate change. I presume this was not because they considered climate change to be unimportant, but because they identified pollution as a greater priority at that time.

One and a half decades later while pollution continues to be of concern, unfortunately, climate change has also become a priority. The silver lining in this very dark cloud is that Dr Chelliah's joint work on pollution deeply informs our work on climate change. The underlying causes are the same - humanity's penchant for violence against nature. And the solutions are also similar – the polluter needs to pay. Only the symptoms differ in that climate change has arguably far larger consequences. While pollution has localized impacts, emissions-related climate change is planetary in scale. While pollution impacts human and animal health, climate change impacts all aspects of our lives and potentially existence itself. While pollution can be addressed at the national level, climate change has to have a globally coordinated solution.

Both are classic externality problems. There are broadly two ways to address them – non-price measures that include prohibitions of various types, and price-related measures that include taxation in various forms. Dr Chelliah's work has focused on price-based

¹ This speech is based on the Dr. Raja J Chelliah Memorial Lecture delivered at the Madras School of Economics on 19th March, 2025.

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measures and so have I in my work. Not because non-price measures are unimportant, but because even non-price measures work best in a regime where price signals are complementary to such prohibitions.

Dr Chelliah was not just an expert working on public finance. I believe he was inherently an institutionalist. I did not know him or even meet him, but reading his works and about his life, it is quite evident that he thought deeply about practical matters of implementation, sustainability, and accountability. Perhaps for that reason in the above-mentioned work, the authors chose to work within the existing tax structure and institutions as that provides the easiest way forward. More importantly, they were able to identify workable mechanisms within the constraints imposed by pre-existing institutions.

I am fascinated with the thinking that would have gone behind some of the most refreshing ideas on environmental taxation for India, even though they were penned some one and a half decades back. I take one example. Today there is a move towards instituting a carbon market in India. Though the details have not been fleshed out yet, it will involve entities trading carbon credits or what Chelliah et. al. refers to as pollution permits. I have instinctively been uncomfortable with this initiative but not able to form a clean and coherent argument against it. But Chelliah et. al. identifies an institutional argument; they argue that there are too many legal and institutional hurdles for tradable pollution permits to be a workable Indian solution. In other words, their argument identifies both institutional feasibility and simplicity as key criteria for tax reform.

Over the course of this talk, I will share some issues related to India's transition towards a greener, more nature-friendly, economy. In a sense I will be sharing my journey as someone who approached the issue from the perspective of an environmentalist but the training of an economist. I will share with you many alternatives before India. Some of these are fairly complex solutions, others don't bother about institutional constraints, and yet others are too futuristic. In that sense, I will venture beyond the frame set by Dr Chelliah as the solutions are sometimes quite challenging. But in all of this, I believe that the environmental challenge before us can best be addressed via an economic solution.

Though there are no straightforward solutions, and each solution has some challenges, each will require a process of analysis and deliberation before being implemented.

How better can I honour the memory of Dr Raja Chelliah than to share with this august gathering how India's environmental transition rests on its Fiscal Policies, and how the frame conceptualized by Dr Chelliah many years back will continue to drive India's shift towards a cleaner greener economy.

The Motivation

I believe that humanity has been self-obsessed and deeply disrespectful of nature. Pollution, plastics, greenhouse gas emissions, groundwater exploitation, overuse of chemical fertilizers, even the misuse of antibiotics, industrial-scale agriculture, heartless livestock rearing, unhindered deep sea fishing, indiscriminate forest cutting, etc. are all symptoms of a deep-rooted malaise that infects humanity in general. The way I see it global warming is merely a symptom of a deeper problem. And falling biodiversity in the form of reduced wildlife, plant life, etc another symptom. Cluttered oceans and rivers unable to support life in many stretches are also some symptoms of this same underlying problem.

But just as economic insights have enabled us to progress more rapidly towards GDP and income growth objectives, so can they help us correct our errors on the sustainability front? Hopefully, I will be able to throw some light on some of these issues throughout this lecture. But I also subscribe to the view that India has a shot at achieving developed country lifestyles in another two and a half decades. The real challenge for India is whether it can achieve both, higher growth and a greener economy.

Fossil Fuel Revenues

Over the next few decades, like most other countries, India will go through a significant energy transition, with a steady reduction in the share of fossil fuels in its energy portfolio. Fossil fuels account for a significant share of Indian government revenues, and therefore this energy transition will also impact government revenues and necessitate a simultaneous fiscal transition.

Historically, India has not been among the major consumers of fossil fuels, and this is largely due to its low per capita income. The transition from a low per capita income country is an important consideration for its economic policy and will require sustained and high economic growth. India's economic growth has, to a significant extent, been powered by imports of fossil fuels. At the same time, among major economies, India's growth in renewable energy capacity has been among the highest in recent years.

Currently, the Indian governments at the Union and state levels impose a multitude of taxes, cesses, duties, etc. on all fossil fuels. Non-tax revenues are also significant and include royalties from domestic mining operations, and also dividends from public sector ownership of fossil fuel companies. Tax revenues from coal include those from GST and GST compensation cess, custom duty on coal imports, corporate taxes etc. In the case of Oil and Natural Gas tax revenues include those from cess, customs duties, excise duties, National Calamity Contingent duty, VAT imposed by state governments, corporate tax, GST on select petroleum products under GST. Nontax revenues for both coal and petroleum products include royalties and dividend income contributed by public sector companies.

In 2019-20 the bulk of revenues from fossil fuels, at both central and state levels emanated from taxes, though non-tax revenues are not insignificant either. For central and state governments combined tax revenues from fossil fuels were 3.2 per cent of India's GDP, of this revenues on various union and state taxes on fossil fuels were 2.9 per cent and non-tax revenues about 0.3 per cent. **Compare this with some other items on government budgets.** India's total defence expenditure was half that at about 1.6 per cent of the GDP. Total government health expenditure was about 1 per cent of the GDP in 2019-20.

Table 1: Key Economic and Budgetary Figures of India 2019-20 (Rs 10,000 crores or Rs 100 Bill)

	Central	State [^]	Total	Total as % of GDP
I	II	III	IV	V
Tax Rev from Fossil Fuels	37.0	21.4	58.4	2.9
Non-Tax Rev from Fossil Fuels	3.5	2.9	6.4	0.3
Total Revenue from Fossil Fuels	40.5	24.3	64.8	3.2
<i>Compare with</i>				
Govt. Health Expenditure*	6.4	14.6	21.0	1.0
Govt. Education Expenditure*	9.5	56.8	66.3	3.3
Defence Expenditures	31.6	-	31.6	1.6
Total Govt. Budget Expenditures	269.9	400.6	670.5	33.0
India's GDP			2034.0	100.0

Source: Government Budgetary Documents. *Note: This includes the transfers from central government, including Centrally Sponsored Schemes, Finance Commission Grants, and Other grants/loans. ^Note: These are for all states combined. Education includes sports and art and culture. Health includes public health.

Source: Bhandari, L., Dwivedi, A. (2022). India's Energy and Fiscal Transition (CSEP Working Paper 27). New Delhi: Centre for Social and Economic Progress.

Significant global literature categorizes continued high government revenues from fossil fuels as one of *carbon entanglement*. The argument is that economies with a high level of entanglement have a lower motivation to increase the pace of change towards a low-carbon future.

But in India's case, the opposite is true. That is, India is keenly interested in reducing its fossil fuel dependence, and that is because of its dependence on imports. Energy security objectives in an increasingly volatile geoeconomic environment combined with import reduction objectives have been important motivators for India to reduce its fossil fuel dependence. Therefore, as the government seeks to reduce its fossil fuel

dependence, the growth of fossil fuels will first fall and later become negative before reaching insignificant levels by 2070 as per India's Net Zero objectives. I will be sharing some more details on that later.

Transition and the Revenue Problem

In joint work I conducted with Aasheerwad Dwivedi, we identified the combined quantum of both tax and non-tax revenues from fossil fuels for both the union and state governments for the year 2019. We took the base energy use scenarios developed by the International Energy Association for India for the years 2030 and 2040 and studied how both tax revenues and non-tax revenues for the union and state governments would change over time.

We found that under fairly standard assumptions on growth, prices, and taxes, there would be continued growth in revenues from fossil fuels till 2040; however, as a share of the GDP and overall government budget, it would fall significantly. In other words, if tax rates and coverage do not change the revenues would not fall but would reduce in significance.

Table 2: Government Revenue Projections as a share of GDP

	Central	State	Total
2019	2.0	1.2	3.2
2030	1.1	0.7	1.8
2040	0.6	0.4	1.0

Source: Bhandari, L., Dwivedi, A. (2022). India's Energy and Fiscal Transition (CSEP Working Paper 27). New Delhi: Centre for Social and Economic Progress.

We estimated that by 2040, from 3.2 per cent in 2019, aggregate government revenues would fall to 1.0 per cent of GDP. Of this, the bulk of the fall would be for the central government – from 2.0 per cent of the GDP to 0.6 per cent of GDP by 2040. For the state governments, the fall would be from 1.2 per cent of the GDP in 2019 to 0.4 per cent in 2040.

The Problem with States

Many coal-producing states rely on fossil fuels for revenues as they benefit from both coal-related royalties from mining and tax revenues from the sales of oil and natural gas. Jharkhand, Chhattisgarh, and Madhya Pradesh obtain 22% to 23% of their own revenues (OR) from coal, oil, and natural gas combined. Further, the states of Odisha, Bihar, Andhra, and Rajasthan derive between 15% and 18% of their own revenues from fossil fuels. Even smaller and special-category states such as Assam obtain 10% to 15% of their OR from coal, oil, and natural gas. Most states have a relatively higher dependence on oil and natural gas in comparison to coal. All the major industrialised states in India, such as Gujarat, Maharashtra, Tamil Nadu, and Karnataka, receive about 15% or lower of their OR from fossil fuels.

In other words, there is a somewhat higher dependence on fossil fuel revenues for states with lower per capita incomes. This is essentially because their tax base is lower. And as fossil fuel revenues fall over time these states would be worst affected. Unfortunately, most of these high-impact states are also in the eastern part of India, where new renewable energy opportunities are also limited. And consequently, the energy transition will affect such states the most.

Table 3: State Government Fossil Fuel Revenues as a Share of Own Revenues

State	Fossil Fuel Revenues % of Own Rev 2019-20
Jharkhand	23.1
Madhya Pr.	22.4
Chhattisgarh	22.1
Odisha	18.0
Andhra	17.0
Bihar	16.4
Tripura	16.0
Gujarat	15.1
Rajasthan	15.0
Telangana	14.4
W. Bengal	14.4
Haryana	14.4
Tamil Nadu	14.3
Karnataka	14.3
Maharashtra	13.7
Punjab	13.6
Assam	13.0
Uttar Pr.	12.7
Kerala	11.9
Uttarakhand	8.6
J&K	8.3
Himachal	4.3

Bhandari, Laveesh and Aasheerwad Dwivedi, Critical Challenges in Realising the Energy Transition: An Overview of Indian States. CSEP Working Paper, 2023

Therefore, as India transitions to a low fossil fuel future, three major movements are imminent. First, fossil fuel revenues will become less important in the total budget. Two, the centre will be more impacted than the states in the aggregate. Three, states towards the east and with lower per capita incomes will be severely impacted.

The Coal Problem

There is another issue: While India heavily taxes petroleum products—sometimes more than some Western countries—the real problem lies with coal which is taxed in a limited manner. Coal is primarily used by thermal power plants, which supply electricity to state-level power distribution companies (Discoms), many of which are already in deep financial distress. If coal taxes were to increase, either consumers or Discoms would need to absorb the cost. Given the structure of India's power sector, it is more likely that Discoms would bear the burden, worsening their already precarious situation. Addressing the Discom crisis is a separate issue altogether, which is beyond the scope of this talk. However, India must solve its Discom problem and correct the inclination to price electricity lower than it costs at the state government level.

Tax Revenue Uncertainty

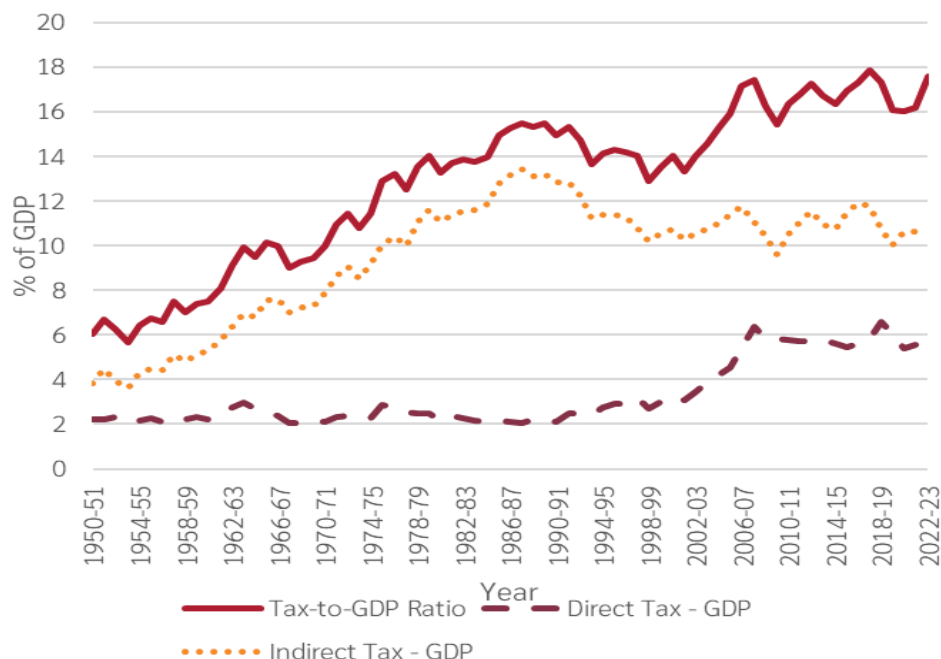
Now let us consider overall government revenues, and not only from fossil fuels. The tax to GDP ratio had been rising steadily throughout the post-independence period crossing 15 per cent of GDP in the mid-1980s from about 6 per cent in the early 1950s. It stagnated and even fell in the 1990s but again grew significantly in the 2000s almost touching 18 per cent in the mid-2000s. For the last two decades, however, it has been stagnant and within the 16 to 18 per cent range.

This remains one of the major unanswered questions in Indian economics, despite significant tax reforms, including expanding coverage of services, the introduction of VAT, GST, digitization, etc. Let me refer to some of these next.

The introduction of Goods and Services Tax (GST) is undoubtedly a very important event in India's history of taxation, but the introduction has not been a single event, a multitude of changes have followed its introduction including greater digitization, amnesty schemes, rate rationalization, etc. Moreover, the introduction of E-Invoicing and E-Way Bills for businesses and shipments above a minimum benchmark was also aimed at reducing evasion and avoidance.

On the direct taxes front the reduction of corporate tax rates, faceless assessment and appeals, *vivaad se vishwaas* to reduce disputes, taxation of dividend distribution, and also appropriate taxation of foreign companies through the concept of 'significant economic presence' were some but not the only measures aimed at increasing the ease of businesses' engagement with tax authorities and consequently enhancing the potential for tax revenues. Unfortunately, the combined effect of this, though not insignificant, has been inadequate. It has not been able to lift the tax-to-GDP ratio beyond the 16 to 18 per cent range as yet. Of course, the hope is that these may play out with a longer time lag.

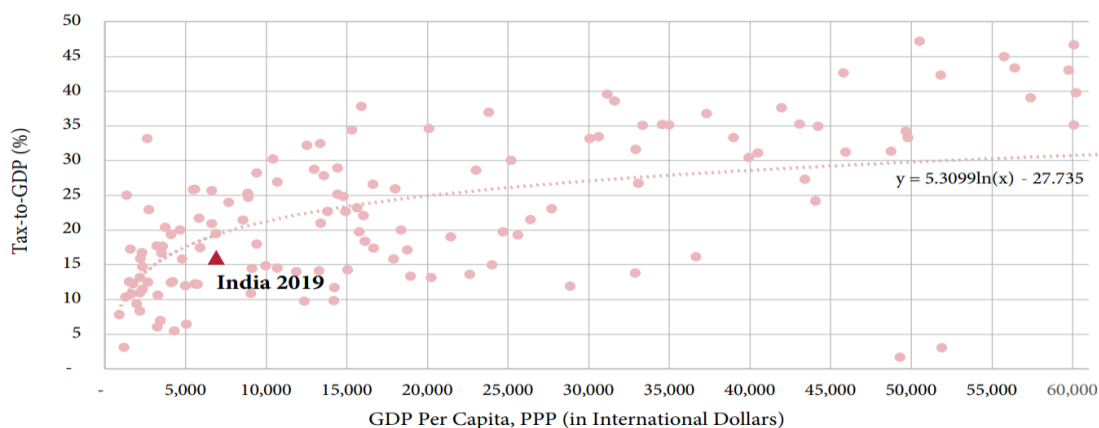
Figure 1: India's Tax to GDP Ratio



Source: Bhandari, Laveesh and Rajat Verma, Compensating for the Fiscal Loss in India's Energy Transition, CSEP Working Paper, 2023

Nevertheless, it is evident that if we consider global experience, an increase in the aggregate tax-to-GDP ratio is plausible. If we consider only the larger economies, though, India's tax-to-GDP ratio is somewhat below what one would expect for its per capita GDP. Though there is significant variation between countries. Moreover, if we examine the tax-to-GDP ratio in India over the past 20 to 30 years, we find that its growth follows a step function rather than a smooth curve. Major reforms occur, and then, after five, six, or even ten years, there is a surge. It's unpredictable. This suggests that we may not need to take immediate action; rather, the measures already implemented may yield results in the coming years. Consequently, though we can predict the eventual rise of the tax-to-GDP ratio, we cannot be sure when that will occur. That therefore is a key motivation why we need to look for other avenues for tax revenues.

Figure 2: Tax to GDP Ratio and Per Capita GDP for 2019: A Global Comparison



Source: UNU-WIDER (2022) & World Bank (n.d.).

Source: Bhandari, Laveesh and Rajat Verma, Compensating for the Fiscal Loss in India's Energy Transition, CSEP Working Paper, 2023

What is the Problem We Need to Solve

While we need greater revenues to compensate for the expected fall in revenue potential from fossil fuels, there are other issues that we need to keep in mind. We need to consider the following aspects:

1. Capacity – what is the likely capacity to generate significant revenues in the future? There are many different taxes that may be feasible but some such as, say, professional tax do not have the inherent capacity to generate the quantum of funds required to replace fossil fuel revenues.
2. Continuity - whether the potential for tax revenue generation is of a long-term nature. Taxes such as carbon taxes may be significant, but they do not work well in the long run, given that at some point as fossil fuel use becomes insignificant, tax revenues from those would necessarily be low.
3. Institutional - whether a significant institutional change would be required, such as a constitutional amendment. This is an important criterion since any new tax that requires an institutional change will take long.
4. Autonomy - whether potential taxation solutions provide adequate flexibility and control to the State governments. While the GST has been a success, it has led to a curtailment of state government autonomy over its own revenues. Therefore, any new revenue source should also be looked at from the autonomy perspective.

5. Impact on growth, equity and employment – what is the impact of any new tax on growth and employment? Some taxes will tend to be less disruptive than others and this needs to be an important criterion.
6. Impacts on emissions – given that sustainability should be an important criterion any new tax proposal should also be looked at from this angle.

Cooperative Fiscal Policy

It is evident that the union and state governments will need to work hand in hand to find cooperative solutions. Unfortunately, we do not see that to the extent required. There are two sets of issues that we need to correct. The first is the lack of effort by state governments to generate own revenues. The second is the risk of the union government to raise taxes through cesses and surcharges.

Whether it is electricity prices or duties, property taxes instituted by ULBs but backed politically by state governments or other revenue-raising mechanisms such as user charges, we find that state governments take limited measures to raise their own revenues. This creates a greater dependence on nationally determined mechanisms including the GST.

Unlike other tax revenues, cesses and surcharges are not shared with state governments. And the increased use of these mechanisms among others has worked against state government revenues. There is an argument that there is a greater tendency for this to occur after the 14th Finance Commission's large reward to the states. I however argue, that there is an inherent tendency to overuse cesses which must be guarded against.

The combined result of these two forces is constrained growth in state government revenues. Given these dynamics, securing state cooperation for a constitutional amendment that limits state government autonomy seems highly unlikely in the next decade. For context, it took nearly two decades to implement GST. Institutional changes of this magnitude are never easy and require significant time—time that we don't have if we seek urgent revenue solutions.

This political economic challenge lies at the core of many issues delaying reform and progress. While state governments need to take greater initiative in generating their own revenues, the union needs to be more forthcoming in sharing.

Conventional tax solutions

The question that arises then is, what kind of revenue options do we have? In two studies on additional tax revenue options to compensate for the energy transition Rajat Verma and I looked at some of the likely candidates.

We first eliminated direct taxes as a likely candidate for greater revenues of the quantum required. This is for many reasons. First, greater taxes at the margin do not necessarily increase revenues as experience from the past has shown and only encourage evasion. And here I must add, the latest income tax break for those typically referred to as middle income, works against the notion of expanding the direct tax revenue base. On corporate taxes as well, given the great need to attract investment, there is little possibility to increase revenues significantly.

There has also been some discussion about increasing the coverage of direct taxes, particularly on agricultural income. It is difficult to see how agriculture incomes can generate adequate revenues. Taxing the rural rich, particularly large landowners, would be a difficult administrative exercise. Families in rural areas are larger, land records show multiple owners, and there are many interconnections between owners and cultivators. Given the complexities of agricultural demographics, I believe that agricultural incomes are an unlikely revenue source of any significance at this point. This of course may change in the future.

Among major indirect taxes, customs tariffs have increased somewhat in recent years and are unlikely to be a significant enough additional source of revenue. Moreover, with the current geo-economic uncertainties, tariffs are unlikely to be a stable source.

This leaves us with GST among the major revenue options. But that brings up the question of whether increasing GST rates is feasible on a large enough scale - how much more can we expect to raise without economic repercussions? Using a SAM-IO (social accounting matrix – input-output analysis) based analysis Rajat Verma and I found that, indeed it was possible to access greater revenues by increasing aggregate GST rates. We also found that there are limited negative impacts on equity and growth but also limited impacts on emissions if we were to simply increase aggregate GST rates and spread them over all outputs. However, compared to VAT on petroleum products, GST provides lower autonomy for the states and therefore this may not be a preferred option for them. Also getting a consensus for a large-scale increase in GST rates may not be a politically feasible solution.

User Taxes

We looked at two types of user taxes, electricity duties that are currently charged by state governments, and a distance travelled tax. Currently, electricity duties are a significant source of revenue for state governments. It is possible to increase electricity duties in principle. Moreover, as power generation transitions away from taxed fossil fuels to subsidized renewable energy, higher electricity duties could act as a good balancing mechanism that would protect the fisc from transition-related volatility. However, given that state governments are typically not in favour of increasing electricity rates, it is unlikely that electricity duties can be increased to cover revenue losses elsewhere.

Another potential avenue is distance travelled taxation. New technologies now enable distance-based taxation, where GPS systems can measure how far a vehicle travels, and taxes are applied accordingly. Under such a system, petrol-based vehicles would incur a higher tax rate, while electric vehicles would pay less. Similarly, smaller vehicles like two-wheelers would be charged a lower rate and larger ones such as luxury SUVs could be charged a higher rate. Already Fastag works on a similar principle and a significant toll is being collected. As in the case of electricity duties, distance-based taxation will also help protect government revenues from transition, since revenue-generating fossil fuel-driven vehicles will steadily be replaced by subsidized EVs.

Electricity duties are solely in the ambit of the state and preserve the autonomy principle. And distance travelled tax will be in the domain of the union under Article 248 since it is as yet not included in any list. Therefore, one can also conceive of a mechanism whereby state governments take up electricity duties and union governments impose a national distance travelled tax. There will be no need to coordinate and no need for any institutional reform. Therefore, this dual combination could also be put in place rapidly.

However, our analysis finds that the combination of increased electricity duties and distance-based taxes would have a high negative impact on economic activity – to the order of almost a per cent of GDP. This is not surprising since user taxes in general have a significant negative impact on economic activity and are often inequitable.

Carbon Taxes

A frequently discussed solution is the imposition of carbon taxes. Carbon taxes are taxes that are levied on the basis of carbon or equivalent GHG emissions. Hence if an economic activity were to emit greater greenhouse gases, it would need to pay greater tax. Note however that carbon taxes are inherently temporary, lasting perhaps 20, 30, or 40 years, after which they will become irrelevant as we transition away from fossil fuels. Therefore, they do not meet our continuity criterion. We therefore ask the next question: If not as a long term, can carbon tax at least serve as a viable short-term solution?

Currently, India taxes both coal and petroleum differently. However, these taxes cannot be labelled as carbon taxes because their taxation criteria are not based on emissions. If a carbon tax was imposed in India and other taxes on fuels removed, it would lead to a dramatic rise in the price of coal and a reduction of that of major petroleum products. This is because there is only a 5 per cent GST on coal whereas petroleum products are taxed much higher by both union and state governments.

Just like distance travelled tax, under Article 248 carbon taxes would be in the ambit of the union. But states already levy their own taxes on fuels, particularly petroleum. Moreover, coal is already under GST. For a comprehensive carbon tax, if we want to avoid double taxation, state governments will need to relinquish their power. Thus, violating the autonomy principal. Moreover, to stop states from taxing petrol and taking coal out of GST

would both require a constitutional amendment, again a difficult exercise if states are not on board. Carbon tax, in its purest form, is therefore extremely unlikely in India.

However, Carbon taxes may be more feasible if we consider carbon taxes as an add on, or as a top up tax. That is, over and above taxes that are already in place. That would of course add a lot of complexity to an already overcomplicated taxation regime. Having said that, an add-on carbon tax is not entirely infeasible, especially if the union government imposed a carbon tax only on select activities – thermal power generation, fossil fuel refining, and major emitting sectors such as steel, cement, fertilizers etc.

To avoid complexity, we can also try to fuse Carbon taxes within the GST regime.

Fusing GST and Carbon Taxes

Carbon taxes are imposed on emissions and are not levied on inputs, outputs, or the technology utilised. The GST, however, is levied on an ad valorem basis. How can we make the two systems work with each other? There are two possibilities that I will illustrate using coal used for thermal power as an illustration.

Consider the case where a charge is levied on the coal user for its emissions, such as in a thermal power plant. Since GST is an ad valorem tax, it is imposed on the output value. Carbon emissions can also be considered as a type of output, albeit we would call it a 'bad' and not a 'good.' This type of carbon tax regime under the GST scheme would, therefore, need to take a form where the tax is imposed on a notional value that is either proportional to the emissions or proportional to the amount of 'bad' being caused by the emissions. That is, the carbon tax revenue, C_t , is the function of a tax rate, k , imposed on the notional value $n(.)$, levied on the CO₂ or GHG emission (e), or $C_t = k \cdot n(e)$. In this scheme, the greater the emission, the greater the notional value and the greater the C_t paid, though the rate k may remain the same. The rate k and the emissions may be chosen based on industry averages or be based on a regular and firm-specific monitoring process. In the latter case, the notional value may differ across firms and over time. Therefore, an authority will have to be assigned the responsibility with built-in accountability for high-quality monitoring and valuation capacities.

Next consider the case where a charge is levied on a coal seller for the potential emissions from its sale. Since coal is predominantly used in thermal power plants and industrial furnaces, we can estimate the average emissions per unit of coal used. The GST rate on coal paid by the coal producer can be made proportional to the per-unit emissions of the class of users. Applying this principle, we estimate that the current GST on coal can be equated with Rs. 1,392 per tonne of coal for it to be equivalent to a carbon tax of USD 25 per tonne of CO₂. In this scheme, some authority would need to regularly monitor users' emissions and impose a GST rate on the seller based on the users' emission parameters. Moreover, in this scheme, the GST would be a tax on a bundled product: the sales value of coal plus the value of the potential harm caused by its buyer.

Each of these mechanisms is possible, and if accepted by the political-economic process can be implemented relatively easily. However, maintaining them would not be an easy task, there would be perpetual pressures on measurement and translating them to rates.

Concluding

As is evident there are no easy solutions, each solution we can think of has some challenge. It is the classic policy problem that India's political economic process will need to solve. But what is the best policy for India going forward? Let me start via a process of elimination.

First, the way I see it, while it would be great to identify a long-term solution, it is more important to find a solution now. Therefore, it is evident that continuity may be less important as a criterion. Second, given the success of direct benefit transfers, equity may also not be an important criterion as long as adequate revenues can be generated from a tax, and a method can be found to compensate the losers. Third, arguably political-economic infeasibility should not be a criterion to eliminate possibilities. India's political economic process may leave a lot to be desired, it may also work slowly, but it has also delivered in many key aspects. It is for us to identify various alternatives and their pros and cons, and inform the political economic process to take forward.

I find that depending upon our priorities there are three workable options for India.

If economic growth and efficiency are the key criterion then the most preferred solution would be a general enhancement of GST to cover all goods and services and complete stoppage of all other indirect taxes. This may lead to some increase in aggregate GST rates initially. The state autonomy problem will however get in the way. Given that this would be by far the most efficient method for enhancing tax revenues to cover the fall of fossil taxes, this should be shared as the first preference for the political process to consider along with non-price measures to encourage energy transition.

If the speed of rollout and circumventing the need for centre-state coordination is the most important criterion, then a combination of electricity duties for the states and distance travelled tax for the union government could be rolled out the fastest. Another alternative is a top-up carbon tax. In both these cases, there is no need for states and unions to coordinate their actions. However, these are clearly not the most efficient of taxes.

If reducing emissions and increasing the pace of transition is the key criteria then clearly a carbon tax is the most desirable. As I had discussed earlier there are many ways by which some form of a carbon tax can be instituted. However, I would argue that any mechanism that can fuse carbon tax with the GST may be the best way forward under this criterion.

There are some issues that at the risk of repetition I would identify as the key enabling factors, or necessary conditions, whichever options India chooses.

One, due to a combination of factors including poor Discom management and regulation, most Discoms have logged massive amounts of debt. Not only does this debt need to be eliminated, but conditions also need to be created such that cost-plus pricing is done in a better manner by state-level electricity regulators and state government-owned Discoms do not pick up such high levels of debt. If we do not address this problem not only would energy transition be impossible to achieve, but India's ambitions of improved fisc would also fail.

Two, the union-state relation has to be one of mutual respect and individual responsibility. This cannot happen if state governments do not take responsibility for their own revenues. But this can also not happen if the union government overuses cesses and surcharges.

Three, whatever path is eventually chosen by the political-economic process, we must strengthen the mechanisms and institutions that will be required to implement these changes. The success of the tax options we choose will be determined by the institutions we create and sustain.

And finally, it is time now for the policy process to embrace environmental objectives, just as it embraced growth and equity in the past. For that to be possible it is our responsibility as economists and policy professionals to identify the right alternatives and inform this process such that all three can be achieved.

I think Dr Chelliah would agree.

Thank you.

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