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The Framework for Assessing Tax Incentives: A Cost-Benefit Analysis Approach

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Contents

I. A Few Fundamentals 3
II. A Conceptual Preparation 7
a. Defining Cost and Benefit 8
b. Assessing Cost and Benefit by Stage 11
c. Exploring Alternative Options 12
d. Conducting Sensitivity Analysis 13
e. The Toolkit for Cost-Benefit Analysis 14
III. A Review of Two Official Studies 15
1. The Massachusetts Study: A Report on the Massachusetts Film Industry Tax Incentives, March 21, 2013 16
2. The Nevada Study: Economic Impact of Tesla on Washoe and Storey Counties, September 11, 2014 20
IV. A Prototype Model for Cost-Benefit Analysis 26
V. Conclusion 31
REFERENCES: 33

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I. A Few Fundamentals

Tax incentives are *preferential* tax treatments that *deviate* from the general tax structure and are provided only to a *selected* group of taxpayers. When a generous tax provision, ranging from a lower tax rate to a higher tax allowance, is universally available to all taxpayers, regardless of their business lines, nationalities, investment and/or employment size, and business locations, it is not a tax incentive but an integral part of the general tax structure.

A classical justification (see below) for using tax incentives is to mitigate a market failure associated with the externality of certain economic activities (e.g., research and development). Aside from this classical justification, tax incentives are often a result of policymakers' ad hoc judgment on their jurisdiction's need. To these policy makers, a selected group of taxpayers are so crucial to national or regional economic growth that they deserve an exclusive tax break.

To judge the merit or demerit of tax incentives, one needs to go back to the fundamentals of taxation: why tax in the first place? The ultimate purpose of taxation is raising revenue to fund government functions and to enhance social welfare. And the ultimate tax base is GDP, or value added by all types of economic activities in the form of investment returns, labour compensation, or consumption drawn from investment and labour incomes. Therefore, providing tax incentives to selected economic activities is an intended erosion of the tax base within a limited timeframe but with the expectation of ultimate growth in GDP; that is, the ultimate expansion of the tax base. To this extent, a tax incentive program is worth pursuing only if it leads to ultimate economic growth and hence the ultimate expansion of the overall tax base.

Furthermore, taxation is a government monopolistic power, which unavoidably distorts market efficiency. With an added task in income redistribution, taxation also grows over time into greater complexity that burdens both tax administration and taxpayers. It is mainly for these reasons that economists have long established three principles for an optimal tax structure. They are:

- Efficiency: to minimize tax distortion to resource allocation by market forces.
- Equity: to ensure taxing according to ability to pay. And
- Simplicity: to minimize both administration and compliance cost.

It is self-evident that, except for dealing with market failure (see below), tax incentives, given their discretionary nature, generally violate these three principles of optimal taxation. It is these violations, as outlined below, that lead to the cost of tax incentives in addition to eroding the general tax base.

- Tax incentives violate the efficiency principle by lowering the tax cost below average, as implied by the general tax provisions, for a selected group of taxpayers. That is, tax incentives allow their targeted group of taxpayers to operate below the average of effective tax-inclusive returns to capital while still reaping the average (or above) tax-exclusive return to capital. As a result, tax incentives further distort resource allocation by encouraging low-efficiency activities to crowd out market-efficient activities; in the long run, tax incentives may even work against economic transformation.[1]
- Tax incentives violate the equity principle by treating taxpayers not by their ability to pay but by their economic significance as judged by the policy makers. Therefore, they naturally induce excessive tax planning and even open the door for tax evasion, particularly during the early stage of establishing a modern tax system.[2]
- Tax incentives violate the simplicity principle by adding discretionary layers, or loopholes, to the general tax system. As a result, they instantly increase administrative and compliance cost and could even debase the entire tax structure in the long run.[3]
- Moreover, providing tax incentives in an ad hoc manner and outside of the normal tax legislation also damages the integrity of the overall tax system. This is the main reason

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1 For example, the almost perpetual manufacturing tax incentives provided by Canadian governments through reduced corporate income tax rates, investment tax credits and fast write-offs have neither helped grow manufacturing investment, nor stopped Canadian manufacturing industry from shrinking over the first decade of the 21st century. See Chen and Mintz, "2012 Annual Global Tax Competitiveness Ranking – A Canadian Good News Story," SPP Research Paper, 5(28), September 2012, Figures 1-2.

2 According to a CCTV (China Central television) news report (http://news.cntv.cn/special/tan/11/0519/), from 1995 to 2000, China's annual tax revenue loss due to tax evasion was over RMB400 billion, ranging from 4 to 7 percent of GDP. Note that the Chinese government offered numerous tax incentives targeting a wide range of categorized investors before and during that period.

3 Based on the CCH standard federal tax reporter, the number of pages of the U.S. tax code almost tripled over the past three decades and almost doubled over the past two decades, from 26,300 pages in 1984 to 40,500 pages in 1995 and 73,954 pages by 2013.

that transparency and predictability are often added as additional principles of a desired tax structure.

It has been broadly acknowledged that, in addition to eroding tax bases, these violations of optimal tax principles are also significant costs of tax incentives.[4] Then, why do tax incentives never die? And why did tax incentives even become trendy from time to time in all parts of the world? The reasoning for such sustainability of tax incentives can be outlined below, in the order of their legitimacy.

First, tax incentives may help compensate investment projects that can produce positive externalities that benefit society but are at the cost of the project investors (e.g., R&D, job training). This is the theoretical justification for tax incentives required to mitigate market failure associated with positive externalities, of which the producer's cost cannot be fully recovered by the market force itself.

Second, tax incentives may be an explicit tool targeting only the new industry and mobile investments that are highly sensitive to tax competition without causing revenue loss from existing capital and immobile activities (assuming revenue leakages induced by tax incentives remain limited). This is a realistic concern for policy makers facing economic globalization and tax competition.[5]

Third, some location-based and firm-specific tax incentives may help generate a form of agglomeration economies, or concentration externalities. In particular, such tax incentives may be justified if it is expected that the targeted firm can offer higher spillovers through its highly skilled workers, or broad scope of industrial activities, or great attractiveness to a wave of following firms, or a combination of all these advantages.[6]

Fourth, politicians often think they are smart to hand-pick winners and losers and hence providing tax incentives only to the winners would benefit society as a whole. They may also

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4 For example, refer to Klemm (2009) and James (2013).

5 Refer to Klemm (2009).

6 Refer to Glaeser (2001), particularly his "Positive Theory #2: Agglomeration Economies," and Garcia-Mila and McGuire (2002).

feel obliged to subsidize a given significant economic player during his/her sector's downturn.[7] Such phenomena can be attributed to common politicians' naivety and/or "good will" because they forget that the success of any tax incentive program lies in a jurisdiction's pre-conditions, i.e., non-tax conditions, for profitability.[8] That is, without a suitable non-tax climate for profitability, a tax incentive itself won't work. On the other hand, tax incentives often appear to be a costless fiscal tool because they do not seem to affect the current budget and hence tie the hands of politicians in power.

And finally, tax incentives can be a pure play of politics and even intentional bad governance. However, because pure politics and bad governance do not allow any professional assessment of tax incentives, we will ignore these types of tax incentives in our discussion.

Whatever the argument might be, tax incentives can be justified only if they bring net benefit to society as a whole. That is, the well-anticipated losses in revenue and economic efficiency and increased cost in administration have to be outweighed by the intended and achievable long-term economic and revenue growth to justify a tax incentive program, both before its introduction (i.e., appraisal) and on an on-going basis (i.e., evaluation). To estimate this net benefit, we need to conduct cost-benefit analysis starting from concrete specification of costs and benefits.

The rest of this paper is structured in four sections: a conceptual preparation for analysing the cost and benefit of tax incentives (Section 2), a comparative critique of two existing state government studies of their respective tax incentive programs in America (Section 3), and a prototype model of cost-benefit analysis for assessing tax incentives without involving sophisticated economic modelling tools (Section 4). The final section concludes this brief paper.

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7 For example, against global steel industry overcapacity (Wall Street Journal, March 15, 2015), Saskatchewan, a Canadian province, in its 2015 budget provided a tax rebate for primary steel producers on a minimum capital investment of $100M in the province (Ernst & Young, Tax Alert – Canada, No. 18, March 18, 2015), which to this author is an obvious waste of public tax revenue.

8 Both Klemm (2009) and James (2013) make a convincing case for this argument. Also, see James (2013) for a general list of such pre-conditions.

II. A Conceptual Preparation

As identified above and in general, the benefit of a tax incentive program (TIP) lies in its ultimate impact on overall economic growth and hence the long-term expansion of the overall tax base; and its cost includes the anticipated revenue loss, efficiency loss and increased administration and compliance costs. In this section, we focus on identifying and deliberating on these benefits and costs so as to facilitate a quantitative assessment for any intended or existing tax incentive programs. For descriptive convenience, we narrowly frame the economic activities targeted by tax incentives as "investment projects" only, since they are also the most popular target of existing and intended tax incentives. But our discussion can be equally applied to any TIP-targeted economic activities (e.g., job creation).

Before specifying the terms of these benefits and costs, we want to limit our analysis of tax incentives to those associated with direct taxes. That is, in our analytical framework, we do not consider tax incentives under the value-added tax (VAT), import duty, excise tax and local sales taxes. Our reasoning for excluding these indirect taxes is the following:[9]

- VAT is a consumption tax by nature: any exemption or zero rating for capital or material inputs are not tax incentives by nature but most likely a remedy for a taxpayer's loss in tax value (and their grievance) caused by an inefficient VAT administration in refunding input-tax credits.
- Local sales tax on capital and material inputs is a direct addition to investment and production cost that causes a cascading impact on final products. It is an impediment on the economy and hence should be reformed for the sake of the economy as a whole. Targeted exemption from local sales taxes, although a tax incentive to local investors, is not an incentive to investors from jurisdictions with a VAT system.

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9 Also refer to A Klemm (2009), p15, "Exemptions from other taxes, particularly those assessed at the border, can be important, but are second-best solutions. Often such exemptions address more fundamental problems in tax policy or administration that should ideally be fixed directly. Exemptions from VAT on imports, for example, are not necessary if, in cases of excess credits, the tax law provides for VAT to be refunded on all goods including capital goods, and provided the tax administration has a record of timely refunds. Similarly, exemptions from excises on inputs should ideally be dealt with in a more general way, so that all firms using such inputs benefit—in many cases the simplest solution would be the abolition of excises on many capital goods. Equally, any other small nuisance taxes should be abolished right away rather than wasting resources on both their collection and on monitoring their exemptions."

- Similarly, import duty and excise tax on capital and material inputs, as a direct addition to investment and production cost, should be exempted for all investment and business operations.

We can now proceed to define the quantifiable terms of cost and benefit and related terminologies that are required for assessing the net benefit of a planned or existing tax incentive program. All the costs and benefits should be monetized as much as possible and ultimately linked to government revenues and expenditures. This is because government tax revenue reflects overall economic activities, which is the aim or the ultimate goal of tax incentives in general; and government expenditure should have a positive economic impact in theory. Any non-quantifiable benefits and costs should be diligently noted as memorandum items in any assessment of a tax incentive program.

a. Defining Cost and Benefit

Both the costs and benefits of any given tax incentive program (TIP) can be wide ranging.[10] In assessing any given tax incentive program in a quantitative manner, it is common to focus on its economic impact—ranging from increased capital investment, jobs and gross domestic product--and its revenue consequence, or revenue impact. Therefore, it is a consensus that, the cost of any given tax incentive program can be defined as the direct revenue loss,[11] efficiency loss and the increased administrative and compliance cost caused by such a tax incentive program; and the benefit can be defined as the increased economic activities attributable to such a tax incentive program and the revenue gains generated by all these increased economic activities.

However, the above general definitions of the cost and benefit of tax incentives are only conceptual. To arrive at the concrete and measurable definition of cost and benefit associated with any given tax incentives, many critical questions need to be answered. Below is our list of such critical questions, which by no means is an exhaustive one. Some of these questions may

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10 For example, Klemm (2009) states that the cost of tax incentives is "wide ranging" from any immediate revenue loss to economic distortion, administration costs (including preventing fraudulent use of incentive schemes), and social costs of rent-seeking behaviour including possibly an increase in corruption.

11 As we shall see later, this direct revenue loss can arise from the efficiency loss of tax incentives, which can be categorized as the displacement effect and "crowding out" effect of tax incentives.

appear to overlap with each other. Nevertheless, they deserve to be asked individually to ensure analytical diligence.

First, ***additionality***:[12] Is the increased number of investment projects within the TIP target a true addition to the existing capital stock, which would not be possible in the absence of the TIP?

It is clear that only a true addition to the existing capital stock that is solely attributable to the TIP can be counted as the ITP's net direct economic impact. And only such a true additional investment project can produce a possible net revenue gain to the government.

Several terminologies and measurements are involved here:

- Redundancy ratio:[13] the amount of investment that is within the TIP target *but* would be in place even without the TIP, as a share of the total investment within the target of TIP. The higher this redundancy ratio, the more wasteful is the TIP. That is, a higher redundancy ratio indicates a smaller additionality associated with the given TIP and hence a smaller benefit and greater revenue loss of a TIP; and vice versa.
- Displacement share: A "net addition" of investment within the TIP target (e.g., the targeted geographic area, or business line, or capital size, or investor's nationality, etc.) may include a relocation (i.e., displacement) of existing capital from outside of the TIP target; such a net addition within the TIP target represents a "washout" within the overall economy and a sure loss in both economic efficiency and government revenue. This displacement effect should be measured as a share of the additional investment truly attributable to TIP. A high displacement share indicates a great efficiency and revenue loss; and vice versa.
- Crowding out effect: Even if the number of investment projects within the TIP target is a net addition with zero displacement share, they may have crowded out potential investment projects being intended outside of the TIP target in the absence of the TIP. In this case, a potential expansion of the economically more efficient investment activities is

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12 Refer to HM Treasury, The Green Book: Appraisal and Evaluation in Central Government (2011), Annex 1.

13 Refer to James (2013), page 16 and Appendix 1.

crowded out and its "normal" tax base is eroded by the actual expansion of less efficient economic activities within the TIP target, which results in a narrower tax base. Admittedly, this effect is harder to identify, not to mention quantify. Nevertheless, it's an effect that should always keep us vigilant.

Second, ***opportunity cost***: What is the opportunity cost of the anticipated revenue loss associated with the intended tax incentive program?

Estimating the opportunity cost of the anticipated or estimated revenue loss can help prevent rushed decisions in providing, or preserving, any tax incentives. Within a budget constraint, anticipated revenue loss may be saved for a more effective fiscal measure such as direct spending to improve infrastructure required for the targeted investment, or a loan guarantee that can be more cost effective. That is, a thorough assessment of the cost of any tax incentive should include estimating its opportunity cost by exploring alternative measures that may achieve the same goal at a lower cost (also see the next subsection).[14]

Third, ***additional cost***: What is the additional cost to the government other than the anticipated revenue loss associated with the given tax incentive program?

For example, will the additional investment activities within the TIP target require additional government spending on infrastructure (e.g., transportation) and other public services (e.g., public utilities and schools) to accommodate both the investment project and increased population associated with such a project?

Fourth, ***the multiplier effect (and the negative one)***: If all the above concepts are concerned with the direct or "first-round" benefit and cost, what are their "second-round" or multiplier effects? In particular, if there is revenue loss (and increased administration and compliance cost) that offset government (and private) spending, what is the negative multiplier impact of such costs of tax incentives?

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14 For example, according to Brown and Earle (2013), the per-job-based cost of a loan guarantee provided by the U.S. Small Business Administration is only $14,000; this is much more cost-effective compared to a general fiscal stimulus (which costs $158,000 to $407,000 per job created), or an employment tax credit ($37,000 to $75,000).

In general, a multiplier is "the ratio of the change in income to the initial change in expenditure that brought it about." [15] But, conceptually, there are two types of multipliers involved here. First, by classic definition, the size of multiplier is determined by the marginal propensity to consume: the higher the marginal propensity to consume (and hence the lower the income withdrawn from economic activities), the greater the multiplier. And second, in its more broad definition and application, the multiplier is derived from the input-output accounts that provide inter-industry linkages within the concerned jurisdiction, which can be a country or a region. Both these two concepts of a multiplier are relevant to our cost-benefit analysis, although obtaining the latter one (i.e., the one derived from the input-output accounts) is the most challenging.

It is widely promoted that the increased investment activities stimulated by a tax incentive program can have positive spillover and multiplier impacts. It is, however, uncommon to see policy makers acknowledge the negative multiplier impact of the revenue loss from tax incentives. Under a common budget constraint, the revenue loss from a given tax incentive program must be offset by a spending reduction or tax increase outside of such a tax incentive program; such a spending reduction or tax increase can have a negative multiplier impact on the economy. Without estimating such a negative multiplier impact of a TIP cost, any cost-benefit analysis cannot be said to be complete.

The above list of critical questions can grow longer. Nevertheless, within this limited deliberation, two extremes of quantifiable costs and benefits emerge: nil cost if both redundancy and displacement ratios are zero, or nil benefit if either the redundancy ratio or displacement ratio is 100 per cent. The reality is often in-between with both redundancy and displacement ratios between zero and one; our task is a careful assessment of *net* benefit, which can be positive or negative.

b. Assessing Cost and Benefit by Stage

Standard cost and benefit analysis of a given tax incentive program covers both economic impact and revenue impact. By economic impact, we mean economic activities ranging from capital investment and business operations that generate additional jobs and gross domestic product

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[15] See The MIT Dictionary of Modern Economics.

(GDP); by revenue impact, we mean both the revenue loss directly caused by the tax incentive program and possible revenue gains from additional GDP, including both investment and labour income, generated from the tax incentive program. More specifically, such economic and revenue impact of tax incentives can be estimated through the following three stages:

- **Direct impact** – net economic activities directly stimulated by TIP and their revenue consequence. By "net," we exclude the "redundant" economic activities that are within the target of TIP but would occur in the absence of TIP.
- **Indirect impact** - economic activities triggered by the "direct impact" (see above) through inter-industry linkages (or supply chains), and tax revenues generated from these economic activities.
- **Induced impact** – the multiplier effect of the spending of the income generated by economic activities through both direct and indirect impacts of TIP (see above) and its revenue consequence.

When there is no adequate data for counting the indirect and induced economic impacts, analysts often use the published or justifiable estimate of multipliers to catch these two impacts. Although the concept of a multiplier is straightforward, rarely is it applied to estimating the total economic impact of the direct cost of tax incentives. That is, many tax analysts including myself are used to estimating the positive multiplier impact of tax incentives but we often forget the *negative* multiplier effect of the direct cost of tax incentives (as discussed above).

c. Exploring Alternative Options

For any intended tax incentive program, there are always possible alternatives that should be included in the preliminary assessment stage to be appraised simultaneously to verify whether the intended TIP is truly the most worthy. These alternatives can be divided into two groups: one consists of alternatives to providing tax incentives, and the other alternative packages of tax incentives.

Examples of non-tax alternatives to tax incentives may include the following: direct government spending to foster agglomeration economies (e.g., laying down an infrastructure foundation for diversified industrial parks), loan guarantees for the potential infancy sectors (e.g., for high-tech start-ups), funding training programs for skills required by the new investment projects, etc.

The alternative tax incentive programs should also be explored to obtain a reliable appraisal of the intended tax incentive program. For example, if the objective of an intended TIP is to create jobs through encouraging investment and the initial design includes a per-job-based tax credit, then alternative tax incentives may range from a tax allowance for training cost, or partial exemption from payroll taxes.

Both types of alternatives share the same critical concern: what is the opportunity cost of the estimated revenue loss from the intended tax incentive program? If any possible alternative can achieve more than the intended tax incentive program at the same or lower cost, then that alternative should replace the intended TIP to reduce the cost to the government.

d. Conducting Sensitivity Analysis

We have emphasized that assessing the cost and benefit of any intended tax incentive program should be aimed at its overall and long term economic and revenue impact; and all the impacts should be quantified in monetary terms as much as possible. Such an assessment for appraisal purposes always requires some basic assumptions. For example, if a TIP is to encourage a certain amount of increased investment projects that would ultimately increase the growth rate of GDP and hence tax revenue by a half percentage point, then, naturally, a required assumption is the "normal" GDP growth rate that is compatible with the "do-nothing" scenario without the intended TIP. If the "normal" GDP growth rate is assumed to be 2 per cent, then a half-percentage-point increase targeted by the intended TIP should lead to an annual GDP growth rate of 2.5 per cent.

The assumption for this "normal" GDP growth rate is often based on the average of the GDP growth rate over the past five to ten years, or as long as recent statistics are available. But what if an un-forecasted external shock, either positive (e.g., the global investment boom before year 2000) or negative (e.g., the 2008 global financial crisis), occurs? That's where the sensitivity analysis is required to ensure our estimate of the intended TIP impact is accountable.

That is, sensitivity analysis involves varying economic scenarios across which the input parameters are being varied accordingly. Such input parameters may include the real interest rate, normal GDP growth rate, the national or regional multiplier, which is in turn determined by

the corresponding marginal propensity to consume and the inter-industry linkages, the split of capital and material inputs between imported and locally produced, and the split of output between exporting and local absorption.

e. The Toolkit for Cost-Benefit Analysis

Based on our deliberations in defining the cost and benefit of tax incentives, there are theoretically two extreme models. One extreme is a primitive model that counts only the direct cost (e.g., the direct revenue loss) and benefit (e.g., the net investment increment) of a given tax incentive program. This extremely primitive model can be derived solely with ***conventional accounting***, or use of the so-called "head count" approach.

And the other extreme is an ultra comprehensive model that is the ***computable general equilibrium (CGE) model***[16] built upon the national (and/or regional) ***input-output accounts***[17] with both overall and sectoral *economic multipliers* being readily available for simulating the impact of various specified tax and non-tax parameters and behavioural reactions. Such a comprehensive model is supposed to be able to capture all three-stage (i.e., direct, indirect and induced) economic and revenue impacts of any given tax incentive program by simply plugging in the input data. However, as we shall see in the next section, even a comprehensive model may produce a questionable assessment when the input data were not carefully thought through or well covered.

While the primitive and purely "head count" approach is unacceptable to any serious analysts, the well-established input-output accounts and computable general equilibrium model are often beyond the reach of many of us due to the usual budget and resource (e.g., human capital and/or statistics) constraints. Therefore, within such constraints, we always need to search for a practically accessible analytical model that allows us to approach, as much as possible, a reliable cost-benefit assessment of any intended tax incentive program. Fortunately, with integrated revenue administration and computerized data management that are making progress

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16 For a brief and practical explanation of CGE model and its use for impact analysis, refer to the World Bank website with the entry "Computable General Equilibrium (CGE) Models."

17 For an informative discussion of the concepts and use of the input-output accounts, see Horowitz and Planting (2009).

in most countries,[18] it is possible to build micro-simulation models that are solely based on companies' financial statements and tax returns submitted to the tax authority. Such a firm-based micro-simulation model can work wonders in the absence of sophisticated input-output accounts and a computable general equilibrium model. We shall provide such a prototype micro-simulation model in Section IV, after reviewing two existing government studies of tax incentives in the next section.

III. A Review of Two Official Studies

Many existing studies are devoted to identifying and quantifying the effectiveness of tax incentive programs.[19] But most of them are not intended to be full-fledged cost-benefit analyses. For our purposes, I choose to review only two official studies for a detailed comparison of their analytical thoroughness. One study is the Massachusetts Government's latest annual report, issued by its Commissioner of Revenue, on its state film industry tax incentives (hereafter the Massachusetts Study). And the other is the assessment report issued by the Nevada Governor's Office of Economic Development (GOED) on the economic impact of its tax incentive package offered to Tesla's Gigafactory, a gigantic battery-producing factory for Tesla's electrical cars (hereafter the Nevada Study). The Massachusetts film industry tax incentives appear to fall into the category of cross-jurisdiction tax competition for a selected industry (e.g. film production), and the Nevada tax incentives for Tesla seem to be a firm-specific program hoping to produce some agglomeration effect (see below).

Both of these two studies fit the standard framework of a cost-benefit analysis. That is, they measure the cost and benefit of their respective tax incentive programs along the lines of economic impact and revenue impact and in three stages: direct impact, indirect impact and induced impact (refer to Section II.b. above). And both of these two studies used the most

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[18] Chen (2010).

[19] For example, see Brown and Earle (2013), Chirinko and Wilson (2008), James (2013), Kalko and Neumark (2009), Klemm (2009), and Klemm and Van Parys (2009).

sophisticated modeling tools (i.e., the input-output accounts and computable general equilibrium models).[20] Therefore, they are readily comparable.

My review of these two studies is not intended to validate their conclusions. Instead, I will focus on exploring analytical ideas, or deficiencies, embedded in these studies, which we can borrow, or avoid, while building our prototype cost-benefit analytical model (see the next section). In the meantime, I am not hiding my preference between these two studies, as I will review the Massachusetts Study first as an almost model study.

1. The Massachusetts Study: A Report on the Massachusetts Film Industry Tax Incentives, March 21, 2013[21]

The Massachusetts film industry tax incentives, as amended in July 2007, are composed of a tax credit equal to 25 percent of a film's production cost, 25 percent of a film's payroll costs and an exemption from sales tax for film productions. The tax credits can be used to reduce the production company's tax liability, and to the extent that the tax credits exceed that tax liability, production companies may receive cash refunds from the Department of Revenue equal to 90 percent of the amount of the tax credit remaining. The tax credits may also be transferred or sold by production companies to third parties, which can use the tax credits to reduce their Massachusetts corporate, insurance, financial institutions, or personal income tax liabilities. In some cases, sales to third parties are direct sales from the production company to such third parties. In other cases the credits may be sold to tax credit brokers, who in turn may resell the credits to Massachusetts taxpayers who use the credits to reduce their state tax payments.[22] In summary, by ignoring the sales tax exemption, the Massachusetts film industry tax incentives

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20 For example, both studies employed the REMI (Regional Economic Models Incorporated) model that is popular in America. According to its website (http://www.remi.com/the-remi-model), the REMI model "incorporates aspects of four major modeling approaches: Input-Output, General Equilibrium, Econometric, and Economic Geography. Each of these methodologies has distinct advantages as well as limitations when used alone. The REMI integrated modeling approach builds on the strengths of each of these approaches."

21 Pitter, Amy (2013), available at http://www.mass.gov/dor/docs/dor/news/reportcalendaryear2011.pdf

22 As an example of good governance and tax transparency, Massachusetts publishes its annual **Tax Credit Transparency Report,** as required by state legislation and starting from calendar year 2011, with respect to such credits awarded or issued for the previous calendar year. The report publishes details for each tax credit program including the administering agency, period covered, identity of the taxpayer receiving an authorized tax credit, amount of authorized tax credit and the date for such credit issued and received.

(MFITI) are a tax credit equivalent to 25 percent of the total film production cost including the payrolls, and this tax credit is refundable and transferable and can be used to offset any direct tax liabilities to the state. We therefore use the term (Massachusetts') "film tax credit" interchangeably with the MFITI.

The report reviewed here is the fifth annual report on the Massachusetts film industry tax incentives (MFITI) issued by the State Department of Revenue (DOR). One of the primary purposes of this report is to estimate the impact of the film tax incentives on the state economy. The study employs a Massachusetts' version of the REMI model[23], which incorporates aspects of four major modeling approaches, including Input-Output accounts and a General Equilibrium model, to estimate the *net* economic and fiscal impacts of the film tax incentive program. The following statistical information is used for the study:

(1) The total amount of tax credits generated, claimed, and paid by calendar and fiscal year;
(2) The types of productions claiming the tax credits;
(3) An estimate of the film production activity that would have occurred in Massachusetts even in the absence of the tax incentives;
(4) The dollar amount of wage and non-wage spending for film productions that claimed the tax incentives;
(5) The dollar amount of wages and salaries that were paid to Massachusetts residents and non-residents;
(6) The dollar amount of non-wage spending that was paid to Massachusetts-based and out-of-state businesses;
(7) The number of new jobs generated by film productions that claimed the tax incentives, for both residents and non-residents; and
(8) The net increase in the amount of spending that occurred in Massachusetts as a result of the film tax credits.

In this list, item (3) is the most noteworthy. It is an estimate of the film production activity that would have occurred in the state even without the film tax credit but would

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23 See footnote 16.

nevertheless have been eligible for the film tax credit.[24] By taking this estimate seriously, the state administration clearly understands that the film tax credits issued to such film production activities are not generating net benefits but are a waste of public funds. As such, this part of the film tax credits issued is excluded from the government estimate of direct "local spending" due to its film tax credits that can generate additional economic impact.

Similarly, items (5) – (6) are painstakingly segregating the direct spending triggered by the film tax credit between the state resident and non-resident groups. With this segregation, only the direct spending that went to the employees and vendors as Massachusetts residents is counted as the direct impact of the film tax credit.

The most intriguing point in the study, however, is its estimate of negative economic impact and negative "multiplier" impact. A conventional cost-benefit analysis may estimate the tax expenditure associated with the tax incentives as the cost and then stop there. The Massachusetts Government went further with the cost-benefit assessment of its film tax credit. Since the film tax credit is refundable and transferrable and the state's balanced budget requirement also obliges the government to make spending cuts corresponding to the film tax credits issued, the state administration equates the film tax credits issued to the "state spending cuts or tax/fee increases" required to maintain a balanced budget.[25] By making this point clearly and openly, this study links the film tax credit instantly and directly to a budget cut or new tax measure that has economic consequences. As such, estimating the "negative multiplier impact" became an integral part of Massachusetts' cost-benefit analysis of its film tax credit.

As a result of all the above due-diligence, the Massachusetts Government estimated that, over the course of 2006-2011, the annual *direct* impact of its film tax credits ranged from only 22 to 38 per cent of the film production total spending (see Table 4 in the study). In other words, only 22 to 38 per cent of the annual film production spending in the state were *both* truly relevant to its film tax credit *and* benefited the Massachusetts film producers and residents. More specifically, these rather low annual *direct* economic impacts of film tax credit are arrived at by

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24 Refer to the report, pages 6-7, for the detailed methodology and assumptions used to arrive at this estimate.

25 Refer to the report, pages 8-9 for detailed analysis and reasoning on this issue.

subtracting the following items from "film production total spending" in the state: (a) spending in the absence of tax incentives (i.e., "redundant" film spending), (b) wages paid to non-residents (i.e., not benefiting residents), (c) non-wage spending on non-MA vendors (i.e., having no indirect impact on the state economy), and (d) reduced MA spending to balance the budget (i.e., offsetting the impact of film production spending).

With a clear step-by-step explanation, the report is relatively easy for voters to understand its numbers, analysis and conclusion. Taking its reporting for year 2011 as an example, the dollar amount of tax credits generated by film production is $44 million (Table 3) corresponding to total film production spending of $176 million (Table 4), which reflects the exact 25-percent tax credit as an incentive. The net spending that is accounted for as a "direct impact" is $38.7 million after the aforementioned four subtractions (Table 4). By running the REMI model, the estimated total impact, including direct, indirect and induced impacts of the film tax credit, is an increase in the state GDP by only $118 million, of which a large proportion was spending paid to non-MA employees and businesses, and an increase in state personal income (PI) by only $26.7 million (Table 5), which is substantially lower than the total film tax credits issued ($44 million).

Finally, it is noteworthy that the Massachusetts study reveals the net impact of its film tax credit program on government finances. Again taking year 2011 as example, the total of the film tax credit issued is $44 million, and the total tax revenue generated from the total economic impact of the film tax incentive program is $6.9 million. As a result, for every dollar of tax expenditure associated with the film tax incentives, the government generated only 16 cents in tax revenue. From this perspective, I would say that the Massachusetts film industry tax incentive program is not a worthy one to keep. But for the Massachusetts' government and residents, the film tax credit might help enhance their pride for the films produced in the state, a benefit that is not quantifiable but seemingly worth pursuing to them.

In summary, I would give this official annual assessment of the Massachusetts film industry tax incentives an A-plus grade for four reasons: (1) its thorough report and deliberation of the direct impact (including both cost and benefit) of the film tax credits issued, (2) its coverage of efficiency loss (through its careful estimate of "redundant" film production), (3) its estimate of the negative multiplier impact of revenue loss caused by the film tax credit, (4) its

exclusion of the costs and benefits "leaked out" of the state, and (5) its revelation of the negative government revenue impact. With these merits, the omission of the increased administration and compliance cost is forgivable; in particular, this cost can be judged as rather negligible since the program itself is rather simple and straightforward and can be claimed through filing a tax return.

2. The Nevada Study: Economic Impact of Tesla on Washoe and Storey Counties, September 11, 2014[26]

In September 2014, the Nevada state government signed a tax incentive package for Tesla, the California-based electrical carmaker, to build its gigantic battery-producing factory (hereafter Gigafactory) in Nevada. In this tax incentive package, the State government offered $1.25 billion of tax-abatements, tax exemptions and tax credits in return for Tesla's promise of a $3.5 billion direct investment and 6,500 direct jobs.

The government assessment report appears professional as it employed three popular economic modeling tools in America--IMPLAN[27], REMI (see above) and EMSI[28]—to provide three sets of impact estimates for reaching a seemingly sound conclusion. However, compared with the Massachusetts' assessment of its film tax credit program, as reviewed above, the Nevada Report seemed to be hyper on the benefit side and mute on the cost side. It also seems to lack details while taking Tesla's gigafactory plan as net addition to the state economy, which reflects the government's casual attitude towards its assessment.

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26 Nevada Governor's Office of Economic Development (2014).

27 IMPLAN (stands for "**IM**pact analysis for **PLAN**ning"). It is data and analytical software that combines classic input-output analysis with regional specific Social Accounting Matrices and Multiplier Models. According to Wikipedia, it "provides a highly accurate and adaptable model for its users. The IMPLAN database contains county, state, zip code, and federal economic statistics which are specialized by region, not estimated from national averages and can be used to measure the effect on a regional or local economy of a given change or event in the economy's activity."

28 EMSI stands for Economic Modeling Specialists International. The modeling tool, "using sound economic principles and good data" "turns labor market data into useful information that helps organizations understand the connection between economies, people, and work."

The Tesla plan for its Gigafactory:[29]

(1) Facility construction with a total cost of $1.0 billion over the first three years.
(2) Equipment investment totaling $10 billion with an initial $3.95 billion over the first four years and replacement equipment purchases of $5.0 billion in subsequent years through 2028.
(3) New manufacturing jobs up to 6,500 at a full operational level by 2018.
(4) Significant power consumption that could generate substantial utility fees to the host county.

Nevada offered the following tax incentives for Tesla's Gigafactory:

(1) A 100-percent real and personal property tax abatement through June 2024.
(2) A 100-percent exemption of both state and local sales taxes on equipment purchases and construction materials for 20 years.
(3) A 100-percent abatement for the modified business tax (MBT), a gross-payroll-based tax.
(4) A per-job based $12,500 transferable tax credit for the first 6,000 new jobs created, totaling $75 million. And
(5) A transferable tax credit totaling $120 million combining 5-percent of the first $1 billion investment and 2.8-percent of the next $2.5 billion investment.

This package of tax abatements, reimbursements and credits for Tesla's Gigafactory is estimated to be between $1.1 billion and $1.3 billion in total. It is apparently a location-based-firm-specific tax incentive program aimed at its agglomeration impact.[30]

Unlike the Massachusetts Study, which is an annual evaluation of an ongoing tax incentive program, the Nevada study is an appraisal of the intended tax incentive package for its total economic and revenue impact over a 20-year horizon. And its input data consists of mainly Tesla's investment plan (e.g., when to invest at what size and when to hire however many employees) and the government tax incentives. By entering these two datasets into the readily

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29 Nevada Governor's Office of Economic Development (2014).

30 According to GOED (2014), page 3, the Tesla investment in its Gigafactory "would also support improvements in transportation and utility infrastructure that would greatly enhance the region's competitiveness for future manufacturing and logistics projects."

available analytical tools, the government was happy to show a range of both economic and revenue impacts to make a persuasive case.

The main findings of Nevada Study are the following:

(1) Economic impact:

- Direct impact (as included in the Tesla plan): 6,500 jobs with annual incomes of $370 million
- Indirect and induced impact (estimated by the government through its use of modeling tools): 6,400 - 16,200 jobs with annual incomes of $334 million - $953 million
- Total impact: 12,900 - 22,700 jobs with annual incomes of over $700 million - $1.3 billion.

Revenue impact (note that Nevada does not have an income tax):

- Direct impact (i.e., based on the Tesla plan and net of government incentives): $460 million over 20 years
- Indirect and induced impact (based on indirect taxes payable through estimated additional jobs and population): $776 million - $1,487 million.

Note that within the range of the indirect and induced impact, the lower number is associated with the regional multiplier and the higher one with the national multiplier; and both multipliers are generated through the modeling tools used by the government. The regional multiplier is lower because it excludes the indirect and induced impact on the nationwide economy that is outside of Nevada. (See below for further analysis.)

As a fiscal economist who is not familiar with either Tesla or Nevada, I would raise the following questions simply out of the critical thinking required for a balanced cost-benefit analysis.

First, how critical is Nevada's tax incentive package to luring Tesla to land its gigafactory in Nevada? More specifically, would Tesla choose Nevada without getting a tax incentive package of this size? If the answer to this second version of our question is YES, then the redundancy ratio is greater than zero, indicating a sizable loss of potential revenue. I am not searching for a definite answer here but find the following information is worth noting:

Tesla was originally seeking only $500 million in government support and had broken the ground for its gigafactory in Nevada two months before this billion-dollar-tax-incentive deal was sealed. According to Mark Rogowsky at Forbes (2014/09/04), among the five potential competitor states[31], Nevada was actually Tesla's best bet for its Gigafactory even without the tax incentives. That is, Nevada has no competitors in the country as the most desirable location for Tesla's Gigafactory because of its unique possession of all the following attributes: (a) geographic proximity to Tesla, (b) active lithium resources, (c) rich solar energy resources desired by Tesla, (d) "right politics" as a "right to work" state[32], (e) "right people" (i.e., human capital needed for Tesla's construction), and (f) on-site high-tech facilities (i.e., Apple and Amazon manufacturing facilities) that provide Tesla with locational security as a "follower." The other four states at most have three of these six non-tax advantages, and none of them has the "active lithium resources" required for Tesla's Gigafactory's production of batteries. Moreover, according to the Tax Foundation, Nevada is ranked as the third most competitive in business tax climate among the 50 states, and number one among its four potential rivals.

It is therefore only natural to suspect that the government paid an excessive premium on the Tesla deal. But verifying this suspicion is beyond our focus here.

Second, is it true that there would be no additional cost to Nevada's government even if its underlying assumption of a "zero redundancy ratio" were true? In other words, the study sees Tesla's investment as a net gain to the government coffers with no additional cost outside of its tax incentive package. But this "zero-cost" conclusion cannot be true.

For example, since the population expansion on the Tesla site is estimated to be 49,000 (or a 50 percent addition to the existing local population), a substantial increase in public

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31 Besides Nevada, the other four states (and their ranking in business tax climate) are: California (#48),Arizona (#23), New Mexico (#38) and Texas (#10). (Who provides the business tax climate rank?)

32 According to Wikipedia, a "right-to-work" law is a statute in the United States that prohibits union security agreements, or agreements between labor unions and employers, that govern the extent to which an established union can require employees' membership, payment of union dues, or fees as a condition of employment, either before or after hiring. Right-to-work laws do not aim to provide a general guarantee of employment to people seeking work, but rather are a government regulation of the contractual agreements between employers and labor unions that prevents the former from excluding non-union workers, or requiring employees to pay a fee to unions that have negotiated the labor contract all the employees work under.

spending would be required to accommodate this substantial population expansion (e.g., transportation, water, sewage and school expenses). Unfortunately, the study did not make note of this spending requirement at all.

Neither did it look at the opportunity cost of the foregone tax revenue. For example, what if a small portion of this package, particularly the transferrable tax credit (see below) is saved for making up the shortfall in the state's educational system (which may face an even greater shortfall due to the aforementioned population expansion), or government direct spending on the state's infrastructure,[33] or simply reducing its ever growing budget deficit[34]? It is also noteworthy that the governor and the lawmakers of the state are struggling hard on whether to introduce a new tax.[35]

Third, the Nevada Study provides two scenarios of economic and revenue impact by applying the regional multiplier and national multiplier respectively to the Tesla plan (see above for its findings). The scenario associated with the regional multiplier represents a lower economic and revenue impact because the regional multiplier is lower, reflecting the fact a substantial portion of the supply chain for Tesla's battery-producing factory in Nevada is located outside of Nevada. The scenario associated with the national multiplier represent a higher economic and revenue impact because the national multiplier is higher and covers nationwide economic activities related to Tesla's battery producing factory in Nevada. Instead of making a sound judgment about the most possible scenario that lies between these two scenarios, the government assumed the higher-impact scenario associated with the national multiplier is the most likely because "the local economy adjusts over time to the presence of this new industry."[36] This assumption ignores the fact that a modern manufacturing supply chain no longer requires traditional locational concentration. The fact that Tesla is building its battery-producing facility

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33 According to Wikipedia, "Nevada is one of a few states in the U.S. that does not have a continuous interstate highway linking its two major population centers. Even the non-interstate federal highways aren't contiguous between the Las Vegas and Reno areas."

34 According to Ballotpedia, Nevada's state debt per capita was $19,152 in 2014, ranking 13th highest in the nation. http://ballotpedia.org/Nevada_state_budget_and_finances#State_debt

35 Refer to "Nevada state budget and finances" (http://ballotpedia.org/Nevada_state_budget_and_finances) for details.

36 Nevada Governor's Office of Economic Development (2014), page 15.

in Nevada rather than in its home state (California) is a typical example of the geographic spread of a modern supply chain.

Fourth, within the government offer, the most questionable element is the Transferrable Tax Credits of $12,500 per job for the first 6000 jobs, which amounted to $75 million in total. The question here is twofold: (1) Given that government has offered an incentive for capital investment, and the labour input is technically determined by the industry characteristics, is it necessary to offer a further tax credit for job creation? (2) Even if only half of these 6,000 jobs are by nature a within-state job displacement, there would be an outright waste of $37.5 million of government expenditure on jobs that do not help generate additional jobs and payroll taxes. For those jobs filled by out of state residents, the tax credit represents a reward for a cross-state job transfer to Nevada; this would certainly be a net loss to Nevada for its wasted tax credits in addition to being a lower job-creation effect.

Fifth, the rest of the *transferable* tax credit, totaled to $120 million, includes a 5 percent credit on the first $1.0 billion in capital investment, and a 2.8 percent credit on the next $2.5 billion in capital investment. These credits would extend through 2020 and would be offset by current tax programs. Without the government spelling out the content of these "current tax programs," such a transferable tax credit appears to be a pure giveaway of public funds. In a closer look at the study, this tax credit appears to be provided solely to satisfy Tesla's demand for paying no tax whatsoever by 2020.

Sixth, the estimate of indirect revenue (including both property tax and sales tax) gains "generated by direct and indirect employees" and their families appears to assume all the employees of Tesla are a net addition to Nevada. Here again, the study assumed there would be no displacement or relocation within Nevada and hence no revenue loss in other parts of the state to partially offset the revenue gains estimated in the study.

And finally, the Nevada Study appears prone to double counting the benefit. For example, by combining our fourth and sixth points above, either the per-job-based transferable tax credit (Point 4) is a pure waste of government money, or the estimate of indirect revenue gains is untrue. That is, if Nevada counted all the increased population associated with Tesla Gigafactory, including both the employees and their families, as a net addition to the pool of taxpayers for property tax and sales tax (Point 6), that would imply all the jobs created by the

Tesla Gigafactory are filled by out of state residents. By this assumption, all the per-job-based transferable tax credit (Point 4) would be helping out-of-state jobseekers and hence be a pure waste of Nevada's taxpayers' money. On the opposite side, if all the Tesla jobs would be filled by Nevada residents and hence help reduce the state's unemployment rate, then the estimate of indirect revenue gains (Point 6) would be an overestimate. Of course, the reality would be mostly between these two extreme scenarios, but any realistic combination between these two extremes will include a partial waste of the transferable tax credit on aiding out-of-state jobseekers and lower revenue gains resulting from within-state relocation of Nevada residents.

In comparison with the Massachusetts' study reviewed above, the Nevada study did not pass my test. It appears to be a zero-cost-all-benefit analysis that reveals the government's eagerness in pleasing an investor whose location decision had been pre-made. It is legitimate for any business investors to minimize their cost by bargaining hard with the government. But the same business attitude should be adopted by the government to serve the interest of all of its taxpayers rather than a selected one. A fiscally irresponsible government can induce irresponsible behavior from taxpayers if they see the hardest bargainer as being the winner.

Technically, the lesson from the Nevada Study is that the intention for a full accounting of cost and benefit is often more critical than the availability of analytical tools. In other words, use of analytical tools, regardless of their professional appearance, can always be dictated by the intentions of policymakers. When the intention is to accommodate the interest group's demands, which is Tesla in this Nevada case, the cost factors are often ignored from the start, either intentionally or unintentionally.

IV. A Prototype Model for Cost-Benefit Analysis

As reviewed above, an ideal model for assessing the cost and benefit of any tax incentive program, or more broadly any government fiscal program, is a computable general equilibrium model built upon the detailed input-output accounts. While the input-output accounts allow analysts to derive the inter-industry linkages as formularized estimates of multiplier effects for a given jurisdiction or industry, the computable general equilibrium model is assumed to catch all behavioural reactions to the initial changes resulting directly and indirectly from the concerned tax incentive program. Since many countries do not have the input-output accounts, not to

mention a computable general equilibrium model, the lack of data and analytical tools is often seen as the foremost technical hurdle to a proper assessment of the tax incentive program.

However, also as reviewed above, the availability of data and analytical tools do not automatically guarantee a sound cost-benefit assessment of intended tax incentive programs. More often than not, data and analytical tools are serving the will and intention of policy makers. Therefore, professional integrity and critical thinking can play the role of crosschecking to ensure a reliable cost-benefit analysis. Furthermore, despite the crucial role of accurate multipliers in estimating the second-round impact combining both indirect and induced impacts, identifying and quantifying the first-round cost and benefit to all stakeholders, ranging from the government, business sector and society as a whole, are the most critical. The good news is: obtaining such first-round sets of data can be done with a straight "head-count" approach; that is bookkeeping.

In fact, even if both I-O accounts and a CGE model are available, firm-based accounting and tax data are still required to build a micro-simulation model for estimating revenue impact. And this is where bookkeeping also becomes critical. Although the two official studies reviewed above did not mention the term "micro-simulation model" explicitly, the Massachusetts Study is actually based on accounting information for film-production firms in the state. The Nevada Study involved Tesla only hence it is a "micro-simulation" by nature.

Keeping this realistic view in mind, I am presenting below a prototype model for assessing the cost and benefit of any given tax incentive program in the absence of input-output accounts and any complicated economic models. The only data requirement here are a combination of firm-based financial and tax data, which are assumed accessible by the revenue authority, and fine national accounts, from which we can draw the national multiplier based on the propensity to consume. Again for descriptive convenience, I assume the tax incentive program targets capital investment and involves only direct taxes such as company income tax. Also, I assume the tax incentives are granted by the national government and hence assessed at the national level.

Our prototype model here is focused on estimating the economic and revenue impacts of an intended or on-going tax incentive program. The model is divided into three steps corresponding to the three stages of economic and revenue impact specified in Section II.b.

These three stages of economic and revenue impact of a given tax incentive program are: direct impact, indirect impact and induced impact. By assuming the absence of IO accounts and a CGE model, our approach solely relies on data obtained through firm-based financial statements and tax returns, both of which are assumed to be available at the revenue authority.

Step 1: Estimating the Direct Impact

1. Estimate the total capital investments as reported by the targeted firms that are entitled to the tax incentives.
2. Estimate the total of the "redundant" investments within the target of tax incentives. This estimate can be based on an open-ended survey. (A sample question in such a survey may include: "what's the main motivation for your investment in our country?") The "redundant" investments are those that would occur even without tax incentives and hence are "redundant" in relation to the target of tax incentives being assessed.
3. Estimate the "genuine" additional capital investment size that solely results from the tax incentives. This genuine additional capital investment size is the difference between the total and the redundant investments within the target of tax incentives.
4. Estimate the increased jobs and corresponding labour income and taxable profits (i.e., pre-tax profits) associated with the genuine additional capital investment. This estimate can be made according to firm-based accounting/reporting, and with a reference to the industry-specific capital-labour ratio by international standards if foreign investors are involved. (Note: the "international" reference is particular important if the targeted industry is new to the country.)
5. Estimate the revenue loss corresponding to tax incentives granted to those investors whose investments are accounted as "redundant." For example,
   - If the tax incentive is an income tax exemption (or reduction), then the revenue loss can be estimated by multiplying the taxable income arising from the redundant capital investment by the statutory income tax rate (or the gap between the standard and the reduced income tax rates).
   - If the tax incentive is an investment tax credit in proportion to the investment size, then the revenue loss is the product of the investment tax credit (in percentage) and the size of the redundant investment.

For this step, the ***sensitivity parameters*** may include the redundancy ratio, displacement share, and crowding-out probability. A higher level of any of these three parameters will lead to a lower level of direct, indirect and induced impacts as well as a higher level of revenue loss. And vice versa.

Step 2: Estimating the Indirect Impact

1. Estimate the total purchase of capital goods, including both building materials and machinery and equipment) associated with genuine additional capital investment resulting from Step 1.
2. Estimate the split of the total purchase of capital goods into domestically purchased and imported. Only the domestically purchased capital goods can be counted as the first round of *indirect* impacts. (This estimate can be made based on firm-based accounting and customs itemized records by importer.)
3. Estimate the economic impact of domestically purchased capital goods in terms of the increased investment and labour inputs required for producing such additional capital goods and the resulting pre-tax profit and labour income. This is also a genuine addition to existing economic activities, and it can be based on accounting and tax filing by existing firms involving the production of these specific capital goods.
4. Estimate the total purchase of material inputs for production, including both raw and processed materials) associated with the genuine additional capital investment resulting from Step 1.
5. Estimate the split of total purchase of material inputs into domestically purchased and imported. Only the domestically purchased materials can be counted as the first round of *indirect* impact. (This estimate can be made based on firm-based accounting and customs itemized records by importer.)
6. Estimate the economic impact of domestically purchased materials in terms of the increased capital investment and labour inputs required for producing such additional materials and the resulting profit and labour income. This is also a genuine addition to existing economic activities, and it can be based on accounting and tax filing by existing firms involving the production of these specific types of materials.

7. Estimate revenue gains by applying the company and personal income tax rates, respectively, to investment profits and labour income generated by the above additional capital-goods- and material-producing activities.
8. Repeat Steps 1-7 as many times as the industrial linkage indicates and existing data allows, in order to account as thoroughly as possible for the indirect economic and revenue impact of the tax incentives.

For this step of estimation, the ***sensitivity parameters*** may include the split of any physical/material inputs between those imported and those domestically purchased. The higher share for the imported inputs will lead to lower indirect and induced impacts. And vice versa.

Step 3: Estimating the Induced Impact

1. Estimate the national economic multiplier based on the national accounts. That is, in the national accounts, the national income (Y) based on the expenditure approach provides a clear share of consumption (C), including both consumers' expenditure and public current spending, within the total income, based on which, the multiplier (= 1/(1-C/Y)) can be derived. The ratio of consumption to income is the marginal propensity to consume, in economics jargon.
2. Estimate the sum of labour incomes resulting from Steps 1 and 2 above, and subtract from this sum the government revenue loss associated with the redundant capital investment estimated in Step 1. The result is additional disposable income attributable to the tax incentive program before the multiplier effect.
3. Estimate the induced impact by multiplying with the national multiplier and additional disposable income obtained above.

For this step of estimation, the ***sensitivity parameters*** may include the propensity to consume, which can change in either direction as the national income changes and the social safety net improves. What is relevant here is that, the higher the propensity to consume, the greater the multiplier and hence the greater the induced impact.)

As illustrated above, our prototype model can help identify and quantify the economic and revenue impact of any given tax incentive program without the use of sophisticated input-output accounts and other economic models. What is useful and generally accessible is a firm-based micro-simulation model that requires only financial and tax information contained in a

general company income tax return. Therefore, the most critical technical procedure required in constructing our prototype model is thorough bookkeeping and a computerized database. Given that large-taxpayer units are now well established in many developing countries, constructing such a micro-simulation model is no longer impossible.

Figure 1 in the Appendix provides a simplified numerical illustration of this prototype model covering all three steps. It is simplified because it covers only a single accounting period with simple and arbitrary numerical assumptions, and it does not perform any sensitivity analysis although it provides possible parameters for such analysis.

V. Conclusion

Tax incentives by nature are base-eroding tax measures and violate the three basic principles of tax optimization: efficiency, equity and simplicity. However, tax incentives may be justified for mitigating market failure, competing for mobile investment projects while preserving a general tax base, or pursuing agglomeration economies. Regardless, only those tax incentive programs that can pass cost-benefit assessments of both economic and revenue impacts are worth attempting or preserving.

As broadly accepted, the benefit of any given tax incentive program can be defined as the increased economic activities directly and indirectly traceable to such a program and their positive multiplier impact on the overall economy and government revenue. And the cost of any given tax incentive program can be defined as the direct revenue and efficiency loss, the increased administrative and compliance cost, and their negative multiplier impact on the overall economy and government revenue.

Our review of two state government assessments of their tax incentives programs demonstrated that the analytical tool that combines a computable general equilibrium model with input-output accounts is ideal but not indispensable. Only professional integrity combined with critical thinking and diligent bookkeeping can ensure a reliable cost-benefit assessment of any tax incentive programs.

This paper provides a prototype model in the absence of both input-output accounts and a computable general equilibrium model. With a simplified step-by-step illustration, we showed that a cost-benefit analysis of any tax incentive for its economic and revenue impacts can be

done with straight accounting and simple math, as long as firm based accounting and tax information are thoroughly recorded. Also to this extent, it is critical that tax incentives are designed and administered by the tax authority, rather than by non-tax government bodies (e.g., an investment promotion agency), so that all the accounting and tax-filing records are kept under the roof of the revenue agency.

I believe that, even from a purely analytical point of view, tax incentives are always inferior to nationwide tax reforms that tax all investment activities across all economic sectors indifferently. The countries that provide the least tax incentives and hence preserve the broadest tax base are able to tax all at the minimum rate, which in turn is the most effective in inducing the economic activities to obtain their full potential.

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Nevada Governor's Office of Economic Development, Economic Impact of Tesla on Washoe and Storey Counties, September 11, 2014 http://www.diversifynevada.com/documents/Full_Tesla_Summary_Report_Analysis_Letters.pdf

Appendix: A Simplified Numerical Illustration (for a Single Accounting Period and with a National Annual Wage Rate = 2)

	Input data (by assumption)	Output estimate	Sensitivity parameters
Step 1: **Direct impact:** GDP increase=210	I = total investment within TIP target = 200 (by accounting) I_0 = redundant investment =100 (by survey) K/L/M = capital-labour-material ratio = 1/2/2 (by international standard & domestic stats) W = domestic wage rate = 2 (by accounting) r = estimated pre-tax return to capital = 10% (based on industrial statistics)	$I_1 = I_1 - I_0$ = genuine impact of TIP = 100 (derived from I and I_0) $L_1 = I_1/(K/L) = 100/(1/2) = 200$ (= M_1) $P_1 = rI_1 = 10\% \times 100 = 10$ Hence, **increased GDP: $\Delta Y_1 = L_1 + P_1 = 210$** **And job creation $J_1 = L_1/W = 200/2 = 100$**	Redundancy ratio = I_0/I (by survey, assumed as 50% here) Displacement share (by statistics, assumed as 0 here) Crowding-out probability (by survey, assumed as 0 here) Pre-tax return to capital (by accounting, assumed as 10% here)
Step 2: **Indirect impact** (GDP increase **≥** 75 (Note: similar calculations can be repeated as long as the inter-industry linkage implies. Therefore, the increased GDP is 75 at a minimum)	$K_1 = I_1 = 100$ K_{1m} = imported capital goods (by firm reporting and customs accounting) = 50 $K_{1d} = K_1 - K_{1m}$=100-50=50, from industry K_1 Where I/O = 0.9 and K/L/M = 4:4:1 Similarly, M_1 = total purchase of material inputs = 200 M_{1m} = imported material inputs (by firm reporting and customs accounting) = 100 $M_{1d} = M_1 - M_{1m} = 200 - 100 = 100$, from industry *$M_1$, with* I/O = 0.9 and K/L/M=2:4:3	Estimating required increment in capital and labour corresponding to K_{1d} and M_{1d} according to their respective I/O and K/L/M ratios. That is, For K_{1d} = 50, with I/O=0.9 and K/L/M = 4:4:1 K_{2k} = 20, L_{2k} = 20, M_{2k} = 5, and P_{2k} =5 Similarly, for M_{1d} = 100, I/O = 0.9 and K/L/M = 2:4:3 K_{2m} = 20, L_{2m} = 40, M_{2m} = 30 and P_{2m} = 10 Hence, the indirect economic impact consists of: **(1) Increased GDP, or ΔY_2 is 75**. That is $\Delta Y_2 = L_{2k} + P_{2k} + L_{2m} + P_{2m}$ = 20+5+40+10. And **(2) increased jobs = $(L_{2k} + L_{2m})/2$ = 60/2 = 30**	(1) The proportional split of both capital and material inputs between imported and domestically produced is assumed as 50:50, which should vary by industry and by type of inputs (i.e., capital vs. materials) and can be estimated using both firm based accounting and records at customs. (2) The pre-tax profit is assumed to be 10% of total output for illustrative simplicity; it can vary widely using firm-based accounting information.

	Input data (by assumption)	Output estimate	Sensitivity parameters
Step 3: **Induced impact** (GDP increase **≥ 1060**	The direct and indirect GDP impact = $\Sigma\Delta Y_i$ (with i = 1, 2, 3…) > 285 (= 210 + 75), as resulted from *Steps 1&2; and assuming* *a national economic multiplier = 5, implying a national propensity to consume = 80%*	The **induced GDP impact** **= 4 x $\Sigma\Delta Y_i$ - R_I ≥ 1,060** [= 4 x (285 - 20)] (Note: Revenue loss, R_I, is obtained from Step 4 below, which is assumed to be offset by a reduction in social welfare spending.	The assumed propensity to consume should be derived from the national accounts but can be changed according to economic forecasting. Note: induced impact does not include direct/indirect impacts hence we have (multiplier -1).
Step 4: **Revenue impact** **≥ -15.55**	For revenue loss: assume TIP is a 20 investment tax credit, which is applicable t redundant investment I_0. For revenue gain: assume CIT rate = 25% applicable to P_i, and PIT rate = 10%, applicab to ½ L_i *(i = 1, 2k, 2m, 3k, 3m…) assuming a 30 exemption for labour income.*	**Revenue loss** $R_I = -sI_0$ = 20% x (-100) **= -20** **Revenue collection** R_c due to CIT and PIT: $R_{c\_CIT} = 25\% \times \Sigma P_i - sI_1$ *≥ 25% x [10+5+10] - 10 =* ***-13.75****;* and R_{c_PIT} *=10% x (1-30%)* ΣL_i *≥10% x 182 =* ***18.2*** **Net revenue impact ≥ -15.55** (=-20-13.75+18.2)	Any of the sensitivity parameters that may affect any of the three stages of TIP impact above can affect the revenue impact of TIP.
Quantitative Summary: *(1) total economic impact: increased GDP ≥* $\Sigma\Delta Y_I$*=1,345 (=210+75+1,060) and new jobs ≥130, and (2) Revenue impact ≥ -15.55.* ***Main Finding:*** *The greater the redundancy ratio (I_0/I), the smaller the economic impact and the greater the revenue loss from any well-intended tax incentives.*			