Studies on Open and Closed Economies, Business Inputs and the Gross Receipts Tax

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Presented to the

REVENUE STABILIZATION AND TAX POLICY COMMITTEE

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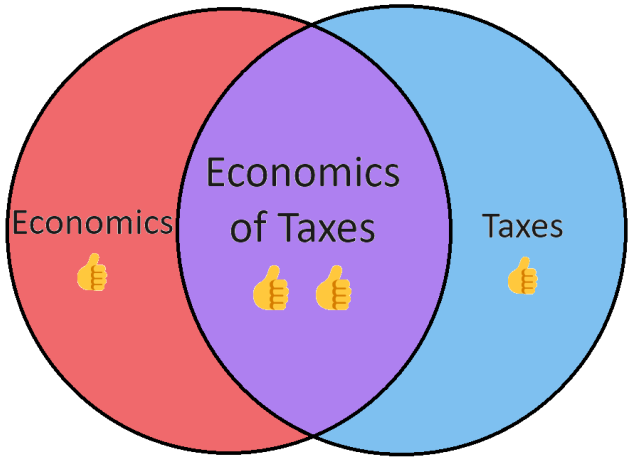
Disclaimer

- I work for the Legislative Council Service. I am here for the sole purpose of providing technical assistance on matters before this committee.
- I do not appear in support or opposition to any policy choices.
- Any opinions expressed are those of the author(s) and do not necessarily reflect the opinions of the New Mexico Legislative Council or any other member of its staff.
- *Only thing better than economics or taxes to spend Friday morning discussing is the intersection of economics AND taxes!*



- A handful of relevant studies are summarized in the slides, but this discussion will not delve deeply into any study. It will focus on why policymakers may want to or need to consider more complex models of policy outcomes.

What Are Economic Models? How economists try to simulate reality*

- "An economic model is a simplified description of reality, designed to yield hypotheses about economic behavior that can be tested."
- What makes a good economic model?
  - Must "yield precise and verifiable implications about the economic phenomena it is trying to explain."
  - "The aim of model builders is to include enough equations to provide useful clues about … how an economy works."
- "No economic model can be a perfect description of reality. But the very process of constructing, testing, and revising models forces economists and policymakers to tighten their views about how an economy works."
- First steps of simplified model construction can be useful for teaching, explanation, and beginning discussions (even standing alone), but not always sufficient for ultimate policy choices in a specific real economy.

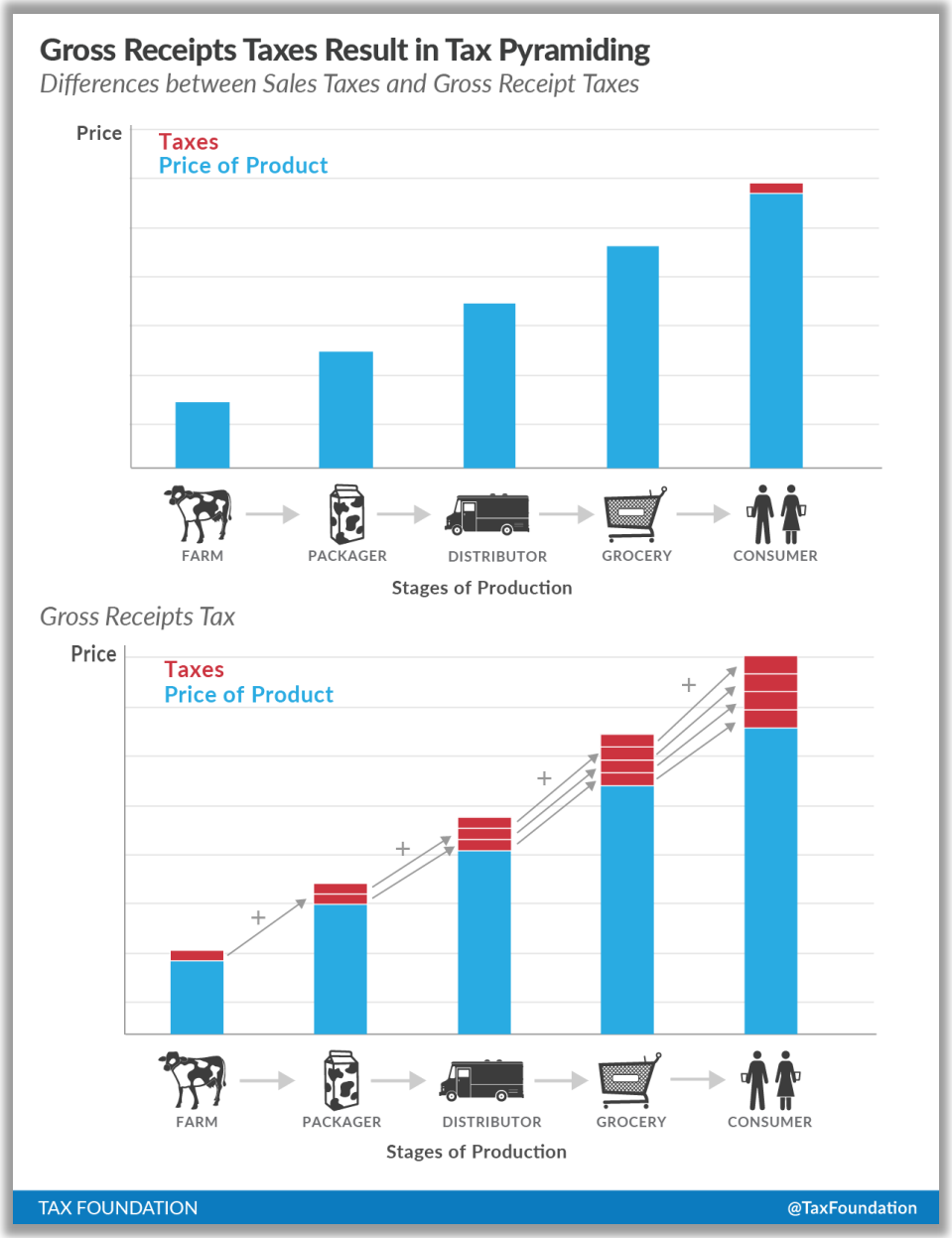
*International Monetary Fund, Back to Basics "What Are Economic Models?" https://www.imf.org/external/pubs/ft/fandd/2011/06/basics.htm

Use economic models with ⚠CAUTION

- An engineer, architect, accountant, attorney, and economist are marooned on a desert island with a can of chile.
  - The question: how to open the can?
  - The engineer observed that the can could be placed on the fire. Eventually the heating of the can would create so much pressure that the can would explode, and the chile could be retrieved.
  - The architect thought that this would be a rather messy solution to the problem and suggested building a small enclosure around the fire.
  - The economist had a better solution: First, he said, *"Assume that we have a can opener ..."*

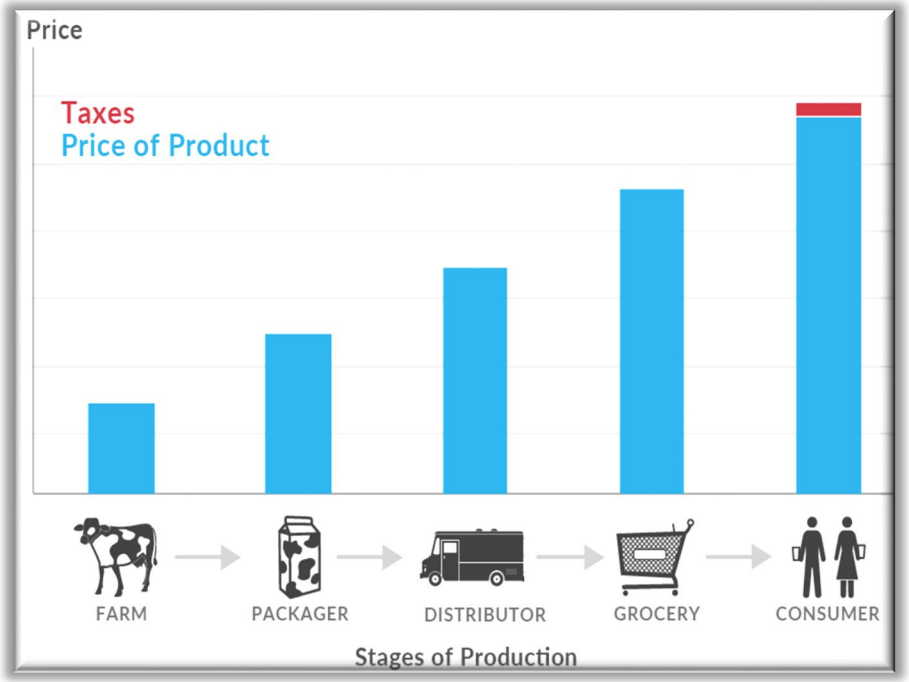
- Today's simplified tax model with assumptions:
  - Preventing Tax Pyramiding is "Ideal", may need assumptions:
    1) Final consumption is taxed
    2) Closed Economy
    3) Horizontal equity and "economic" efficiency are primary goals
       - (vertical equity addressed elsewhere or secondary)
    4) Simplicity/ease of compliance & administration may be secondary

Simplified model of Tax pyramiding



- Useful to begin discussion and begin teaching in simplified introductory economics.
- Not disingenuous, but not final answer.
- One of the most common ways the simplified model begins to break down is when final consumption or intermediate steps are not actually taxed in tax system under consideration.

In some tax systems some final consumption may not be taxed



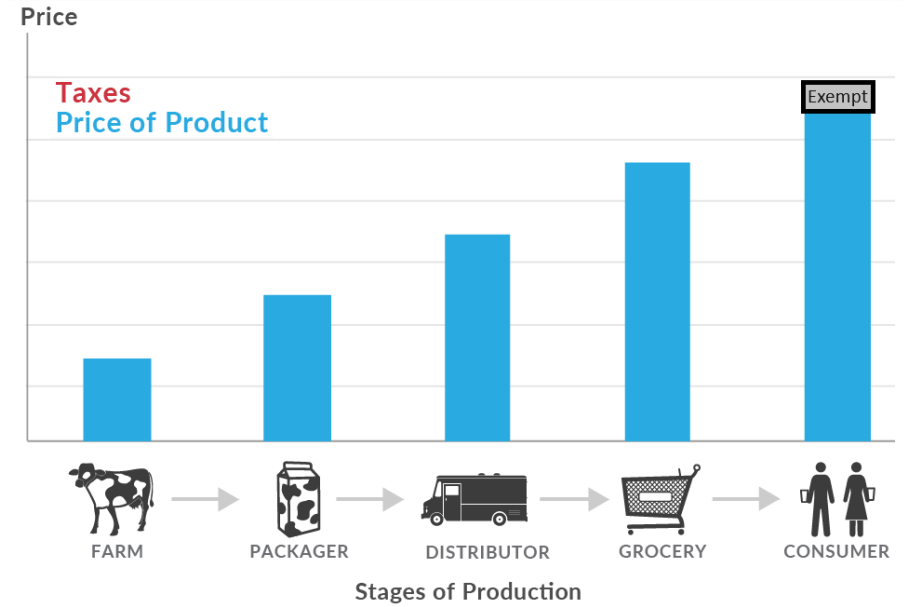
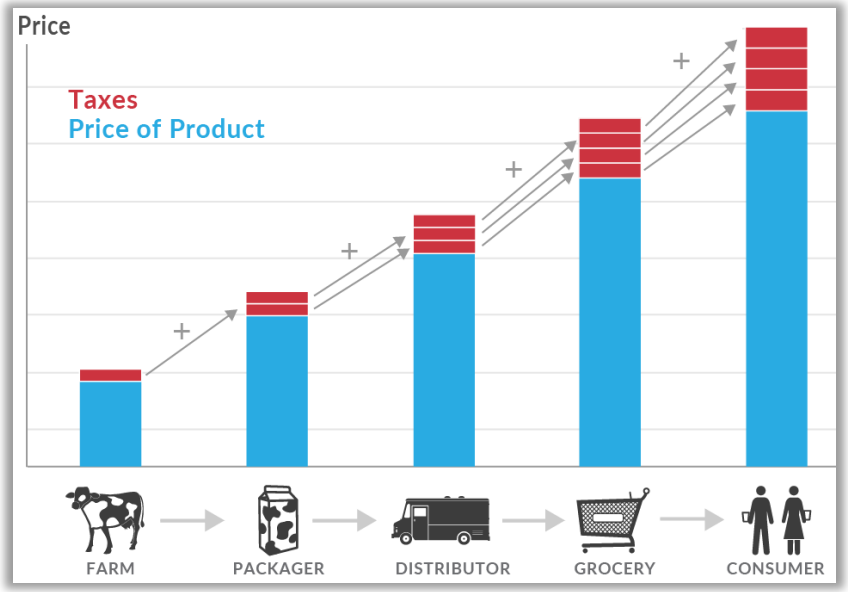
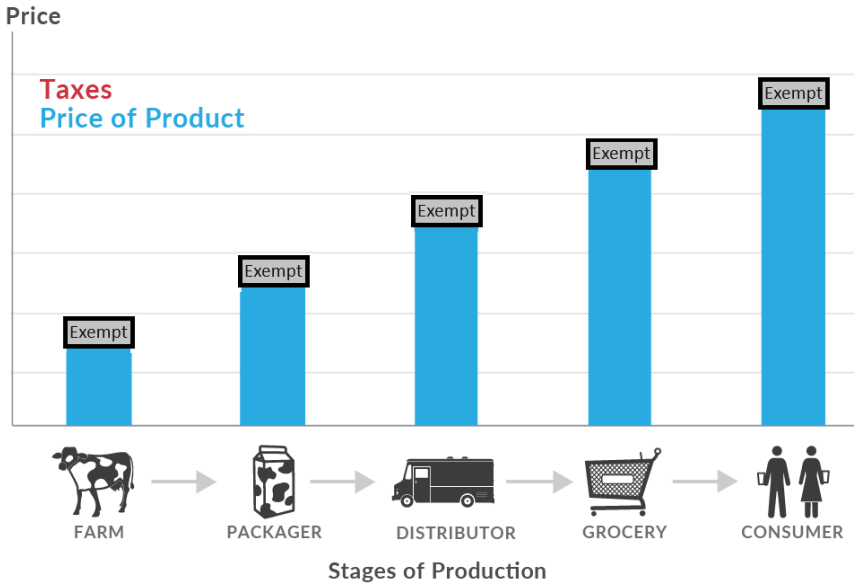


TABLE 18. State Sales Tax Bases: Consumer Goods and Services (as of 7/1/2022)

State	Goods					Services		
	Groceries	Clothing	Rx Medication	Non-Prescription	Gasoline	Legal	Financial	Accounting
Alabama	Taxable	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Arizona	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Arkansas	Alt. Rate	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
California	Exempt	Taxable	Exempt	Taxable	Alt. Rate	Exempt	Exempt	Exempt
Colorado	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Connecticut	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Florida	Exempt	Taxable	Exempt	Exempt	Taxable	Exempt	Exempt	Exempt
Georgia	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Hawaii	Taxable	Taxable	Exempt	Taxable	Taxable	Taxable	Taxable	Taxable
Idaho	Taxable	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Illinois	Alt. Rate	Taxable	Alt. Rate	Alt. Rate	Taxable	Exempt	Exempt	Exempt
Indiana	Exempt	Taxable	Exempt	Taxable	Taxable	Exempt	Exempt	Exempt
Iowa	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Taxable	Exempt
Kansas	Taxable	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Kentucky	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Louisiana	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Maine	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Maryland	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Massachusetts	Exempt	Exempt	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Michigan	Exempt	Taxable	Exempt	Taxable	Taxable	Exempt	Exempt	Exempt
Minnesota	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Mississippi	Taxable	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Missouri	Alt. Rate	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Nebraska	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Nevada	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
New Jersey	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
New Mexico	**Exempt**	**Taxable**	**Exempt**	**Taxable**	**Exempt**	**Taxable**	**Taxable**	**Taxable**
New York	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
North Carolina	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
North Dakota	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Ohio	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Oklahoma	Taxable	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Pennsylvania	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Rhode Island	Exempt	Exempt	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
South Carolina	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
South Dakota	Taxable	Taxable	Exempt	Taxable	Exempt	Taxable	Exempt	Taxable
Tennessee	Alt. Rate	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Texas	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Utah	Alt. Rate	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Vermont	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Virginia	Alt. Rate	Taxable	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt
Washington	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
West Virginia	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Wisconsin	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
Wyoming	Exempt	Taxable	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt
D.C.	Exempt	Taxable	Exempt	Exempt	Exempt	Exempt	Exempt	Exempt

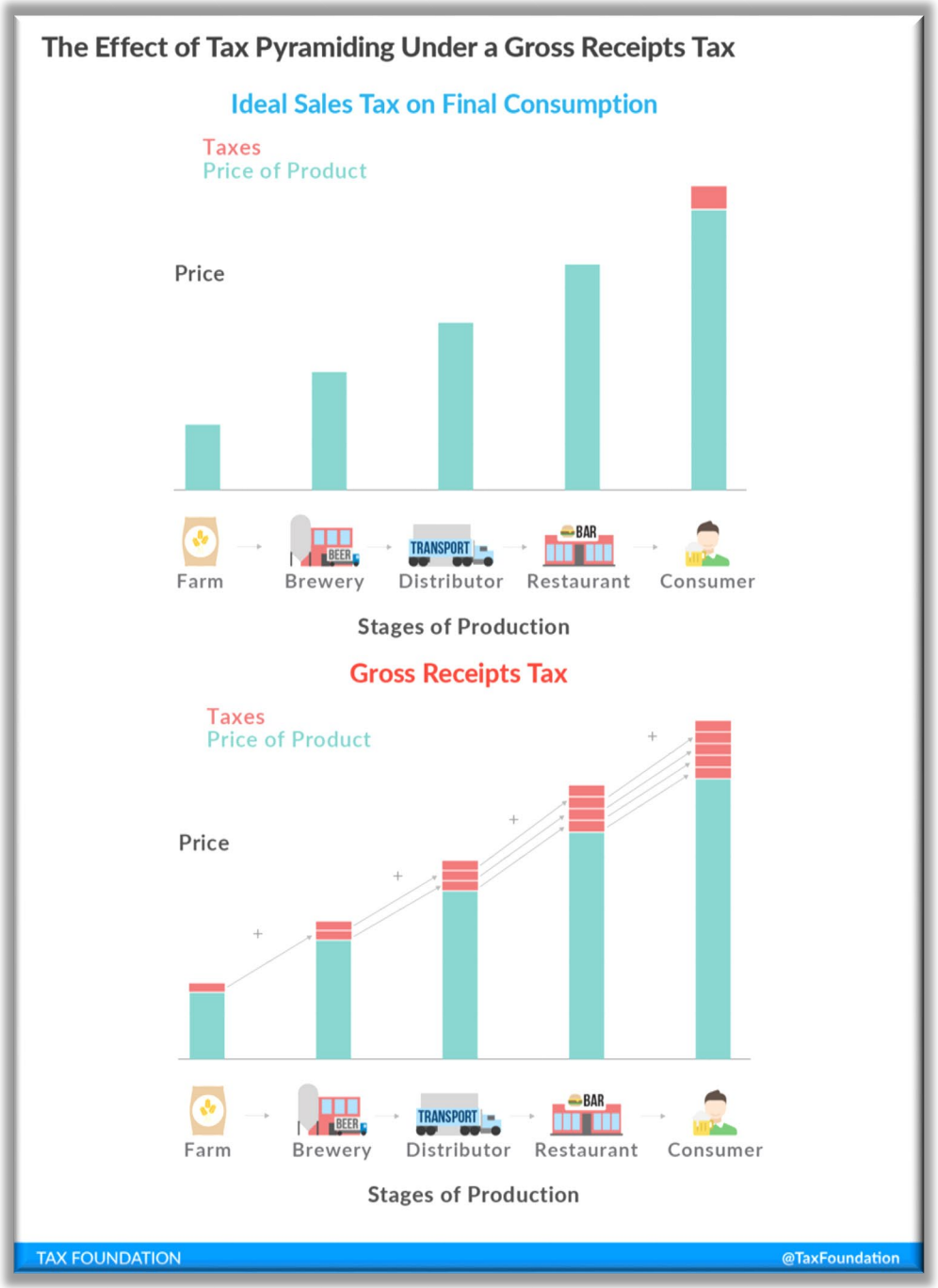
Simplified assumption breakdown continued:





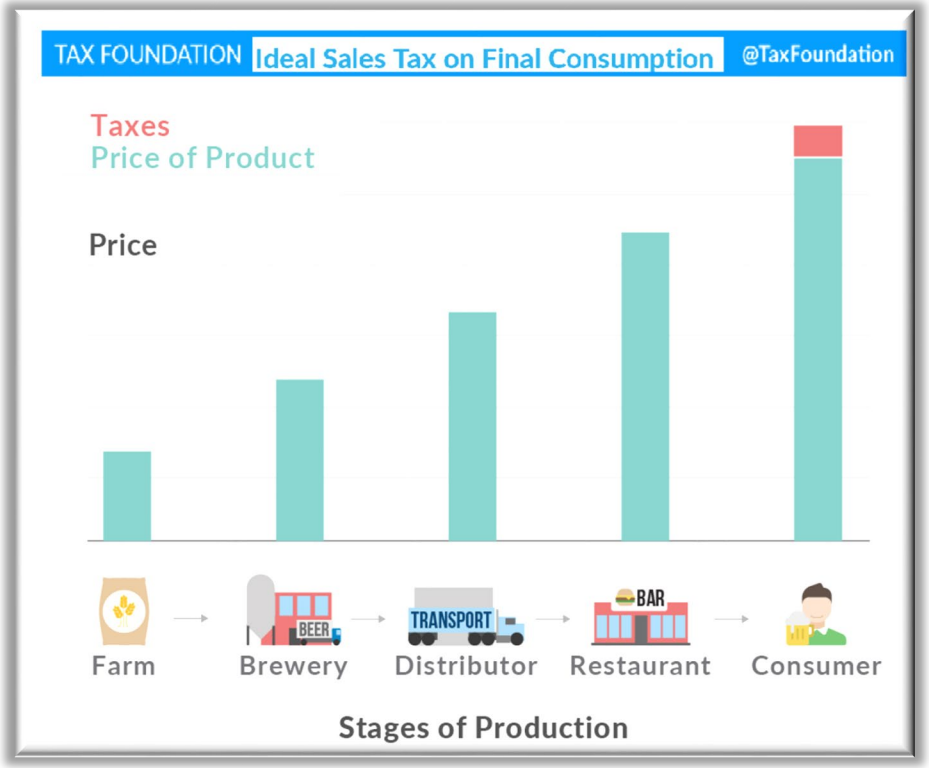
Intermediate stages may not be subject to tax

- 7-9-18. Exemption; gross receipts tax and governmental gross receipts tax; agricultural products.
- 7-9-19. Exemption; gross receipts tax; livestock feeding.
- 7-9-26. Exemption; gross receipts and compensating tax; fuel.
- 7-9-46. Deduction; gross receipts; governmental gross receipts; sales to manufacturers and manufacturing service providers.
- 7-9-46.1. Deduction; gross receipts; governmental gross receipts; sales of services to manufacturers.
- **7-9-47. Deduction; gross receipts tax; governmental gross receipts tax; sale of tangible personal property or licenses for resale**
- 7-9-48. Deduction; gross receipts tax; governmental gross receipts; sale of a service for resale.
- 7-9-55. Deduction; gross receipts tax; governmental gross receipts tax; transaction in interstate commerce.
- 7-9-58. Deduction; gross receipts tax; feed; fertilizers.
- 7-9-59. Deduction; gross receipts tax; warehousing, threshing, harvesting, growing, cultivating and processing agricultural products; testing or transporting milk.
- 7-9-75. Deduction; gross receipts tax; sale of certain services performed directly on product manufactured.
- **7-9-92. Deduction; gross receipts; sale of food at retail food store.**
- 7-9-109. Deduction; gross receipts tax; veterinary medical services, medicine or medical supplies used in medical treatment of cattle.



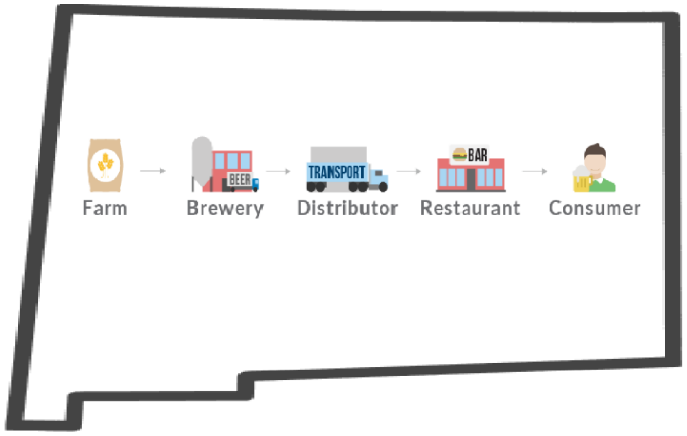
Model Breakdown #2

- If the stages of production and or consumption cross national or state borders the model must become more complex or it can become misleading.

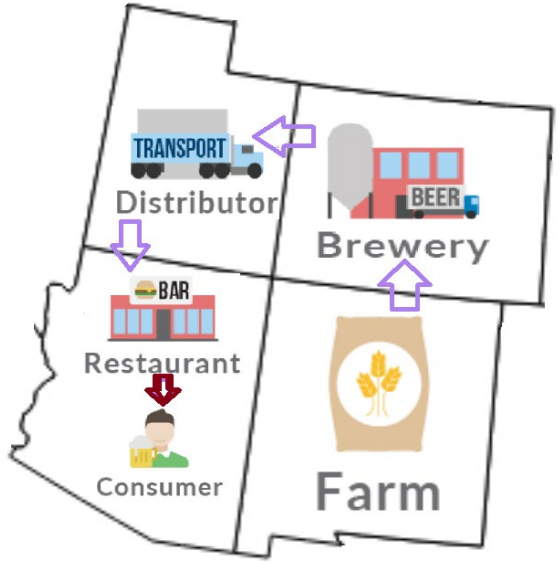


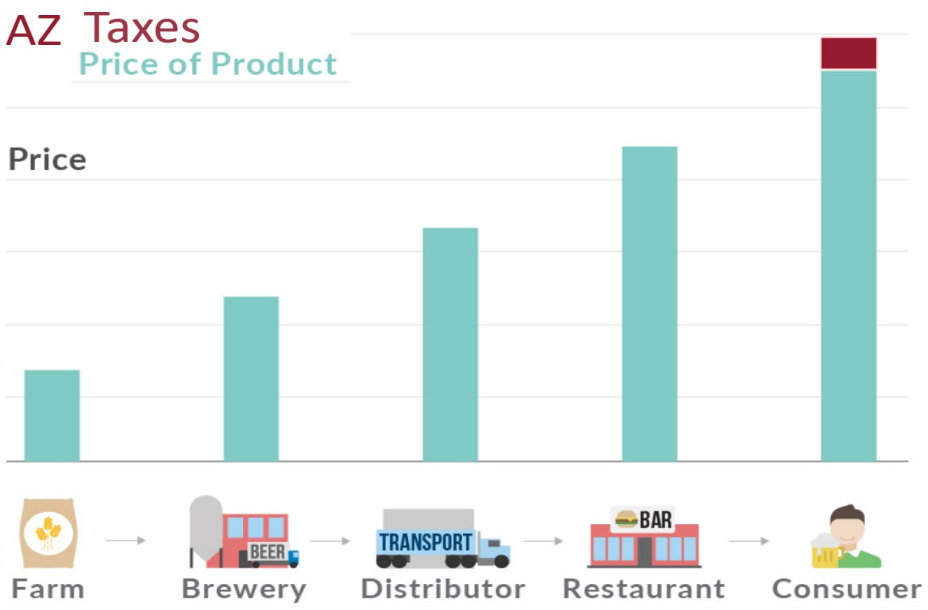
Model Breakdown #2 cont.

- Model works OK if all stages of production and consumption are in one state.

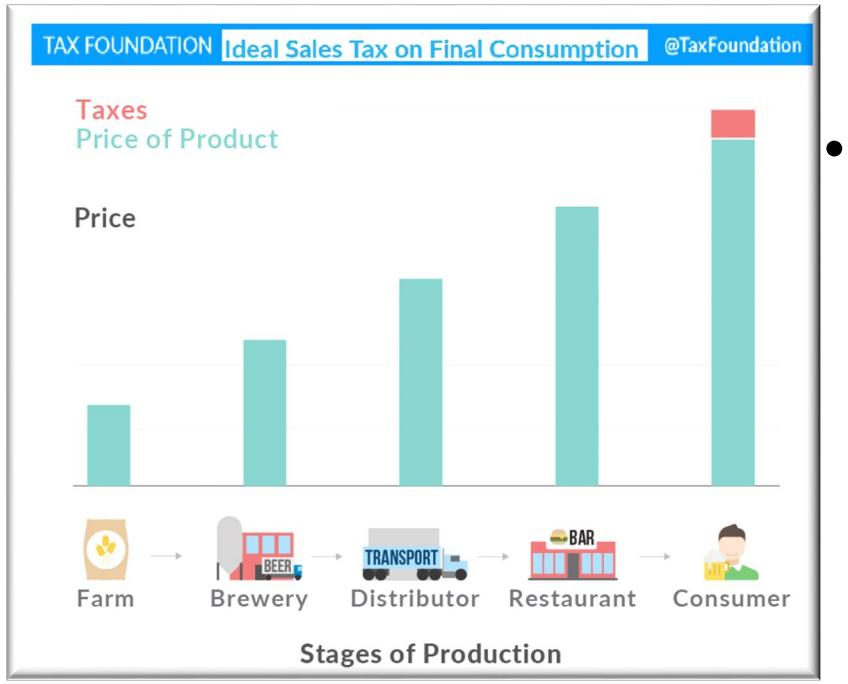


- What if stages of production and or consumption cross borders?
  - No NM tax here:

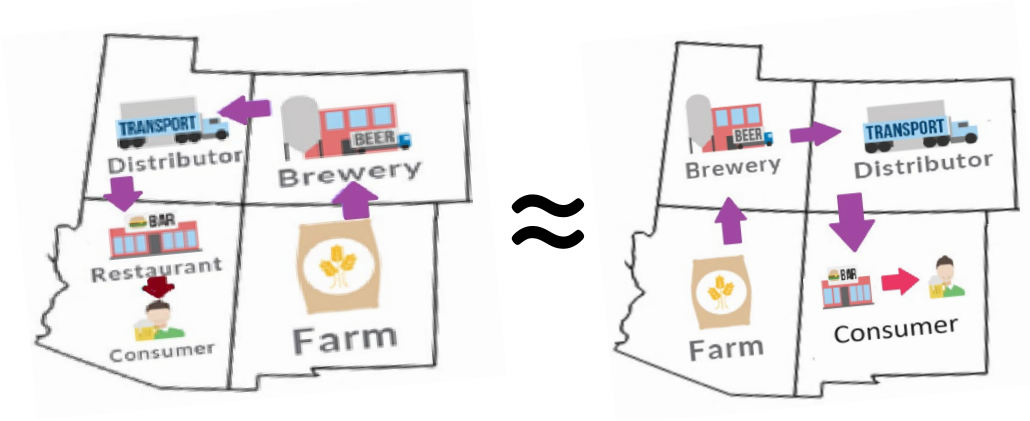




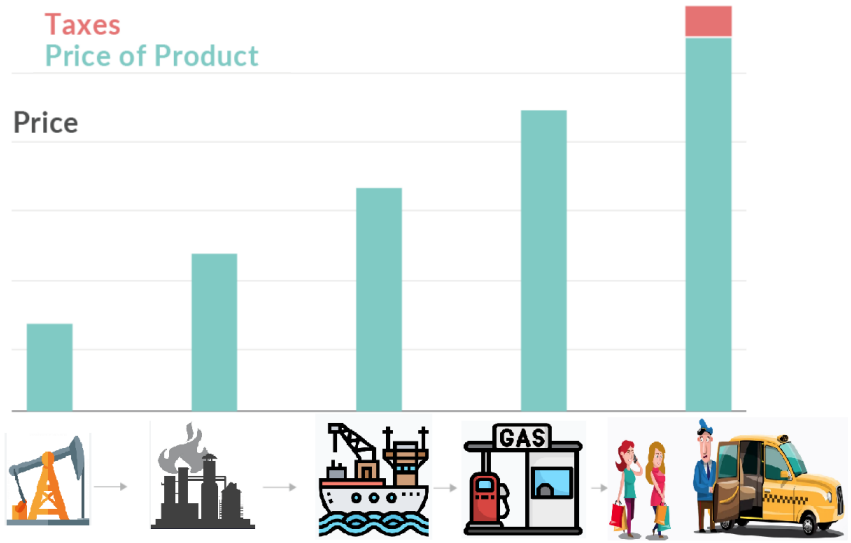
Model Breakdown #2 cont.

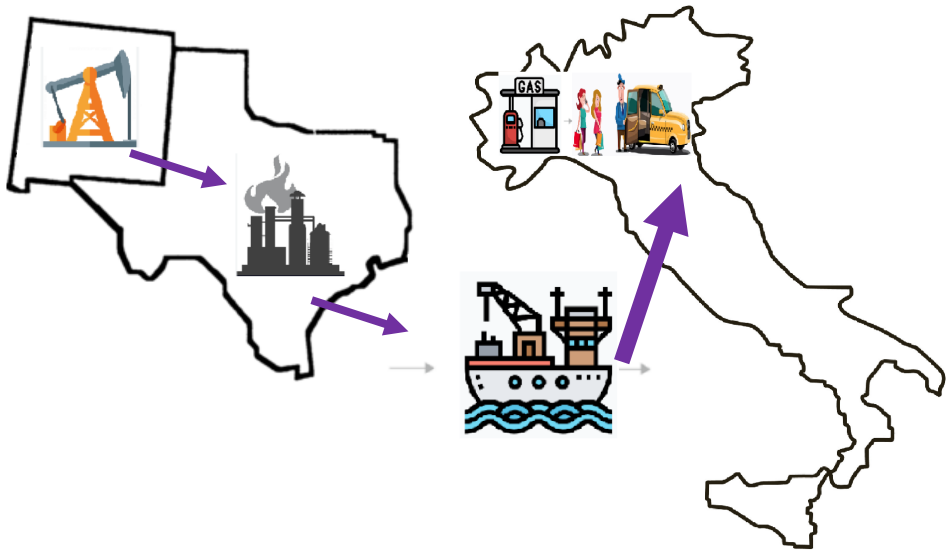


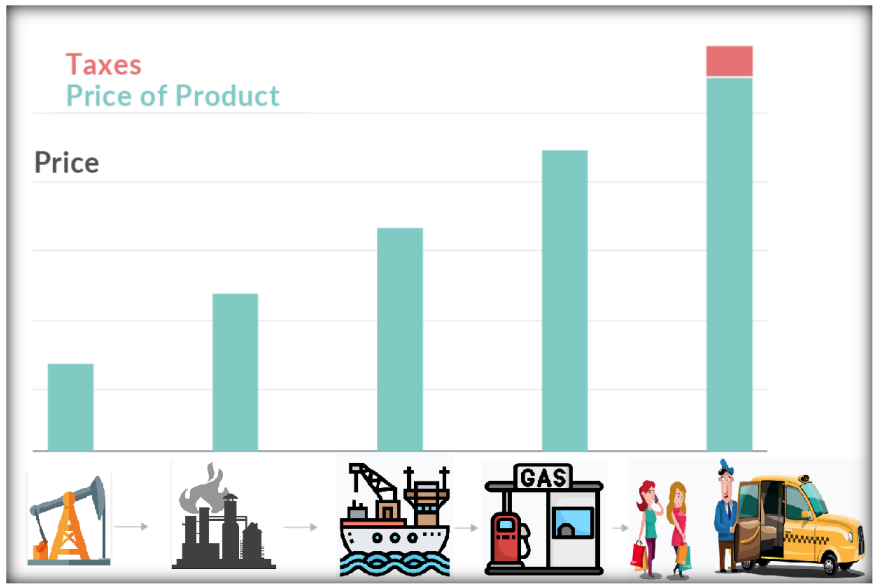
- Model may approximate reality somewhat if amounts of production and consumption across borders are roughly proportional.
  - For example, if production of food or beer and consumption of food or beer are roughly proportional in New Mexico vs. Rest of World



- Model approximates reality less well in economies/sectors where production and consumption are not roughly proportional

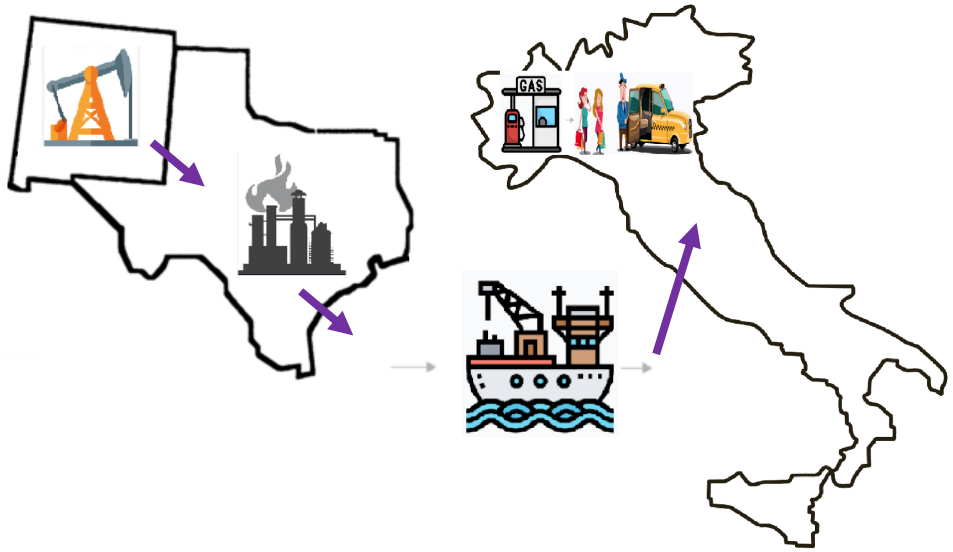


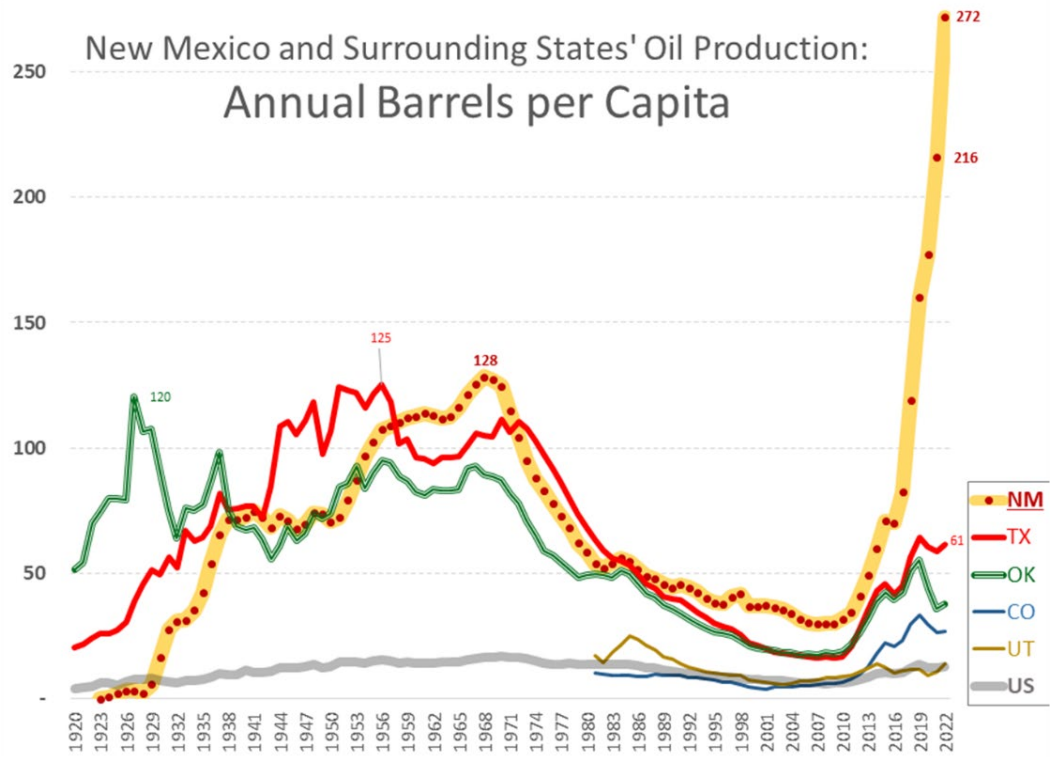




Model Breakdown #2 cont.

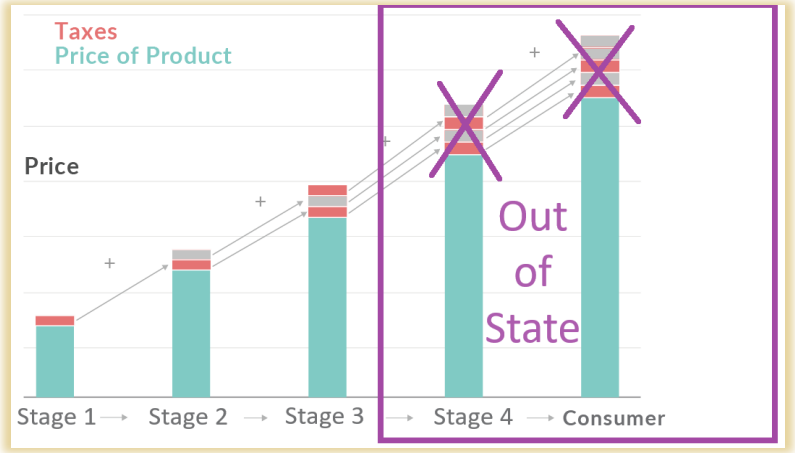
- Simple model approximates reality less well in economies/sectors where production and consumption are not roughly proportional.



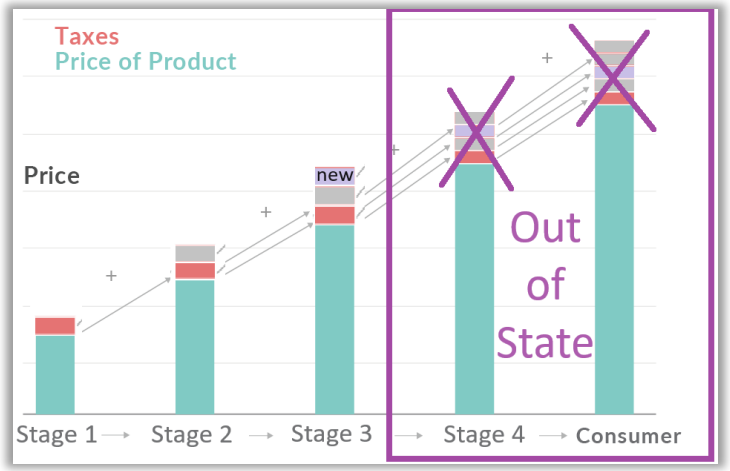


- The production and consumption of tourism in New Mexico is not proportional compared to other states.
- There is significantly more production of national defense in New Mexico than proportional “consumption” of national defense across the US population as a whole.
- New Mexico produces vastly more oil than it consumes:
  - The United States consumed about 22 barrels of oil per capita per year in 2022.
  - New Mexico produced 272 barrels of oil per capita in 2022

Hypothetical choice often closer to real world



Hypothetical current tax system partially taxes production at first and third stages of production; however, subsequent stages of production and final consumption are predominately outside of the state.



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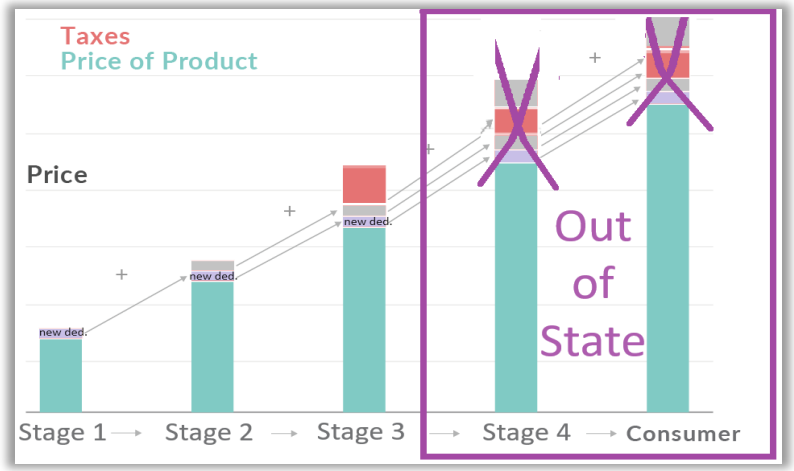

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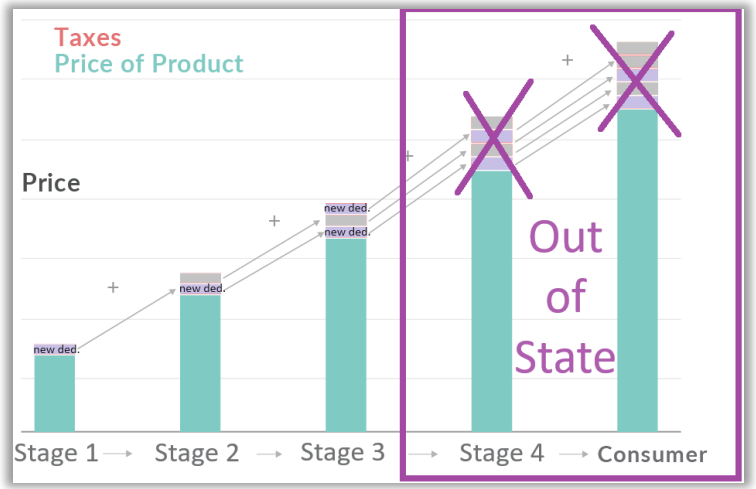


A) Remove tax from third stage and double rate

B) Remove tax from first stage and double rate

C) Remove tax from all stages of production and consumption and double personal income tax

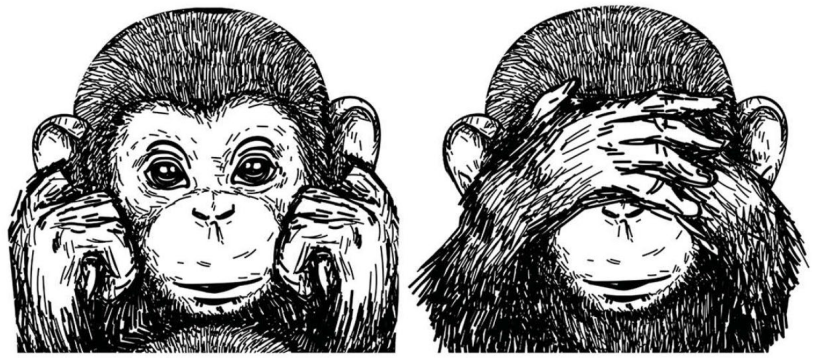
- Neither current situation nor any of three possible paths are perfect, all have tradeoffs.
- Separate question would be increasing or decreasing revenue, then could also consider rate reduction/increase

What to do when simplified assumptions begin to fail?

- Economic models must become more complex, for example:
  - Bowen, R. L., & Leung, P. (1989). Tax pyramiding and tax exporting in Hawaii: an input-output analysis.
  - Del Valle, M. (2005). Pyramiding Transaction Taxes in New Mexico: A Report on the Gross Receipts Tax. New Mexico Tax Research Institute.
  - Pogue, T. F. (2008). Tax Expenditure Budget: Defining the Benchmark GRT Base. Prepared under contract with the New Mexico Taxation and Revenue Department.
  - Wildasin, D. E. (2021). Open-economy public finance. *National Tax Journal*, *74*(2), 467-490.
- It depends, must prioritize tradeoffs:
  - Economics alone does not (and this economist will not) tell you how to prioritize competing goals
    - Horizontal equity
    - Vertical equity
    - Economic “efficiency”
    - Tax exporting (shifting tax burden to New York consumers/workers and off New Mexico consumers/workers)
    - Simplicity
    - Cost of administration & compliance
    - Adequacy
    - Transparency
    - Minimize burden on New Mexico workers
    - Minimize burden on New Mexico businesses
    - Minimize burden on New Mexico investors
    - Minimize burden on New Mexico consumers

Wildasin's "Open-economy Public Finance"

- *…public finance has traditionally been dominated by a "closed-economy" perspective. The main body of the discipline, as communicated to students, researchers, policymakers, and the public at large, commonly proceeds from the (often implicit) assumption that fiscal policies are made by a unitary government, that they apply to a fixed group of households and firms, and that* ***economic interactions with the rest of world may safely be ignored****. As partial evidence in support of this generalization, standard textbooks seldom devote more than a single chapter (about one chapter out of 20 seems typical) to the study of policies involving more than a single government that acts in isolation from the "rest of the world."*



Bowen & Leung's "Tax pyramiding and tax exporting in Hawaii: an input-output analysis."

- Methods
  - Utilized an input-output model to estimate tax pyramiding and exporting in Evaluated tax pyramiding of the gross receipts tax and exporting of Hawaii business-related taxes.
  - Applied a tax model, that uses a state input-output model to derive a tax matrix.

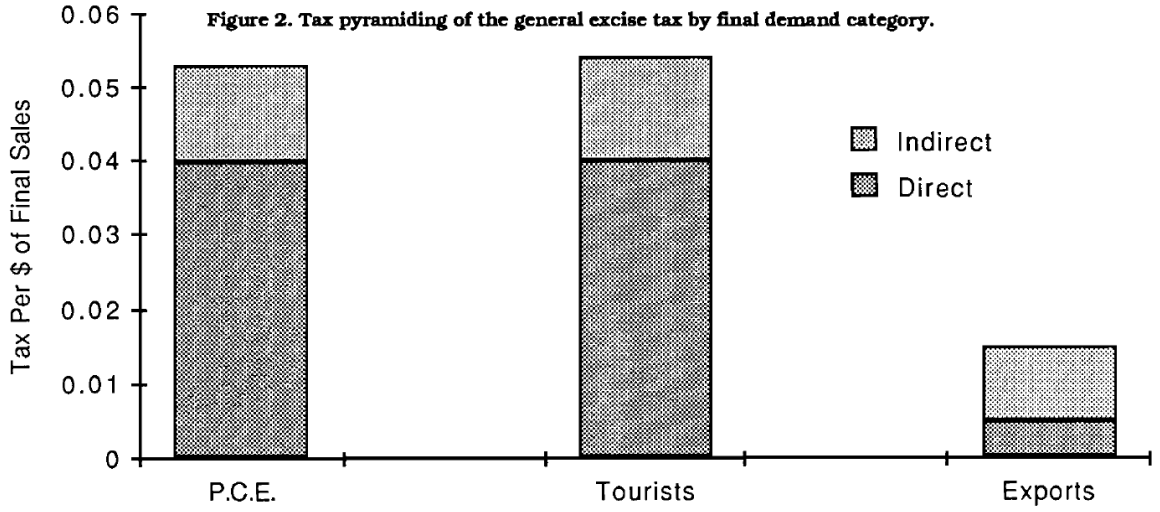


Figure 2. Tax pyramiding of the general excise tax by final demand category.

	Direct	Indirect	Total
Personal consumption expenditure (P.C.E.)	4.0	1.3	5.3
Tourists	4.0	1.4	5.4
Exports	0.5	1.0	1.5

Bowen & Leung's "Tax pyramiding and tax exporting in Hawaii: an input-output analysis."

- Conclusions
  - Hawaii's tax structure facilitates tax exporting and does not excessively pyramid on consumer prices.
  - Tax exporting estimates are reported for each major tax, showing how state and local tax burdens are distributed between Hawaii residents and out-of-state residents.
  - Gross receipts tax pyramiding analysis revealed that final services are more heavily taxed than commodities.
  - Proposals to alleviate the pyramiding of the gross receipts tax might reduce the degree of tax exporting.
  - True pyramiding of the G.E.T. increased its effective true rate by 35%.
  - Policy alternatives were explored, such as:
    - Replacing the gross receipts tax with a retail sales tax.
    - A combination of 0.5% gross receipts tax and a retail sales tax.
    - Replacing the corporate income tax with an increased general excise tax.
    - Exempting food and drugs from the general excise tax.
  - Pyramiding of the gross receipts tax resulted in a total effective tax of 5.3% on most goods and services for Hawaii residents. Visitors had a slightly higher average tax.
  - General excise taxes pyramided more on services than on commodities.

Del Valle's "Pyramiding Transaction Taxes in New Mexico: A Report on the Gross Receipts Tax"

- Objective and Overview
  - Study aims to understand pyramiding in the New Mexico Gross Receipts Tax (GRT).
  - Provides context for policy decisions; does not offer a specific recommendation.
- Pyramiding Debate Context in 2005
  - Viewed as problematic by economists and businesses.
  - Increases costs for businesses, making them less competitive.
  - Legislation in 2005 (HB 410) acknowledged pyramiding and aimed to mitigate its impact.
- Service Economy Challenges
  - Service sales are increasing relative to tangible product transactions.
  - Issues arising:
    - Jurisdictional complexities due to widespread use of technologies.
    - Difficulty defining when a service is an input for another service.
    - Global competition and factors like workforce quality and infrastructure become vital.
- GRT as New Mexico Revenue Source
  - GRT is crucial for state and local revenues; 31% of the state general fund comes from GRT.
  - Changing GRT to reduce pyramiding could impact fiscal health of state/local governments.

Del Valle's "Pyramiding Transaction Taxes in New Mexico: A Report on the Gross Receipts Tax"

- Business Sector Analysis
  - Sectors most susceptible to pyramiding: Manufacturing, Mining, Wholesale and Retail, and Construction.
  - Mining sector has the highest external business input purchase at 42%.
  - New Mexico's Gross State Product: $55 Billion; $19.6 Billion goes into business inputs.
  - Pyramiding [or non-pyramided taxes on business inputs] represent about 32% of GRT revenues ($2.3 billion). Eliminating it would necessitate a two-percentage point increase in GRT rate for revenue neutrality.
- Background
    - Pyramiding in GRT has been a focus in New Mexico tax policy discussions.
    - Pyramiding leads to final buyers paying more than justified by the original tax rate.
  - History of Transaction Taxes: Originated during the Depression as alternatives to income and property taxes. Modern complexities cause more pronounced pyramiding due to increased importance of business inputs in sectors like agriculture and manufacturing.
  - Suspension Mechanisms: Not unique to New Mexico; exists in many states. Aims to reduce pyramiding with two main principles: 1. Applied to inputs that integrate into the final product. & 2. Applied to products purchased exclusively for resale.
- Summary of Conclusions
  - Despite anti-pyramiding provisions, some sectors, like Manufacturing, still face[d] significant pyramiding [or non-pyramided taxes on business inputs].
  - To eliminate pyramiding and maintain revenue neutrality, the GRT rate would have to rise by 2 percentage points. This doesn't factor in the potential demand contraction due to price elasticity.

Pogue's "Tax Expenditure Budget: Defining the Benchmark GRT Base"

- Introduction
  - A tax-expenditure budget identifies revenue losses due to departures from "normal" or "benchmark" taxes.
  - This report focuses on New Mexico's gross receipts tax (GRT) and its associated tax expenditures.
- Defining the Benchmark GRT Base
  - The benchmark GRT base is pivotal in understanding the tax expenditures of New Mexico's GRT.
  - The base can be identified by:
    - The value of all consumption by NM residents
    - The value of all production within NM.
  - Tax expenditures occur when transactions part of the benchmark base aren't taxed.
  - Negative tax expenditures happen when transactions not part of the base are taxed.
- Principles in Defining Benchmark Base, benchmark base should be:
    - 1. Fair.
    - 2. Economically neutral.
    - 3. Transparent.
    - 4. Cost-effective in administration, compliance, and enforcement.

Pogue's "Tax Expenditure Budget: Defining the Benchmark GRT Base"

- Benchmark GRT Base Defined by Consumption by NM Residents
  - Focuses on transactions that should be included in the benchmark without considering the feasibility of taxing its components.
  - Characteristics:
    - Fairness based on consumption.
    - Economic neutrality for most forms of consumption.
    - Transparent for market-traded goods/services.
    - Costs of compliance and administration align with the existing GRT.
- Benchmark GRT Base Defined by Production within NM Borders
  - Defined as the total value of goods/services produced in NM.
  - Characteristics:
    - Includes both consumption and intermediate goods/services.
    - Excludes imports, as they aren't produced in NM.
    - Promotes economic efficiency.
    - Fair in tax payments based on reliance on government-supplied services.
    - Neutrality between production for export and in-state use.
    - Similar transparency to consumption benchmark.
    - Costs for compliance/administration align with consumption benchmark.
- Conclusions
  - Existing GRT hasn't been designed using the consumption or production benchmark.
    - Altering the GRT base to align more with a benchmark would enhance equity and economic neutrality.
  - Converting the existing GRT to a benchmark base would necessitate major overhauls, including rewriting existing statutes.
  - Despite their drawbacks, proponents argue that tax expenditures achieve important public policy objectives, like supporting charities or promoting economic development.
  - This report identifies the sources of tax expenditures but doesn't delve into their desirability.

Wildasin's "Open-economy Public Finance"

- Overview:
  - This study delves into the significance of considering an "open-economy" perspective in public finance, emphasizing the implications of resource mobility for understanding the efficiency and distributional impacts of public policies across various governmental levels.
- Introduction
  - Traditional public finance often assumes a "closed-economy" perspective, suggesting policies are made by a singular, isolated government without considering interactions with other economies.
  - Contrarily, "open economy" typically relates to international economics, focusing on the exchange of goods and services between national economies.
  - This paper presents a blended approach: "open-economy public economics", acknowledging the crucial interconnections between economies and governments.
- Open-Economy Public Finance: Early Contributions and Fundamental Themes
  - This area of study is not entirely new; there are early contributions that set a foundation.
  - The core idea is to understand how fiscal policies in an interconnected world can impact economic outcomes.
- Analytics of Factor Mobility and Public Finance
  - Traditional models often consider economies in isolation; however, real-world scenarios involve multiple interconnected regions or jurisdictions.
  - Analysis should consider how public policies in one region can impact market allocations, incomes, and welfare in both the local and global economies.
  - The spatial allocation of production factors (like labor, capital, and natural resources) and their mobility between regions are key considerations.

Wildasin's "Open-economy Public Finance"

- Fiscal Competition
  - "Tax competition" has been a popular topic but might be misleading. It's essential to consider other policies like expenditure and regulatory policies, better termed as "fiscal competition".
  - Questions arise about how and why governments choose their policies "competitively".
  - Discussions often center on factor mobility and consider the mobility of capital investments and other resources.
  - Both strategic competition (among a few major players) and pure competition (among numerous smaller entities) should be explored.
- Open or Closed? Resource Mobility, Technology, Institutions, and Dynamics
  - Determining the degree to which resources (e.g., labor or capital) are mobile is essential.
  - Categorizing governments as "open" or "closed" is vital but often oversimplified with broad generalizations.
  - Two potential approaches to understand resource mobility:
    - 1. View mobility as a policy choice.
    - 2. Consider mobility as determined by technology.
  - Both approaches might coexist and are not necessarily exclusive.
- Conclusion
  - Issues highlighted by early contributors remain relevant in open-economy public finance.
  - Analyzing through Musgrave's three branches of the public sector offers a valuable framework for understanding interactions between different economic regions and governments.
  - Topics covered include the policies of local to international governments, even including the formation or dissolution of governments.
  - Such issues are not just of academic interest but have profound real-world implications for policymakers, citizens, and analysts across various fields.
  - Many questions in public finance are yet unresolved, indicating a rich field for future exploration.

Final Thoughts

- All models are wrong, but some are useful.
  - Sometimes taxing business inputs can be pyramiding, sometimes taxing business inputs can be tax exporting, in most real tax systems it's a mix.
- What should New Mexico do?
  - It depends.
- Simple economic models don't provide easy and clear policy paths.
  - They can be part of the first steps but not the final step.
  - Examining policies with an open-economy perspective can offer fresh insights.

What Are Economic Models?

How economists try to simulate reality

Sam Ouliaris

THE MODERN ECONOMY is a complex machine. Its job is to allocate limited resources and distribute output among a large number of agents—mainly individuals, firms, and governments—allowing for the possibility that each agent's action can directly (or indirectly) affect other agents' actions.

Adam Smith labeled the machine the "invisible hand." In *The Wealth of Nations*, published in 1776, Smith, widely considered the father of economics, emphasized the economy's self-regulating nature—that agents independently seeking their own gain may produce the best overall result for society as well. Today's economists build models—road maps of reality, if you will—to enhance our understanding of the invisible hand.

As economies allocate goods and services, they emit measurable signals that suggest there is order driving the complexity. For example, the annual output of advanced economies oscillates around an upward trend. There also seems to be a negative relationship between inflation and the rate of unemployment in the short term. At the other extreme, equity prices seem to be stubbornly unpredictable.

Economists call such empirical regularities "stylized facts." Given the complexity of the economy, each stylized fact is a pleasant surprise that invites a formal explanation. Learning more about the process that generates these stylized facts should help economists and policymakers understand the inner workings of the economy. They may then be able to use this knowledge to nudge the economy toward a more desired outcome (for example, avoiding a global financial crisis).

Interpreting reality

An economic model is a simplified description of reality, designed to yield hypotheses about economic behavior that can be tested. An important feature of an economic model is that it is necessarily subjective in design because there are no objective measures of economic outcomes. Different economists will make different judgments about what is needed to explain their interpretations of reality.

There are two broad classes of economic models—theoretical and empirical. Theoretical models seek to derive verifiable implications about economic behavior under the assumption that agents maximize specific objectives subject to constraints that are well defined in the model (for example, an agent's budget). They provide qualitative answers to specific questions—such as the implications of asymmetric information (when one side to a transaction knows more than the other) or how best to handle market failures.

In contrast, empirical models aim to verify the qualitative predictions of theoretical models and convert these predictions to precise, numerical outcomes. For example, a theoretical model of an agent's consumption behavior would generally suggest a positive relationship between expenditure and income. The empirical adaptation of the theoretical model would attempt to assign a numerical value to the average amount expenditure increases when income increases.

Economic models generally consist of a set of mathematical equations that describe a theory of economic behavior. The aim of model builders is to include enough equations to provide useful clues about how rational agents behave or how an economy works (see box). The structure of the equations reflects the model builder's attempt to simplify reality—for example, by assuming an infinite number of competitors and market participants with perfect foresight. Economic models can be quite simple in practice: the demand for apples, for example, is inversely

A useful model

The standard model of supply and demand taught in introductory economics is a good example of a useful economic model. Its basic purpose is to explain and analyze prices and quantities traded in a competitive market. The model's equations determine the level of supply and demand as a function of price and other variables (for example, income). The market-clearing price is determined by the requirement that supply equal demand at that price. Demand is usually set to decline and supply to increase with price, yielding a system that moves toward the market-clearing price—that is, equilibrium—without intervention. The supply-demand model can explain changes, for example, in the global equilibrium price of gold. Did the gold price change because demand changed or because of a one-time increase in supply, such as an exceptional sale of central bank gold stockpiles?

related to price if all other influences remain constant. The less expensive the apples, the more are demanded. Or models can be rather complex: some models that seek to predict the real level of output of an economy use thousands of complex formulations that go by such names as "nonlinear, interconnected differential equations."

Economic models can also be classified in terms of the regularities they are designed to explain or the questions they seek to answer. For example, some models explain the economy's ups and downs around an evolving long-run path, focusing on the demand for goods and services without being too exact about the sources of growth in the long run. Other models are designed to focus on structural issues, such as the impact of trade reforms on long-term production levels, ignoring short-term oscillations. Economists also build models to study "what-if" scenarios, such as the impact on the overall economy of introducing a value-added tax.

How economists build empirical models

Despite their diversity, empirical economic models have features in common. Each will allow for inputs, or exogenous variables, which do not need to be explained by the model. These include policy variables, such as government spending and tax rates, or nonpolicy variables, like the weather. Then there are the outputs, called dependent variables (for example, the inflation rate), which the model will seek to explain when some or all of the exogenous variables come into play.

Every empirical model will also have coefficients that determine how a dependent variable changes when an input changes (for example, the responsiveness of household consumption to a $100 decrease in income tax). Such coefficients are usually estimated (assigned numbers) based on historical data. Last, empirical model builders add a catchall variable to each behavioral equation to account for idiosyncrasies of economic behavior at the individual level. (In the example above, agents will not respond identically to a $100 tax rebate.)

There are, however, fundamental differences among economists regarding how an empirical model's equations should be derived. Some economists insist that the equations must assume maximizing behavior (for example, an agent chooses its future consumption to maximize its level of satisfaction subject to its budget), efficient markets, and forward-looking behavior. Agents' expectations and how they react to policy changes play a vital role in the resulting equations. Consequently, users of the model should be able to track the effect of specific policy changes without having to worry about whether the change itself alters agents' behavior.

Other economists favor a more nuanced approach. Their preferred equations reflect, in part, what their own experience has taught them about observed data. Economists that build models this way are, in essence, questioning the realism of the behavioral constructs in the more formally derived models. Incorporating experience, however, often means it's impossible to untangle the effect of specific shocks or predict the impact of a policy change because the underlying equations do not explicitly account for changes in agent behavior. The gain, these same economists would argue, is that they do a better job of prediction (especially for the near term).

What makes a good economic model?

Irrespective of the approach, the scientific method (lots of sciences, such as physics and meteorology, create models) requires that every model yield precise and verifiable implications about the economic phenomena it is trying to explain. Formal evaluation involves testing the model's key implications and assessing its ability to reproduce stylized facts. Economists use many tools to test their models, including case studies, lab-based experimental studies, and statistics.

Still, the randomness of economic data often gets in the way, so economists must be precise when saying that a model "successfully explains" something. From a forecasting perspective that means errors are unpredictable and irrelevant (zero) on average. When two or more models satisfy this condition, economists generally use the volatility of the forecast errors to break the tie—smaller volatility is generally preferred.

An objective signal that an empirical model needs to be revised is if it produces systematic forecasting errors. Systematic errors imply that one or more equations of the model are incorrect. Understanding why such errors arise is an important part of the regular assessment economists make of models.

Why models fail

All economic models, no matter how complicated, are subjective approximations of reality designed to explain observed phenomena. It follows that the model's predictions must be tempered by the randomness of the underlying data it seeks to explain and by the validity of the theories used to derive its equations.

A good example is the ongoing debate over existing models' failure to predict or untangle the reasons for the recent global financial crisis. Insufficient attention to the links between overall demand, wealth, and—in particular—excessive financial risk taking has been blamed. In the next few years there will be considerable research into uncovering and understanding the lessons from the crisis. This research will add new behavioral equations to current economic models. It will also entail modifying existing equations (for example, those that deal with household saving behavior) to link them to the new equations modeling the financial sector. The true test of the enhanced model will be its ability to consistently flag levels of financial risk that require a preemptive policy response.

No economic model can be a perfect description of reality. But the very process of constructing, testing, and revising models forces economists and policymakers to tighten their views about how an economy works. This in turn promotes scientific debate over what drives economic behavior and what should (or should not) be done to deal with market failures. Adam Smith would probably approve. ■

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TAX PYRAMIDING AND TAX EXPORTING IN HAWAII: AN INPUT-OUTPUT ANALYSIS

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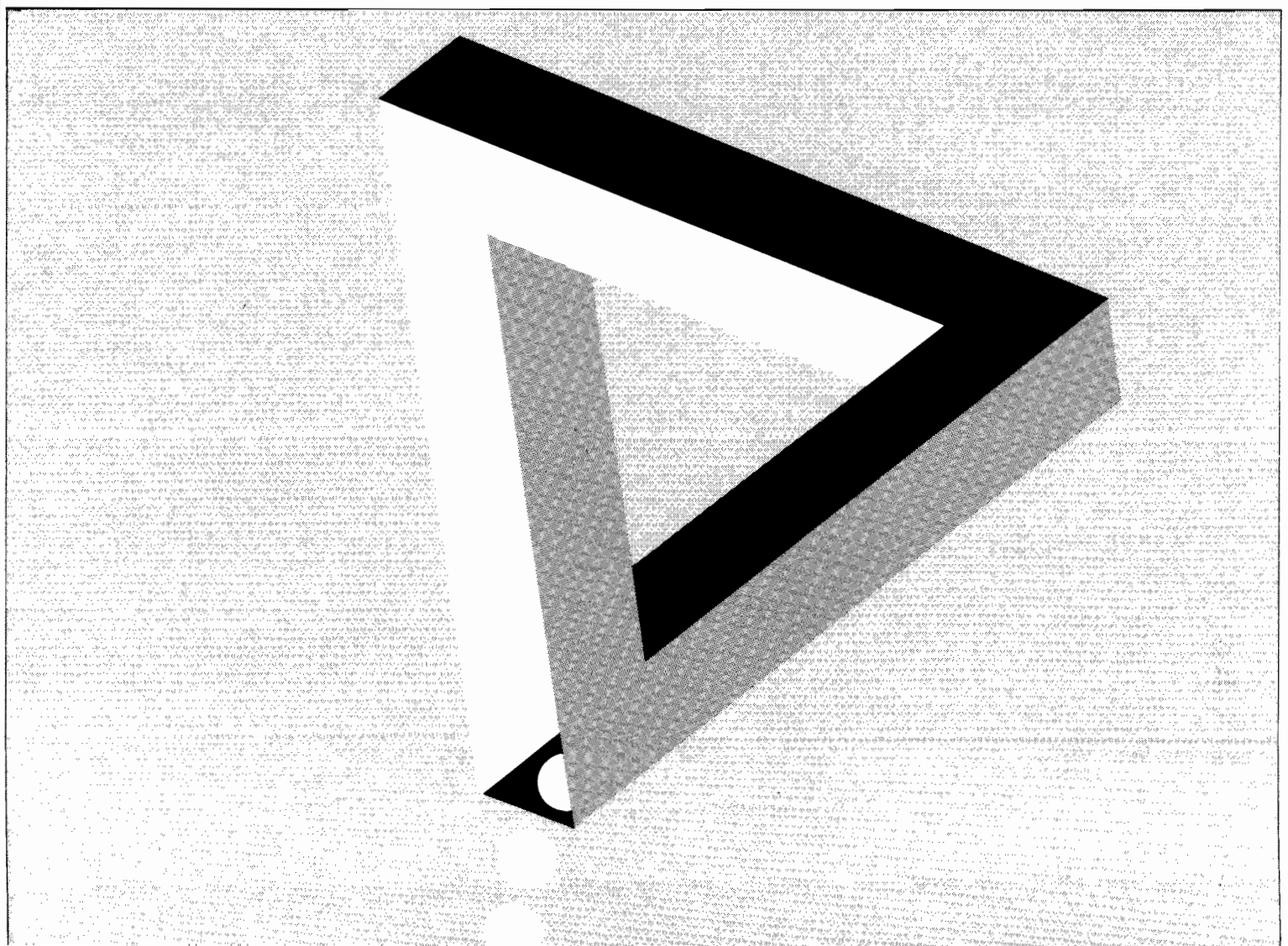

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TAX PYRAMIDING AND TAX EXPORTING IN HAWAII: AN INPUT-OUTPUT ANALYSIS

Richard L. Bowen and PingSun Leung

ABSTRACT

An input-output model was used to estimate the degree of tax pyramiding and exporting in the state of Hawaii. Under the assumption that all taxes are fully forward shifted to final consumers, reasonable estimates are made of the amount of taxes paid by out-of-state consumers (tax exporting) and of the impact on prices of taxes levied on businesses at all stages of production (tax pyramiding). The study concludes that Hawaii's tax structure facilitates tax exporting and, *in general*, does not lead to excessive pyramiding on consumer prices. Estimates of tax exporting are reported for each major tax. An in-depth analysis of the pyramiding potential of the gross receipts tax showed that final services are taxed more heavily than commodities. The study shows that proposals to alleviate the pyramiding of the gross receipts tax may also lower the degree of tax exporting.

Keywords: tax exporting, tax pyramiding, input-output.

INTRODUCTION

Tax pyramiding occurs when a sales or gross receipts tax is imposed more than once on the value of a good or service at different levels in the marketing system. Pyramiding results in higher prices for consumers and can be discriminatory if goods or industries are effectively taxed at different rates. The research reported here measures the extent of pyramiding of Hawaii's gross receipts tax to discover its impact on prices and its discriminatory biases.

Tax exporting is the shifting of taxes to persons and entities residing in other jurisdictions. It is politically attractive in export-oriented economies because it produces a lower tax burden on the resident population. The research reported here estimates how state and local tax burdens (with the exception of the state income tax) are distributed between Hawaii residents and out-of-state residents.

This study evaluates, through the use of the state input-output model, the pyramiding of the gross receipts tax and the exporting of Hawaii business-related taxes. Bahl and Shellhammer's (1969) analytical framework was refined for this purpose. Improved methods of matching legal tax burdens with input-output sectors were devised. Procedures were then developed for forming tax multipliers given a multiple-stage, multiple-rate tax structure. The multipliers are used to estimate both tax pyramiding and tax exporting. Lastly, the study demonstrates that input-output analysis can be extended to explore differential impacts across commodities and across industries, with resulting insights into the discriminatory biases of the tax.

Assumptions about shifting are necessary to estimate tax burdens empirically at the final resting place. For an extensive literature review on this subject, see Phares (1980). There is substantial agreement on the shifting of many taxes, but disagreement still exists over the shifting, for example, of corporate income taxes and property taxes. Thus two scenarios were investigated: full forward shifting of all taxes, and full or partial shifting by type of tax or by industry upon which a tax is imposed. Results under the assumption of full forward shifting are presented in this report.

THE TAX MODEL

The tax model developed by Bahl and Shellhammer (1969) uses a state input-output (I-O) model and requires the derivation of a tax matrix. The coefficients of this matrix are the product of the vector of payments to state and local government per dollar of output in each industry and the matrix of direct and indirect requirements per dollar of delivery to final demand. These tax–final demand coefficients measure the amount of tax embodied in a dollar's worth of delivery to final demand.

The Hawaii state I-O model does not contain a vector of tax payments per dollar of output, having only three final payment sectors: household income, imports, and other value added. This latter row, which is estimated as a residual, includes tax payments. Strictly speaking, regional I-O models simulated from the national model, such as that for Hawaii, do not separate out tax information. Transactions are valued at producers' prices, which include

federal, state, and local excise taxes. Corporate income taxes are not explicitly represented in the models; only indirect business taxes are estimated in the national model.

Because the general excise tax (G.E.T.) rates vary by selling industry, the analysis traces the flow of goods and services through the various industries. However, the I-O tables do not trace the actual flows of commodities through the trade sectors. Instead, commodity flows are shown as if they go directly from producers to users. Thus the output of the trade sectors is measured by gross margins (operating expenses plus profit). Since a considerable portion of Hawaii state taxes are levied on gross sales at retail and wholesale levels, it is necessary to make significant adjustments to the I-O model to trace these taxes. Given these model limitations, the procedures used by Bahl and Shellhammer must be modified to analyze Hawaii taxes.

Because existing tax categories were more aggregated than I-O sectors, taxes were allocated to producing sectors as follows. Retail-level G.E.T. payments for each final goods and services category were estimated and subtracted from total tax revenue. The difference, which is the estimated tax payments on nonfinal transactions, was allocated among industry sectors on the basis of industry sales. Allocation of other taxes to I-O sectors where tax categories were incongruous with I-O sectors was based either on sales or on asset values of the sectors.

I-O models generally treat capital goods as final. However, since taxes on capital were assumed to be shifted forward, the capital goods sector needed to be made an internal sector, i.e., endogenized, in the tax model. Since most capital goods are financed with borrowed funds, it can be assumed that a tax on capital is also financed, and that changes in prices of goods and services produced with that capital will occur over the loan repayment period rather than in the year the tax is imposed (Pollock, 1972). In this study, taxes on capital were estimated on a deferred basis, using standard long-term capital financing terms.

Intermediate excise taxes, expressed as tax per dollar of output, were reallocated from producing sectors to final demand sectors via the I-O model. This created a vector of indirect taxes embedded per dollar of final demand by industry sector. The property tax, business income tax, and fuel tax were treated in a similar way. For a more detailed description of the required allocations and procedures, see Bowen and Leung (1984) and Leung and Bowen (1988).

Given the matrix of indirect taxes per dollar of final demand by industry (Table 1), the direct taxes paid on final goods and services by final demand categories, and the appropriate shifting assumptions by sector, the degree of tax pyramiding and exporting can be readily estimated. Indirect taxes embodied in each final demand category, assuming taxes are fully shifted forward at all stages of transactions, were estimated by simply multiplying the coefficients in Table 1 by the vector of final demand for each category. These indirect taxes per dollar of final demand provide a measure of overall pyramiding effect by final demand category. The degree of exporting was measured simply by aggregating for each the total direct and indirect taxes associated with the export-related final demand categories. The export-related categories include tourist expenditures, exports, and defense and nondefense federal government expenditures.

ASSUMPTIONS

There are critical standard assumptions that must be made when using I-O analysis:

1. All of the enterprises grouped together are assumed to have similar proportions of input factors. Each sector has a single primary output, i.e., there are no joint products.

2. The proportion of sales dollar spent upon each good or service used in production of a particular output will remain the same for higher or lower output. The coefficients of production are assumed to be fixed, allowing for no substitution among inputs.

3. Purchasing patterns change slowly over time, with the technical relationships and trade patterns based on recorded transactions. Historically, changes in technology, relative prices, and regional import patterns occur slowly. This allows the same model to be used over a period of years.

The analysis reported here was performed under the assumption of full forward shifting of all taxes. This occurs under either perfectly inelastic demand or perfectly elastic supply. Inelastic demand was assumed for the analysis of proposed policy changes.

COMPOSITION OF TAXES ANALYZED

Figure 1 contrasts the relative sizes of the taxes considered in this study. The general excise tax (G.E.T.) was the single most important tax considered in this analysis, accounting for over half of the total (56.8 percent). Property taxes were next in size (22.5 percent). Almost half of all property tax revenue came from residential housing. "In lieu of" (I.L.O.) taxes

Table 1. Indirect tax per dollar of final demand by industry sectors

Industry	General excise	In lieu of	Real property	Corporate profit	Fuel	Total
1 Sugar, field	0.01021	0.00221	0.00711	0.00298	0.00105	0.02356
2 Pineapple, field	0.00833	0.00059	0.00479	0.00244	0.00083	0.01698
3 Other agriculture	0.01006	0.00070	0.00935	0.00369	0.00156	0.02536
4 Sugar processing	0.01260	0.00201	0.02122	0.00418	0.00205	0.04206
5 Pineapple canning	0.01492	0.00131	0.01804	0.00595	0.00249	0.04271
6 Other food processing	0.01496	0.00134	0.01868	0.00607	0.00255	0.04360
7 Misc. manufacturing	0.00867	0.00122	0.00724	0.00263	0.00170	0.02146
8 Construction	0.02263	0.00083	0.00816	0.00590	0.00209	0.03961
9 Trans. and warehousing	0.01174	0.00146	0.00831	0.00355	0.00301	0.02807
10 Communication	0.00852	0.00145	0.00780	0.00195	0.00070	0.02042
11 Elec., gas, sanitary	0.00981	0.00563	0.00714	0.00302	0.00124	0.02684
12 Wholesale trade	0.01586	0.00190	0.01253	0.00383	0.00152	0.03564
13 Retail trade	0.01126	0.00257	0.01072	0.00265	0.00086	0.02806
14 Eating and drinking	0.01328	0.00195	0.01208	0.00439	0.00165	0.03336
15 Banking and finance	0.01728	0.00238	0.01981	0.00416	0.00135	0.04498
16 Hotels	0.02085	0.00460	0.02075	0.00524	0.00263	0.05407
17 Health, prof. services	0.01436	0.00195	0.01374	0.00364	0.00131	0.03500
18 Other services	0.01648	0.00195	0.01312	0.00402	0.00147	0.03704
19 Govt. enterprises	0.00907	0.00194	0.00655	0.00271	0.00234	0.02261
20 Other industries	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
21 Imports	0.00500	0.00000	0.00000	0.00000	0.00000	0.00000

were mostly in lieu of general excise taxes and, to a lesser extent, in lieu of property and corporation income taxes. These taxes accounted for 8.3 percent of the taxes analyzed in this study. Business income taxes, which also included taxes on business income reported on personal income tax forms, were a relatively small portion (4.9 percent) of the total taxes directly affecting businesses in Hawaii. For example, more fuel taxes (5.5 percent) were collected than business income taxes.

Personal income taxes, except as noted above, were not considered. This tax is not subject to shifting through industry sales and is further complicated by the federal income tax offset.

EXAMPLE OF USE OF AN INPUT-OUTPUT MODEL TO ANALYZE TAX PYRAMIDING AND EXPORTING

The following example illustrates how the I-O model can be used to estimate tax pyramiding and tax exporting. Table 2 shows the transactions required to deliver $1000 worth of milk products to the final consumers in a hypothetical economy. Although grossly simplified from the actual transactions that would take place in the Hawaii economy, the example yields insight into the estimation process and interpretation of the tax pyramiding and exporting estimates generated by the I-O model.

The hypothetical example shows the following interindustry transactions: (1) final consumers purchase $1000 worth of milk products from retail outlets, with $800 worth purchased by residents and $200 worth purchased by tourists; (2) retailers purchase $600 worth of milk from milk processers; and (3) milk processors purchase $400 worth of unprocessed milk from dairy farms. Table 2 shows the factor payments by each of the three sectors (retail, milk processing, and dairy farms) of the economy. For the dairy farm sector, these are $300 to labor, $2 of taxes, and $98 of other value added. Other value added includes profits, depreciation, and payments to management and capital. Factor payments by the milk processing and retail sectors can be interpreted in a similar fashion. It should be noted that for each sector total inputs equal total ouputs, i.e., the sum of each column is the same as the sum of its corresponding row.

Conventional I-O analysis starts with the calculation of the direct and indirect requirements per $1 delivery to final demand, commonly known as the "final demand multipliers." Table 3 shows the direct and

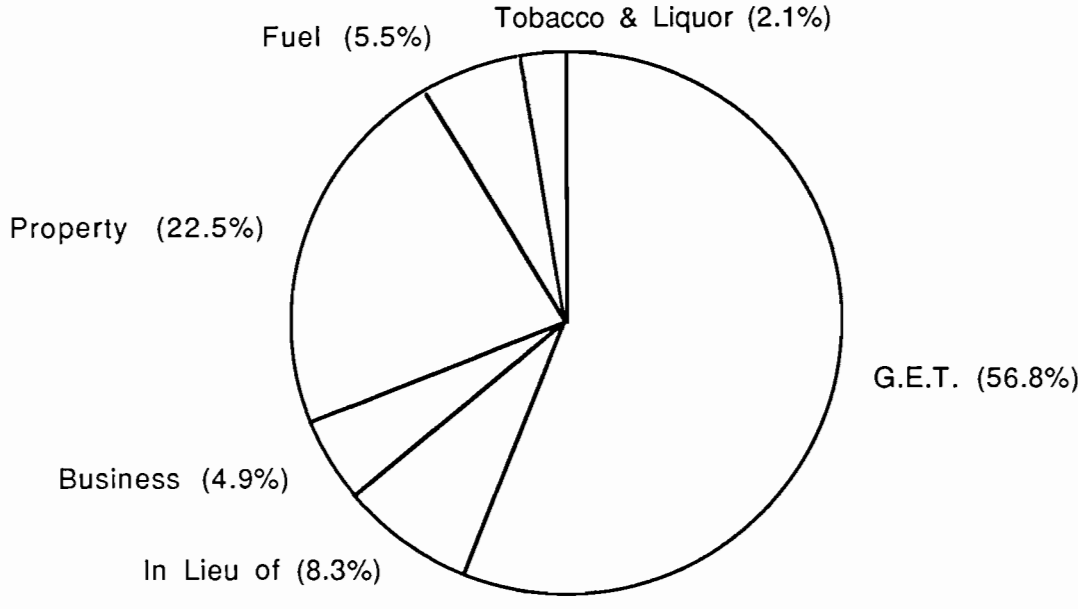

Figure 1. Taxes collected by tax category, FY 1981.

G.E.T.	$527,971
I.L.O.	71,225
Business	47,411
Property	211,858
Fuel	53,389
Tobacco & liquor	25,700
Total business taxes	$937,554

Table 2. Hypothetical transactions attributable to the delivery of $1000 worth of milk product to final consumers (in dollars)

Selling industries	Purchasing industries: Dairy farm	Milk processing	Retail	Final consumers: Local	Tourist	Total output
Dairy farm	0	400	0	0	0	400
Milk processing	0	0	600	0	0	600
Retail	0	0	0	800	200	1000
Labor	300	100	300			700
Tax	2	3	40			45
Other value added	98	97	60			255
Total outlays	400	600	1000	800	200	3000

Table 3. Direct and indirect requirements per $1 delivery of milk product to final consumers by the retail sector (in dollars)

Producing industry			
1. Dairy farm	400/1000	= 0.40	
2. Milk processing	600/1000	= 0.60	
3. Retail	1000/1000	= 1.00	
TOTAL	2000/1000	= 2.00	← Final demand multiplier

Source: Table 2

Table 4. Tax payments per $1 of output (in dollars)

Tax-paying industry	
1. Dairy farm	2/100 = 0.005
2. Milk processing	3/600 = 0.005
3. Retail	40/1000 = 0.040

Source: Table 2

indirect requirements per $1 of milk products sold through the retail sector. As indicated in Table 2, in order to deliver $1000 worth of milk products to the final consumers, milk processors would have to purchase $400 worth of unprocessed milk from the dairy farms. This means that dairy farms would have to increase their production by $400, or 40 cents for each dollar of milk sold to final consumers. Similarly, the milk processors and retailers would have to increase their production by $600 and $1000 respectively, or 60 cents and $1 for each $1 of milk products sold to final consumers. The resulting $2000 in total sales in the economy produced by $1000 in final milk sales indicates a final demand multiplier of 2.0.

Table 2 also shows the tax payments made by each sector. These can be converted to tax payments per $1 of output by dividing sector tax payments by sector output, as shown in Table 4. The product of the direct and indirect requirements coefficients (Table 3) and the tax per dollar of output (Table 4) tells us the direct and indirect taxes attributable to $1 of milk product delivered to final demand (Table 5).

Table 5 summarizes the I-O estimates of tax pyramiding. The total tax paid per $1 of milk sold to final consumers is 4.5 cents. The 4 cents of tax generated through the retail sector is a direct tax on final consumption. Indirect taxes amounting to 0.5 cent are generated in the milk processing and dairy farm sectors. Full forward shifting of taxes means that the final consumer will end up paying for both direct and indirect taxes, regardless of the stage at which a tax is imposed or who is legally responsible for collecting the tax. The I-O model in this hypothetical example estimates that tax pyramiding adds an additional 0.5 percent to the direct tax rate of 4 percent.

Table 6 shows how the I-O model measures tax exporting, assuming that taxes are fully forward shifted. Applying the 4.5 percent direct and indirect tax rate to final sales of milk

products, $36 of tax can be attributed to local consumers and $9 to tourists. Therefore, 20 percent of the tax has been exported.

This example demonstrates the essence of I-O analysis in estimating tax pyramiding and tax exporting. It also defines the terms (direct and indirect taxes, tax exporting, tax pyramiding) used throughout the report.

Table 5. Direct and indirect tax attributable to $1 delivery of milk product to final consumers by the retail sector (in dollars)

Tax-paying industry				
1. Dairy farm	0.005 ×	0.40	=	0.002
2. Milk processing	0.005 ×	0.60	=	0.003
3. Retail	0.040 ×	1.00	=	0.040
TOTAL		2.00	=	0.045

Source: Tables 3 and 4

Table 6. Degree of tax exporting

Final consumers	Amount	Direct & indirect tax	% of total
Local	$ 800	$36	80
Tourists	200	9	20
TOTAL	1000	45	100

Source: Tables 2 and 5

ANALYTIC RESULTS UNDER FULL FORWARD SHIFTING

Pyramiding of the General Excise Tax

A characteristic of the G.E.T. is that it pyramids by sucessive taxation at each stage of production and sales. Hawaii is able to derive a high level of tax revenue from the G.E.T. because a very broad base of expenditure is subject to direct or indirect taxation. Virtually every final sale generates tax revenue; even sales to exempt organizations embody taxes incurred at earlier stages of production or distribution. Although effective excise tax rates of up to 12 percent have been claimed, the I-O analysis reported here shows that, in the aggregate, pyramiding is much less.

Estimates of pyramiding depend upon the definition of the direct tax base. That base could be the 4 percent final retail-level tax or slightly less than 4.5 percent, which would also include the 0.5 percent tax levied on all imported items for resale. The tax on goods and services purchased by Hawaii residents is an estimated 5.3 cents per dollar of final sales (Figure 2). Using the 4 percent base, pyramiding adds 32 percent to the average price of final goods and services. With the higher base of 4.4 percent, pyramiding adds 20 percent to final prices. Depending on which base one uses to measure pyramiding, taxes generated *indirectly* from final sales amount to only 20 to 32 percent of direct taxes.

The G.E.T. appears to pyramid slightly more on tourist expenditure than on resident expenditure because tourists spend a higher proportion for rental housing and for services. The G.E.T. pyramids more on rental property than on most other goods and services. A 4 percent tax is levied on the value of construction and other forms of investment. This is considered to be indirect tax revenue in this analysis; it is levied on businesses and assumed to be shifted forward to consumers. Renters (tourists and local renters) are subject to a further 4 percent general excise tax on their rent.

The service-intensive nature of tourism could also account for slightly higher pyramiding. Hotels and entertainment enterprises tend to purchase intermediate services. Since all services, intermediate or final, are taxed at the 4 percent retail rate, the greater degree to which intermediate services are embodied in a final sale, the greater the effective tax rate.

Caution is urged in drawing inferences from these results. First, the difference in effective tax rates is not great: 5.3 versus 5.4 percent. Second, estimation errors could account for some of the difference. And third, tourists require different government services than residents, making it difficult to determine whether tourists pay their fair share of taxes. Furthermore, a higher effective tax rate on tourists increases tax exporting.

Taxes on exports (also Figure 2) are mostly attributable to indirect taxes. Commodity exports are subject to a 0.5 percent intermediate tax. Exports (and imports) of services are taxed if the work was performed in Hawaii. The effective indirect tax rate on exports is one-third less than the effective indirect tax rate on personal consumption expenditures (P.C.E.).

Interpretation of the model relative to tax pyramiding must recognize that a sizeable portion of final goods and services is exempt from the retail tax. Those include sales to the federal government, duty-free purchases by tourists, and final sales by local nonprofit organizations. This study estimates pyramiding

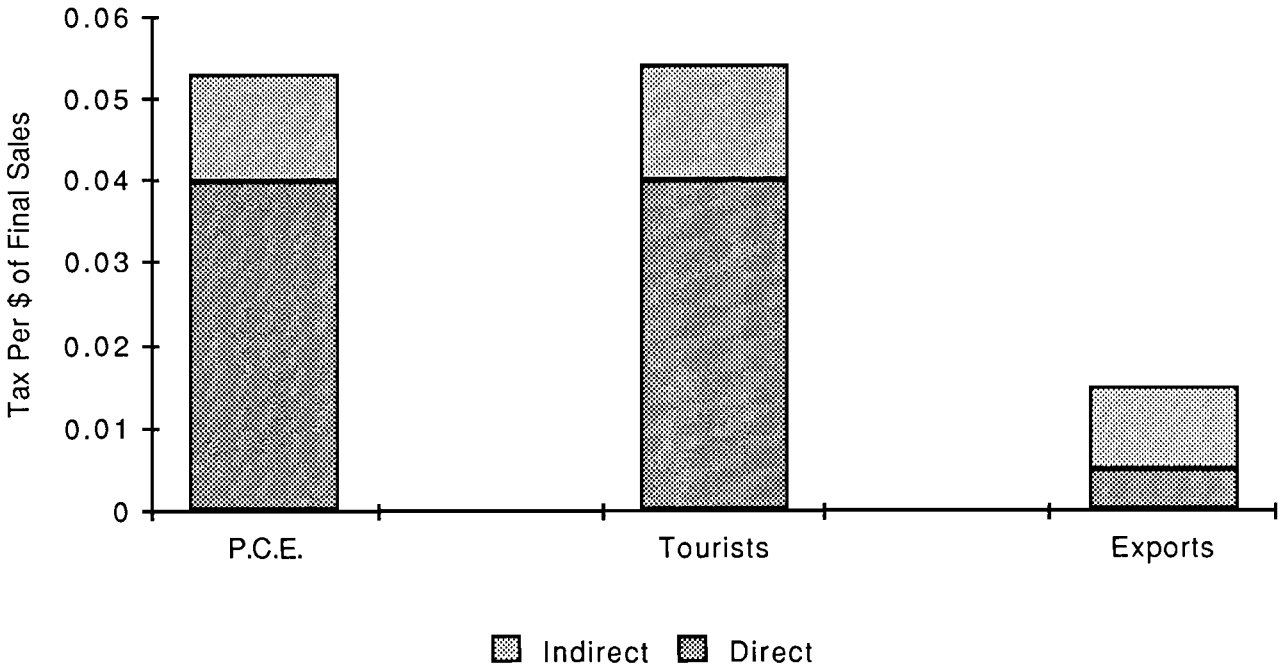

Figure 2. Tax pyramiding of the general excise tax by final demand category.

	Direct	Indirect	Total
Personal consumption expenditure (P.C.E.)	4.0	1.3	5.3
Tourists	4.0	1.4	5.4
Exports	0.5	1.0	1.5

only on *final* sales to tourists and for local personal consumption subject to the 4 percent retail rate.

Exporting of Business-related Taxes

A summary of taxes exported by type of tax is shown in Figure 3. The highest degree of exporting occurs with business income taxes (42 percent), followed by the liquor tax (40 percent). The lowest degree of exporting is the tobacco tax (9 percent). Most of the others fall between 31 and 34 percent with "in lieu of" taxes slightly lower than this range at 26 percent. The overall level of tax exporting of the taxes considered in this analysis was an estimated 32 percent.

Considering only the tax revenue exported (shaded region in Figure 4), tourists account for two-thirds, exports one-fourth, and the federal government one-twelfth of exported tax revenue.

The structure of the G.E.T. facilitates tax exporting. In total, one-third of the G.E.T. is exported under the assumption of full forward shifting. Tourists account for only 17 percent of total final sales in Hawaii but were estimated to pay 25 percent of the G.E.T. Although the tax per dollar of sales is roughly the same for tourists and for residents, there are fewer exempt sales to tourists. Only sales at the airport duty-free store escape direct taxation, and these are for commodities to be consumed outside of Hawaii.

Exports of goods and services accounted for only 5.5 percent of gross excise tax revenue. The federal government accounted for only 2.3 percent. This portion was all indirect tax revenue since the federal government is exempt from direct taxation. Personal purchases by servicemen and other federal employees were included in personal consumption expenditure.

ANALYSIS OF EFFICIENCY ISSUES

In general, it was found that tax pyramiding increased the G.E.T. effective tax rate by 35 percent. Net pyramiding due to intermediate-level business transactions accounts for 1.4 cents to each dollar of cost of goods and services purchased by final consumers, while the direct G.E.T. accounts for 4 percent.

Since we are dealing with an average rate of pyramiding, some goods and services would have a higher tax rate, others a lower tax rate. The high degree of aggregation in the I-O model masks the variance that occurs within groups of goods and services. While the model provided basic results on an industry basis rather than on a commodity basis, extensions of these basic results can provide more information; but reliability declines with efforts to achieve more disaggregated results.

To gain a better understanding of how different classes of goods and services are affected by tax pyramiding, six categories of consumer expenditure were analyzed by extending the basic I-O results. Four of these more refined expenditure categories were goods and two were services. Results are illustrated in Figure 5.

Pyramiding was homogeneous across the commodity groups of food, clothing, furniture, and drugs. The estimated low degree of pyramiding led the authors to conclude that efficiency concerns are minor for most *goods*.

Pyramiding was higher in the service industries, primarily because most services, intermediate as well as final, are taxed at the 4 percent retail rate. Service industries also tend to purchase from other service industries. The state I-O model indicated that in the commodity industries of sugar, fresh and canned pineapple, other food processing, and miscellaneous manufacturing, the purchases of intermediate services amounted to only 1 to 5 percent of sales value. In the service industries of banking and finance, hotels, health and professional services, and other services, purchases of intermediate services amounted to 11 to 18 percent of final sales value. The hotel sector had the highest propensity to purchase intermediate services, at 18.2 percent.

Higher pyramiding would be hypothesized to occur in capital-intensive industries. According to Hawaii tax law, intermediate purchases that are not physically incorporated into the goods and services produced are subject to the "final" tax rate of 4 percent. Thus, business capital investment expenditures for new buildings and equipment are taxed at the 4 percent rate. The hotel sector was estimated to have the highest direct and indirect tax rate because, as an industry, it is capital intensive and purchases a high degree of intermediate services.

ANALYSIS OF ALTERNATIVE TAX POLICIES

Given these general results related to tax pyramiding and exporting, the following policy issues were addressed, assuming the same level of total tax revenue:

1. Replacement of the gross receipts tax with a retail sales tax. A retail tax rate of 6.9 percent would be required even with a broadly defined retail tax base. Common exemptions for different types of services, food, and drugs would require a significantly increased base rate. Tax exporting would be lower (29 percent) under a broad-based retail sales tax than under the present gross receipts tax (33 percent).

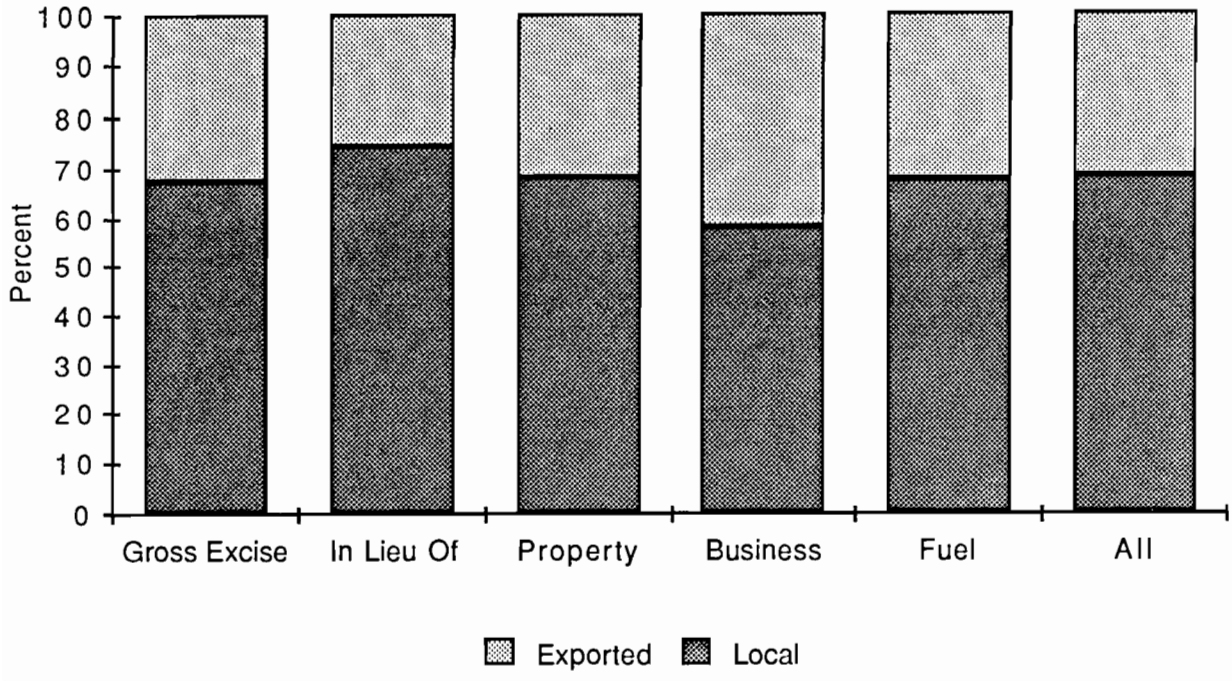

Figure 3. Taxes generated by selected categories, percentage local vs. percentage exported.

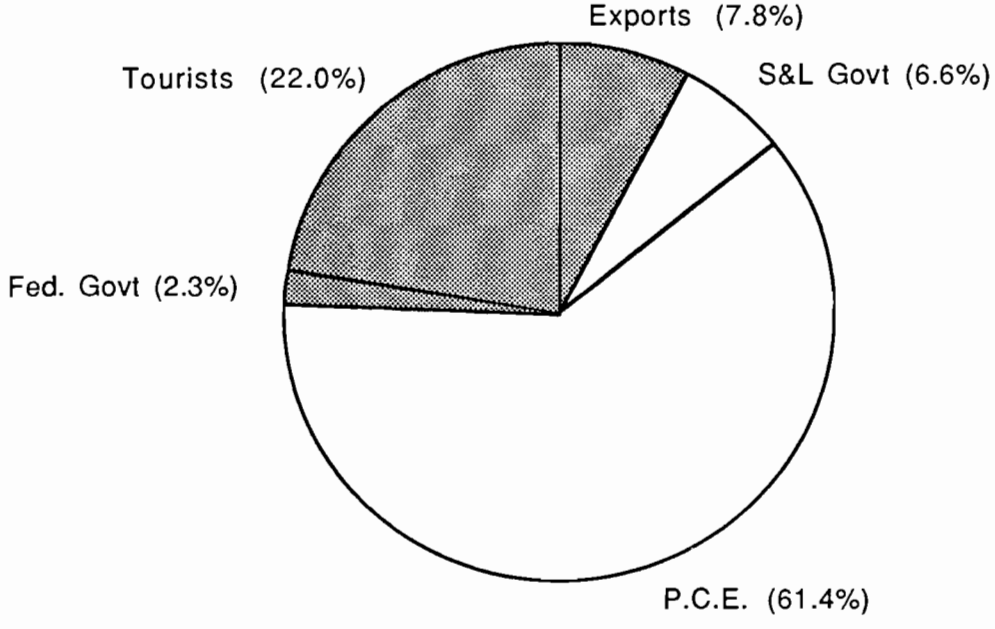

Figure 4. Percentage of taxes generated by final demand category, all taxes.

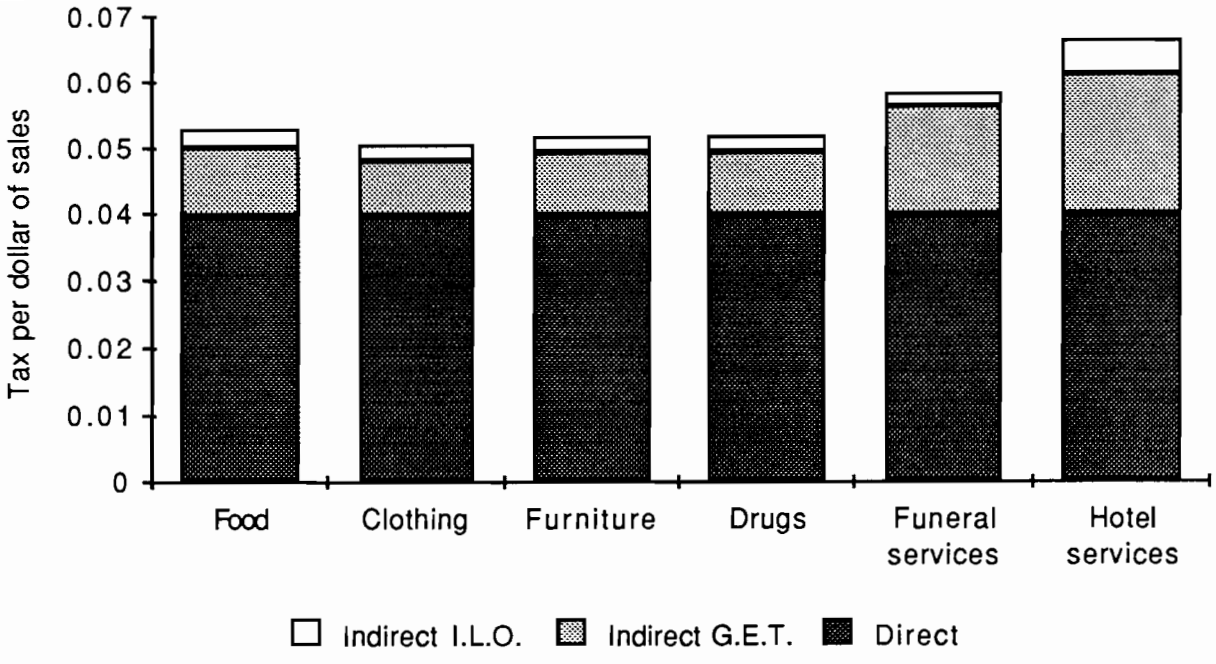

Figure 5. Direct and indirect taxes generated by sales of selected goods and services.

	Direct	Indirect G.E.T.	Indirect I.L.O.	Total
Food	0.040	0.010	0.001	0.051
Clothing	0.040	0.008	0.001	0.049
Furniture	0.040	0.009	0.001	0.050
Drugs	0.040	0.009	0.001	0.050
Funeral services	0.040	0.016	0.002	0.058
Hotel services	0.040	0.021	0.005	0.066

2. Replacement of the gross receipts tax with a combination 0.5 percent gross receipts tax and a retail sales tax. The retail sales tax rate would have to be 5.6 percent. Pyramiding of the 0.5 percent gross receipts tax would add an additional 0.3 percent. The effective average tax rate would be 6.4 percent for most goods and services. The tax export level was estimated to be 30 percent versus the present 33 percent export rate.

3. Replacement of the corporate income tax with an increased general excise tax. This policy would have little impact on prices and would necessitate increasing the present G.E.T. rates of 4 percent, 0.5 percent, and 0.15 percent to 4.36 percent, 0.545 percent, and 0.164 percent respectively. Tax exporting would decrease since a tax with a higher export rate (42 percent) would be replaced by a tax with a lower export rate (33 percent).

4. Exemption of food and drugs from the present general excise tax. The lost revenue from this exemption would be almost the same as that generated by the corporate income tax (approximately $40 million). Therefore, the tax rates estimated in the preceding policy analysis are also appropriate for this policy. Taxes exported, unlike the above case, would increase because the tax burden on residents would decrease relative to that on nonresidents.

SUMMARY

This study used the state I-O model to evaluate the pyramiding of the gross receipts tax and the exporting of Hawaii business taxes. Given assumptions about tax shifting, the model can estimate how taxes imposed at various stages of production affect final consumers.

Pyramiding of the gross receipts tax was estimated to account for 1.3 percent of the average sales price of goods and services purchased by Hawaii residents. This was in addition to the direct tax of 4 percent levied on sales to final consumers (although technically the tax is levied on the firm, not the consumer). Thus, the total effective tax on most goods and services purchased by residents was 5.3 percent. Visitors were estimated to pay a slightly higher average tax of 5.4 cents per dollar of final sales.

General excise taxes pyramid more on services than on commodities because all services are taxed at the 4 percent rate, whereas commodities are taxed at either the 0.5 percent or 4 percent rate, depending on the nature of the good. The highest service group was hotel services, with an effective tax of 6.6 cents per dollar of sales.

The broad base of the gross receipts tax allows for a significantly lower direct tax rate than a retail sales tax. This study estimated that a retail sales tax would require at least a 7 percent tax rate, which could be accomplished by defining the retail base more broadly than is commonly done.

Hawaii achieves favorable rates of tax exporting under the assumptions of this analysis. About a third of gross receipts, fuel, and property taxes are estimated to be paid by nonresidents. Business income and liquor taxes have higher export rates while "in lieu of" and tobacco taxes have lower export rates. Replacement of the gross receipts tax with a retail sales tax will lower tax exporting. The gross receipts tax is an effective means of taxing sales to the federal government, which cannot be accomplished with a retail sales tax. Special taxes that target tourists, such as hotel and entertainment taxes (see Fujii et al., 1984, for an analysis of tourist taxes), are further vehicles for tax exporting.

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