Submission to the Select Committee on the Taxation of Gas Resources

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1 Summary

This submission focuses on export taxes. We argue that export taxes could actually *reduce* total government revenue and are especially inappropriate for resources industries that have stepped production-costs with only finite supply a low cost production tiers. We also highlight that resources companies do indeed pay more tax than is commonly asserted.

The key recommendations are:

1. Australia should not impose an export tax on resources. Such an export tax risks reducing production and could *reduce* total government revenue via a reduction in corporate activity and income.
2. Australia should adopt a measured and nuanced approach to the tax discussion surrounding resources companies. It is inaccurate to assert that resources companies pay little-if-any tax. The evidence suggests otherwise.
3. Australia should focus on increasing resource production, including through natural gas and oil. Such an approach will ‘grow the pie’ through increased corporate income (and corporate income tax) and increased employment. Punitive and capricious tax changes will adversely impact this.

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2 How much tax do resources companies pay?

We can start by looking at how much tax gas companies pay. This is always challenging. Companies typically report earnings on a consolidated basis, meaning that international earnings and earnings from different businesses are often muddled.

Santos – which is largely an oil and gas company – gives us an idea. In FY 2025, Santos derived around USD 5 billion in revenue. However, revenue is *not* profit. For example, from that revenue, Santos must pay employee expenses. After deducting the cost of sales, Santos's gross profit is only USD 1.66 billion. Santos also has other costs, such as interest expenses. This reduces Santos's profit before tax to only USD 1.2 billion.

How much tax did Santos pay? Santos paid USD 372 million in total taxes. So, in percentage terms, it paid 31% tax based on its profits before tax or 22% tax based on gross profits (which, notably, would under-count Santos's expenses). In short, Santos pays tax. The argument that oil and gas companies per se do not pay tax is false.

3 Are export taxes beneficial?

We argue that export taxes have a profoundly negative impact on the economy and can reduce total government tax revenue. As we show, they are not a reliable source of revenue for the government. Indeed, export taxes could *reduce* government revenue, meaning that there would be no additional revenue generated with which to provide cost of living relief.

Policy makers often raise the prospect of export taxes. They are variously argued to increase tax revenue, benefit domestic supply by deterring exports, or both. The arguments become more prominent when export prices rise and companies are perceived to have made a windfall gain. However, the arguments implicitly assume a smooth supply response to the export tax, assuming that companies will absorb a marginal reduction in export prices while continuing to export, albeit at lower levels, in order to drive a stable government revenue base.

Australia, for example, has been debating whether to impose a 25% "windfall tax" on gas exports. To that end, Australia established a "Select Committee on the Taxation of Gas Resources", whose terms of reference specifically encompass export taxation (Select Committee on the Taxation of Gas Resources, 2026). Supporters of such a tax, including politicians, have claimed that exporters are "ripping off" consumers (Bennett, 2026; Pocock, 2026a), presumably by exporting goods for a higher price than would prevail under autarky. Additionally, they have claimed that an export tax "would raise billions of dollars" in tax revenue (Bennett, 2026; Pocock, 2026b). However, are the claims that an export tax would raise revenue, or boost domestic production, correct?

Here we critically evaluate the impact of an export tax, including the assumption that producers would absorb lower costs and government revenue would increase. We focus on what happens in industries with "stepped" production schedules. In such industries, production costs increase stepwise across production types. For example, in LNG and oil there can be cheap onshore production, offshore production, and unconventional production, all of which have different costs and all of which have capacity limits: only so much oil is available from cheap sources.

We develop a partial-equilibrium model of an exporting economy. A novel insight in the model is that we explore a piecewise linear production schedule in which different production tiers have different cost bases, meaning that entire production tiers become uneconomic at certain price points. The resulting discontinuities amplify welfare losses and exacerbate the fiscal Laffer curve: export taxes can *reduce* total government tax revenue by eroding corporate income tax, even at relatively low export tax rates. The model applies broadly to all commodity types and is especially relevant to the current debate about oil and gas export taxes.

The production model we explore is consistent with real world commodity production, and significantly improves upon simplified discussions that assume a smooth supply curve. For example, Aguilera (2014) highlights that different sources of petroleum have significantly different production costs, which costs increasing stepwise across production methods.

These cost-steps in turn can deter additional production relative to what would be the case with a smooth marginal cost curve (see e.g., Roberts et al., 2019). That is, with step-wise production cost increases, when low cost sources are exhausted, a significant price increase can be required to unlock an additional unit of production.

Within our model, we show that an export tax, and the associated reduction in effective revenue, can trigger a regime switch from an exporting equilibrium to autarky. This arises because the tax-adjusted price can fall below the breakeven point for specific production tiers. This contraction in production can be such that domestic demand consumes all production and exports can fall to zero. In this case, the export tax raises no direct revenue, and indirectly reduces revenue through the reduction in corporate tax receipts. Unlike standard export-tax models, which rely on a smooth supply schedule and may predict positive revenue for small taxes, we show that export taxes can reduce total government revenue even before exports cease, due to erosion of the corporate tax base.

The welfare implications of an export tax are unambiguously negative, but are asymmetric across stakeholders. As indicated, an export tax can actually *reduce* total government revenue via a reduction in corporate taxes. Given that the domestic price paid would fall, consumers make an initial gain. However, producers lose significantly from an export tax and lose by more than the consumers gain. If those same consumers own the producers' shares, then the consumers themselves would lose on aggregate.

Make several key insights. First, we show that export taxes can generate discontinuous regime switching when production occurs across heterogeneous cost tiers with finite capacity. Unlike standard smooth-supply models, export taxes can eliminate entire production tiers, leading to abrupt reductions in output and exports. Second, we show that export taxes can reduce total government revenue by eroding the corporate tax base, even when export tax revenue is positive. This creates a fiscal Laffer curve in which the revenue-maximizing export tax rate is substantially lower than the rate that maximizes export tax receipts alone. Third, we quantify critical tax thresholds that eliminate exports, reduce fiscal revenue, and trigger autarky equilibria.

The analysis further adds texture to empirical studies into export taxes. Empirical studies have highlighted the adverse effects of export taxes and our model helps to illustrate another channel through which losses occur. For example, empirical studies show that export taxes reduce welfare across a range of commodities, including rice in Thailand,[1] palm oil in Indonesia,[2] soybeans in Argentina,[3] and the implicit export tax system related to China's VAT system.[4] However, many of these commodities also could feature stepped production costs. The analysis in our paper helps to illustrate a channel through which export taxes in these fields reduce welfare, helping to illustrate another mechanism-of-action underlying empirical results.

A related literature examines mechanisms for capturing resource rents while attempting to avoid distorting production. These include production based royalties and rent taxes (Boadway and Keen, 2010; Garnaut and Clunies Ross, 1983). Such instruments aim to avoid supply side distortions, being variously designed as taxes on tonnage, gross profit, or net profit value. Royalties generally allow for cost deductions and do not typically segment between domestic and international sales.

We extend the export tax analysis to industries with stepped production cost structures. In this scenario, different extraction methods have different breakeven prices and finite capacity. Such merit-order cost structures are well-established within the electricity market. However, they have received comparatively little attention in the trade, public finance, and taxation literatures. By incorporating capacity plateaus between production tiers, we identify a regime switching mechanism, through which export taxes can eliminate the exports that they were trying to tax, exacerbating welfare losses. This effect does not arise in smooth-supply models and substantially amplifies the adverse welfare and fiscal effects of export taxes.

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[1] The export tax from 1961-1970 increased consumer welfare; however, could have had unintended consequences of reducing the incentive to invest in modern farming techniques, for example by creating a domestic price that was too low to justify the risk and price of upfront costs (Wong, 1978). It also can create an incentive for workers, and farmers, to shift from comparatively low revenue activities (i.e., rice farming) to other sectors, potentially undermining production, which could arguably improve welfare in developing economies (Ayal, 1965).

[2] The literature suggests that the palm oil export taxes reduced Indonesia's international competitiveness in the space (Obado et al., 2009; Rifin, 2010).

[3] Argentina's export taxes harmed producers and adversely impacted supply through the significant negative impact on the sectors (Devadoss et al., 2019).

[4] China used a system of VAT rebates in exports, which functioned as a de facto export tax. Relaxing the implicit export tax resulted in more exports and greater producer surplus in the relevant sectors (Chao et al., 2006).

The results in this paper have significant policy implications. Policy debates about export taxes typically arise during periods of high commodity prices. However, as we show, the impact of those export taxes is indeed sensitive to price reductions. Policy debates typically involve discussions surrounding export tax levels that significantly exceed what we find to be fiscal maximizing rates, and indeed are at levels we find would *reduce* total tax revenue. Our findings suggest that policy-makers should exercise significant caution when implementing export taxes and that such taxes indeed have significant adverse effects, especially in commodity markets.

3.1 Modeling the impact of export taxes

This section generalizes a model of export taxes in the context of step-wise production, as is often the case in the commodities sector. The essential insight is that such export taxes harm producers more than they help consumers. Furthermore, they risk *reducing* government tax revenue, especially when they result in deterring exports and shifting production towards autarky.

3.1.1 Model set up

We now analyze how an export tax would impact energy markets when we have different sources of production with different cost levels. We assume that there is a standard linear demand function: $Q_d = a - bP$, where a is the intercept, representing the quantity demanded when the price is zero and $b > 0$ is the sensitivity of quantity demanded to price. The inverse demand function is therefore $P_d = \frac{a}{b} - \frac{Q}{b}$.

The production being segmented means that there are different capacity levels in each production tier. That is, the supply is piecewise linear. This represents the idea that different sources of production are differently costly. For simplicity, we assume that there are three production tiers. For example, one could have onshore production, offshore production, and unconventional costly production. While we illustrate the model with three production tiers, the results generalize to any number of tiers.

We assume that each production tier has a different cost structure, such that they are only viable if the price is above a certain threshold. This is consistent with documented cost structures in commodities, including gas and petroleum extraction (see Aguilera, 2014). We assume the following:

$$
\begin{aligned}
P_0 &= \text{minimum breakeven price (cheapest conventional production)} \\
P_1 &= \text{price at which conventional capacity is exhausted} \\
P_2 &= \text{minimum price to justify offshore investment } P_2 > P_1 \\
P_3 &= \text{price at which offshore capacity is exhausted} \\
P_4 &= \text{minimum price to justify unconventional proudction } P_4 > P_3
\end{aligned}
$$

These different sources of production have different supply response slopes, which we denote s_1, s_2, s_3, with all greater than zero.

We then define the following capacity ceilings: $\bar{Q}_1 = s_1(p_1 - p_0)$ and $\bar{Q}_2 = \bar{Q}_1 + s_2(P_3 - P_2)$. The supply function is thus as follows:

Uneconomic to start
Too costly to produce
$$\rightarrow \{Q_s = 0 \quad \text{if } P < P_0$$

Cheap onshore production
Available to $\bar{Q}_1$units
$$\rightarrow \begin{cases} Q_s = s_1(P - P_0) & \text{if} P_0 \le P \le P_1 \\ Q_s = \bar{Q}_1 & \text{if } P_1 < P < P_2 \end{cases}$$

Offshore production
Available up to $\bar{Q}_2$units
$$\rightarrow \begin{cases} Q_s = \bar{Q}_1 + s_2(P - P_2) & \text{if } P_2 < P \le P_3 \\ Q_s = \bar{Q}_2 & \text{if } P_3 < P < P_4 \end{cases}$$

Unconventional & costly
$$\rightarrow \{Q_s = \bar{Q}_2 + s_3(P - P_4) \quad \text{if } P \ge P_4$$

The marginal cost of the Q^{th} unit is therefore:

$$
\begin{aligned}
MC(Q) &= P_0 + \frac{Q}{s_1} & \text{if } 0 \le Q \le \bar{Q}_1 \\
MC(Q) &= P_2 + \frac{(Q - \bar{Q}_1)}{s_2} & \text{if } \bar{Q}_1 < Q < \bar{Q}_2 \\
MC(Q) &= P_4 + \frac{(Q - \bar{Q}_2)}{s_3} & Q > \bar{Q}_2
\end{aligned}
$$

The policy parameters are that the world price is P_w. Suppose there is an export tax of $T\%$. This will push domestic prices to $P_d = P_w(1 - T)$, as we will see. But, this only holds if there is an export market. If there is no export market, then the domestic price is determined by ordinary domestic supply and demand.

We assume that the economy is a small price taker. The world price, P_w, is determined independently of the economy. Relaxing this assumption does impact the model. As asserted in Devarajan et al (1996), larger economies could influence world prices. In turn, by enabling world prices to respond to export taxes, the impact of the export tax would adjust. However, unless world prices adjust perfectly to the economy (which is unlikely absent monopoly power), export taxes will still have a similar impact to in our analysis.

The next step is to determine whether there is an export market. As indicated, the producer would export if the quantity supplied at the notional $P_d = P_w(1 - T)$ exceeds the quantity demanded. That is, if $Q_s\big(P_d = P_w(1 - T)\big) > Q_d\big(P_d = P_w(1 - T)\big)$. However, if the quantity demanded exceeds the quantity supplied at that notional domestic price, then there would not be any exports: all produce would be consumed domestically. This occurs if $Q_s\big(P_d = P_w(1 - T)\big) \leq Q_d\big(P_d = P_w(1 - T)\big)$. In this case, there would be no exports and the government would collect no revenue from the export tax. The domestic price would be determined by domestic supply and demand.

We can next solve for the autarky (i.e., no export) price, denoted P^*. In this scenario the quantity demanded is $Q_d(P^*) = a - bP^*$. To obtain the price P^* we set it equal to the quantity supplied $Q_s(P^*)$. The precise quantity depends on the production segment (i.e., whether the segment is in the low cost, medium cost, or high cost segment). In each segment, we set $Q_s(P^*) = Q_d(P^*)$. Thus, we have five regimes, matching production regimes.

- Tier 1, $0 \leq P^* \leq P_1$: Then $s_1(P^* - P_0) = a - bP^*$, then $P^* = \frac{a + s_1 P_0}{s_1 + b}$.
- Tier 2, $P_1 < P^* < P_2$: In this case the quantity reaches the plateau at $\bar{Q}_1$. In this case, we have $\bar{Q}_1 = a - bP^*$. Then, $P^* = \frac{a - \bar{Q}_1}{b}$.

- Tier 3, $P_2 < P^* < P_3$: In this case, we have $\bar{Q}_1 + s_2(P^* - P_2) = a - bP^*$. Then $P^* = \frac{a - \bar{Q}_1 + s_2 P_2}{s_2 + b}$.
- Tier 4, $P_3 < P^* < P_4$: Here, we are at another plateau, with production being locked at $\bar{Q}_2$. Then, we have $\bar{Q}_2 = a + bP^*$. This gives $P^* = \frac{a - \bar{Q}_2}{b}$.
- Tier 5, $P^* \geq P_4$: in this case we have $\bar{Q}_2 + s_3(P^* - P_4) = a - bP^*$. Then, rearranging, we get $P^* = \frac{a - \bar{Q}_2 + s_3 P_4}{s_3 + b}$.

The effective domestic price is then:

$$P_{eff} = \begin{cases} P_w(1 - T) & \text{in the export regime} \\ P^* & \text{in the autarky regime} \end{cases}$$

We can then determine the quantities. Before the tax, we have a domestic price of P_w, which is the world price. Here, the domestic quantity demanded before was $Q_{d,before} = a - bP_w$. And, the quantity supplied before was $Q_{s,before} = Q_s(P_w)$, where the quantity supplied is determined according to the marginal cost equations above.

After the tax, the domestic price is equal to P_{eff}, which itself depends on whether there are exports or we are in autarky. We then have $Q_{d,after} = a - bP_{eff}$. And, the quantity supplied is $Q_{s,after} = Q_s(P_{eff})$. The exports after are $\max(0, Q_{s,after} - Q_{d,after})$.

3.1.2 Consumer Surplus

We can start with consumer surplus. The demand curve is linear. Therefore, given that consumer surplus is the area under the demand curve but above the price curve, we have the area of a triangle. Thus, consumer surplus is $CS(P) = \left(\frac{1}{2}\right) Q_d(P) \left(\frac{a}{b} - P\right) = (a - bP)^2$. Therefore, we have:

$$\begin{aligned} CS_{before} &= (a - bP_w)^2 \\ CS_{after} &= \left(a - bP_{eff}\right)^2 \end{aligned}$$

Given that $P_{eff} \leq P_w$, we know that consumer surplus increases. We can decompose the consumer surplus into two major parts.

First, there is a transfer from producers to consumers (ignoring that consumers may indeed own the producers and lose via that ownership). This comes from the shift in price to P_{eff}. Geometrically, this is a rectangle. We can calculate this by multiplying the quantity demanded before the change by the new price. That is, we look at the change in price for the quantity the consumers were already interested in buying. That is, the surplus from transfer is $Q_{d,before} * \left(P_w - P_{eff}\right)$.

Second, if there are additional consumers entering the market due to that low price, we also obtain a surplus from the additional demand. Geometrically, this is a triangle and the relevant area is $\left(\frac{1}{2}\right)\left(Q_{d,after} - Q_{d,before}\right)\left(P_w - P_{eff}\right)$.

3.1.3 Producer Surplus

The producer surplus is calculated piecewise. Having regard to the marginal cost curves above, the surplus in each segment is $\int_a^b (P - MC)dQ$.

Before the tax, and assuming that the world price is above the threshold P_4, we can integrate across each segment to get:

- Tier 1, $Q = 0$ to $\bar{Q}_1$, then $PS_{1,before} = (P_w - P_0)\bar{Q}_1 - \frac{\bar{Q}_1^2}{2s_1}$
- Tier 2, $Q = \bar{Q}_1$ to $\bar{Q}_2$, then $PS_{2,before} = (P_w - P_2)(\bar{Q}_2 - \bar{Q}_1) - \frac{(\bar{Q}_2 - \bar{Q}_1)^2}{2s_2}$
- Tier 3, $Q = \bar{Q}_2$ to $Q_{s,before}$, then $PS_{3,before} = (P_w - P_4)\left(Q_{s,before} - \bar{Q}_2\right) - \frac{\left(Q_{s,before} - \bar{Q}_2\right)^2}{2s_3}$

The producer surplus after depends on where P_{eff} falls on the supply schedule. For each tier that is 'active', we compute the producer surplus with respect to the quantity associated with P_{eff}. However, given that $P_{eff} < P_w$ we know that the producer surplus declines.

3.1.4 Government revenue

Government revenue depends on two factors: (a) export taxes, and (b) changes in corporate tax received. Denoting the corporate tax rate as τ_c, this is given by:

$$\begin{aligned} \text{Export tax receipts} &= \left(P_w - P_{eff}\right) \times \text{Exports After} \\ \text{Corporate tax change} &= \tau_c \times (\text{Producer Surplus Before - Producer Surplus After}) \end{aligned}$$

We now establish key results regarding the fiscal impact of the export tax.

Proposition 1 (Autarky fiscal loss): If the export tax induces autarky, then the net fiscal impact is strictly negative.

Proof. In the autarky regime, exports are zero, so there are no export tax receipts. The effective domestic price satisfies $P_{eff} = P^* < P_w$, where P^* is the autarky equilibrium price. Since $P_{eff} < P_w$, producer surplus strictly declines. Given that corporate tax revenue is the tax rate multiplied by producer surplus, and producer surplus declines, total corporate tax revenue declines.

Interestingly, this proposition buttresses the literature on the gains from international trade. It is well documented that international trade can induce significant welfare gains (see e.g., Dixit and Norman, 1980). Our results support such literature by demonstrating the clear corporate tax channel through which fiscal tax gains accrue. That is, as export taxes bite into corporate earnings, corporate income tax receipts fall, which harms government revenue.

Proposition 2 (Export regime fiscal condition): If exports persist, the net fiscal impact is positive if and only if export tax revenue exceeds the foregone corporate tax revenue. That is, the government's fiscal position increases if and only if:

$$\left(P_w - P_{eff}\right) \times \text{Exports after} > \tau_c \times |\text{Change in Producer Surplus}|$$

Proof. In the export regime, export tax receipts are $\left(P_w - P_{eff}\right) \times \text{Exports After} > 0$ and producer surplus (PS) falls. Therefore, the government's net fiscal position, $\left(P_w - P_{eff}\right) \times \text{Exports After } + \tau_c \times (\text{Change in Producer Surplus})$, improves only if corporate tax revenue exceeds the foregone corporate tax income.

Proposition 3 (Laffer curve: cliff tax rate): There exists a tax rate $T_{cliff} \in \left(0, T_{autarky}\right)$ such that the net fiscal impact is positive for $T < T_{cliff}$, zero at $T = T_{cliff}$ and negative for $T > T_{cliff}$. Further, $T_{cliff} < T_{\max}$, where $T_{\max}$ is the revenue maximizing tax rate, if and only if $\tau_c \times |\Delta Producer\ Surplus|$ grows faster than the gross revenue from the export tax at the revenue maximum. *NB*: this leaving aside costs associated with mothballing production-types, and additional ripple effects throughout the economy.

Proof. We start with the situation where there is no export tax: At $T = 0$, Gross Revenue (GR) from export taxes is zero, and there is no change in producer surplus. For a small positive T, the government's gross revenue increases at approximately P_w × Exports Before while producer surplus decreases at a lower rate. Thus, corporate tax revenue (i.e., $\tau_c \times PS$) falls by less than the government makes from the export tax for small changes. However, as T trends towards the export-eliminating tax rate (call this T_{kill}), export tax gross revenue trends towards zero (as there are no exports). But, at this point, producer surplus is strictly decreasing. Thus, by continuity, total tax revenue cross zero at a point (we denote T_{cliff}). After there are no exports (i.e., $T > T_{cliff}$), the change in total tax revenue is non-positive.

Proposition 4 (Export taxes can reduce total fiscal revenue): There exists an export tax rate $T^* > 0$ such that total government revenue is strictly lower than under free trade. This occurs when the reduction in producer surplus (and hence corporate tax revenue) exceeds export tax receipts.

This proposition highlights that the fiscally optimal tax rate is strictly lower than the rate that might optimize export tax revenue alone. Policy proposals that focus solely on export tax revenue, without accounting for the erosion in the corporate tax base, will overestimate the revenue gains to an export tax regime.

The export tax revenue maximizing tax rate is then the tax rate that maximizes the product of the tax rate multiplied by the price by the quantity exported. That is,

$$T_{\text{export}} = \max_t \left[t \times P_w \times \overbrace{\left(Q_s(P_w(1-t) - Q_d(P_w(1-t)) \right)}^{\text{Quantity Exported}} \right]$$

However, as indicated, the government must also consider corporate taxes. The corporate taxes are approximately equal to the corporate tax rate multiplied by the producer surplus (i.e., gross profit). This means that the tax rate that maximizes government revenue is given by:

$$T_{\max} = \max_t \left[t \times P_w \times \overbrace{\left(Q_s(P_w(1-t) - Q_d(P_w(1-t)) \right)}^{\text{Quantity Exported}} - \tau_c \times |\text{Change in Producer Surplus}| \right]$$

3.1.5 When taxes stop exports or production tiers

The foregoing discussion indicates that there are several critical thresholds to consider: (a) the export tax rate that destroys exports, (b) the tax rates that eliminate production tiers, and (c) the revenue maximizing tax rates, assuming away the impact of sovereign risk as a deterrent to future production and economic activity.

We can start with the export eliminating tax rate. We saw earlier than autarky occurs when the domestic equilibrium price $P^* > (1-T)P_w$. That is, the tax rate that eliminates exports is $T_{kill} = 1 - \frac{P^*}{P_w}$. This leads to the following proposition.

Proposition 5 (export killing tax rate): There exists a tax rate, $T_{kill} = 1 - \frac{P^*}{P_w}$ such that exports cease.

We next know that production tiers are rendered uneconomic if the effective price, P_{eff}, falls below the production tier's breakeven point. This occurs if the resultant equilibrium price is below that breakeven point of production tier k, or $P^* < P_{\text{breakeven},k}$. Thus, the tax rate that results in production tier k becoming uneconomic is the tax rate such that $T_k^* = 1 - \frac{P_{\text{breakeven},k}}{P_w}$. We capture this in the following proposition.

Proposition 6 (production tier killing tax rate): There exists a tax rate T_k^* such that production tier k becomes uneconomic at any tax rate above T_k^*, with $T_k^* = 1 - \frac{P_{\text{breakeven},k}}{P_w}$.

3.1.6 Comparative statics

We now examine how the key welfare and fiscal results respond to changes in model parameters. We focus on the export tax rate (T), the world price (P_w), and the demand sensitivity (b).

The comparative statics highlight that export taxes are most harmful when production costs are heterogeneous, domestic demand is elastic, and export tax rates are high. Indeed, we identify the important result that total tax revenue does *not* per se increase with export tax rates and in fact can *decrease* as export tax rates increase. The conditions discussed are common across resource and commodities industries, especially oil and gas. In such industries, production costs vary significantly across extraction technology and multiple production methods are typically required due to limits to the amount that can be extracted from low cost tiers.

3.1.6.1 Tax rate effect

Increasing the tax rate T reduces the effective domestic price. This has three effects. It increases consumer surplus, decreases producer surplus, and, if exports persist, generates export tax revenue.

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For the consumer surplus, we observe that consumer surplus is $\int_0^{Q_d}\left(P_d(Q) - P_{eff}\right)dQ$, where $P_d(Q) = \frac{a}{b} - \frac{Q}{b}$ is the inverse demand curve. Thus, we get $CS = \int_0^{Q_d}\left[\left(\frac{a}{b} - \frac{Q}{b}\right) - P_{eff}\right]dQ$. Evaluating the integral yields $\left[\left(\frac{a}{b} - P_{eff}\right)Q - \frac{Q^2}{2b}\right]_0^{Q_d}$. We also know that $Q_d = a - bP_{eff}$. Therefore, we have $\left(\frac{Q_d}{b}\right)Q_d - \frac{Q_d^2}{2b} = \frac{Q_d^2}{2b} = \frac{\left(a-bP_{eff}\right)^2}{2b}$. Now, if exports persist, then $P_{eff} = P_w(1-T)$, as explained above. Therefore, the consumer surplus is $CS = \frac{\left(a-bP_w(1-T)\right)^2}{2b}$. Differentiating with respect to T yields $\frac{dCS}{dT} = [a - bP_w(1-T)]P_w$. But, recall that $Q_d\left(P_{eff}\right) = a - bP_w(1-T)$. Therefore, $\frac{dCS}{dT} = Q_d\left(P_{eff}\right)P_w$. Thus, we observe:

$$\frac{d(CS)}{dT} = [a - bP_w(1-T)]P_w > 0$$

The interpretation of this is that increasing the export tax rate increases consumer surplus, with the benefits coming from the reduction in price and the increase in the quantity demanded at that lower price.

For the producer surplus, the producer surplus (PS) is the areas above the supply (marginal cost) curve and below the price. That is $PS = \int_0^{Q_s}\left[P_{eff} - MC(Q)\right]dQ$. Because the marginal cost curve is piecewise, the integral is computed segment-by-segment. For a single segment $MC(Q) = c_0 + c_1Q$, running from Q_L to Q_U. This yields $PS = \int_{Q_L}^{Q_U}\left[P_{eff} - c_0 - c_1Q\right]dQ$. This yields $PS = \left(P_{eff} - c_0\right)(Q_U - Q_L) - \frac{c_1\left(Q_U^2 - Q_L^2\right)}{2}$. The total producer surplus is the sum across the three tiers. But, recall that $P_{eff} = P_w(1-T)$ in the export regime. Thus, PS reduces with tax increases.

For the net fiscal position, we find a non-linear relationship. For brevity, we denote the net fiscal position as $NF = GR + \tau_c\Delta PS$, where GR is the gross export tax revenue, τ_c is the corporate tax rate, and ΔPS is the change in producer surplus.

We start by looking at gross export tax revenue. Now, we know that gross export tax revenue is $GR = P_w \times T \times Exports(T)$. In turn, this equals $P_w \times T \times \left[Q_s\left(P_w(1-T)\right) - Q_d\left(P_w(1-T)\right)\right]$. That is, the exports are simply the difference between the quantity that the producer would supply at price $P_w(1-T)$ and what the domestic market demands.

Differentiating yields $\frac{dGR}{dT} = P_w \times Exports + P_w \times T \times \frac{d(Exports)}{dT}$. But, we know that $\frac{d(Exports)}{dT} < 0$, thus we observe two effects: gross export revenue can increase with tax rates, with $\frac{dGR}{dT} > 0$ up to a point. But, gross revenue receipts increase at a decreasing rate as the reduction in exports becomes more prominent.

We now look at corporate income tax revenue. The change in corporate income tax receipts is $\tau_c \Delta PS$. Differentiating with respect to T yields $\frac{\tau_c d(PS)}{dT} = -\tau_c Q_s P_w$. But, we know that producer surplus declines with export taxes. Recall that export tax rates reduce corporate income by reducing the total quantity supplied and the price received. Therefore, we observe that $\frac{d(\mathrm{T}_c \Delta PS)}{dT} < 0$.

We now consider total fiscal revenue: Because gross export revenue increases at a decreasing rate and corporate income tax receipts are decreasing, we observe a fiscal Laffer curve (i.e., after a point, higher tax rates result in lower tax revenue). Furthermore, we observe that the tax rate that maximizes gross export tax revenue is above the rate that maximizes total revenue when accounting for corporate income taxes.

3.1.6.2 Effect of world price

Holding the tax rate constant, increasing the world price P_w will have a differential impact depending on whether exports persist. If there are exports, then a higher P_w increases producer surplus, reduces consumer surplus, and increase the net fiscal position (relative to a lower world price).

If P_w is sufficiently low, the regime switches to autarky and there are no exports. As previously discussed, this critical price is where $Q_s\big(P_w(1-T)\big) = Q_d\big(P_w(1-T)\big)$. Or, where $P_w = \frac{P^*}{1-T}$, where P^* is the autarky equilibrium price. Thus, a sufficiently low world price results in less fiscal revenue (i.e., corporate income declines and there are no export tax receipts).

3.1.6.3 Effect of demand elasticity

The demand slope, b, tells us the domestic demand elasticity. A higher elasticity means a greater price reduction results in more domestic demand. And, the higher the elasticity, the more likely we are to face autarky. To observe this, consider the export killing tax rate, $T_{kill} = 1 - \frac{P^*}{P_W}$. Now, P^* depends on b because it derives from the demand-supply interaction. Thus, P^* is increasing in b. Therefore, $\frac{d(T_{kill})}{db} < 0$. That is, the more elastic the demand, the lower is the export tax threshold that eliminates exports. The intuition is that a more elastic demand results in a greater demand response for a given reduction in prices. By contrast, inelastic demand results in little demand response to a price drop, leaving more room for exports.

3.1.7 Comparison with a smooth supply curve

The foregoing discussion assumes a stepped supply curve with capacity plateaus. A natural question is how this stepped supply curve compares with a smooth supply structure. The following discussion highlights that the stepped supply curve exacerbates the adverse impacts associated with export taxes. The extent of this adverse impact will depend on the nature of the production/supply plateaus.

To compare smooth and stepped supply curves, we calibrate the model such that the smooth-curve supply initially produces the same aggregate output as in the stepped supply curve at the world price P_W. That is, we define $Q_{s,smooth}(P) = \sigma(P - P_0)$ for $P \geq P_0$. Now, we choose σ such that $Q_{s,smooth}(P_W) = Q_{s,stepped}(P_W)$. Thus, $\sigma = \frac{Q_s(P_W)}{P_W - P_0}$.

Autarky price comparison: Under a smooth supply curve, autarky effectively arises where the quantity demanded exactly equals the quantity supplied (i.e., domestic demand consumes all supply). That is, $Q_{s,smooth}(P^*) = Q_d(P^*)$. Or, $\sigma(P^* - P_0) = a - bP^*$. This gives $P^*_{smooth} = \frac{(a+\sigma P_0)}{\sigma+b}$. By contrast, under stepped supply, $P^*_{stepped}$ depends on the segment in which equilibrium falls. For any price within the plateau region of the stepped curve, the stepped curve produces strictly less output (as the price does not yet justify more production). Given that the stepped curve produces strictly less output, this implies that the autarky price under the stepped curve is higher than under the smooth curve. That is $P^*_{stepped} > P^*_{smooth}$.

Export killing tax rate: We previously saw that $T_{kill} = 1 - \frac{P^*}{P_w}$, where P^* is the autarky price. But, since $P^*_{stepped} > P^*_{smooth}$, the smooth supply curve tolerates a higher export tax rate before exports stop than does a stepped supply curve. Intuitively, the stepped curve creates supply plateaus that make autarky easier to trigger.

Net fiscal comparison: The net fiscal position is less unfavorable under a smooth supply curve. This is for two reasons. First, because $T_{kill,smooth} > T_{kill,stepped}$, the export tax can generate more revenue over a greater range of tax rates. Second, the change in producer surplus, ΔPS, is smaller in magnitude under the smooth curve (i.e., because entire production tiers are not eliminated). Therefore, corporate income tax revenue, $\tau_c \Delta PS$ decreases by less under a smooth supply curve. This implies that the fiscal Laffer curve peaks at a higher tax rate under a smooth supply curve.

The net result of this is that a stepped supply curve exacerbates the adverse effects of an export tax relative to a smooth supply curve. This amplification occurs through several channels. First, the autarky price threshold is easier to cross under a stepped supply curve. Second, the discrete tier exit creates greater deadweight loss under the stepped supply curve. Third, under a stepped supply curve, the corporate income tax base erodes faster than under a smooth supply curve.

3.1.8 General equilibrium considerations

The foregoing model is a partial equilibrium model. In general equilibrium, reductions in commodity production would result in labor and capital being reallocated to other sectors. There is some empirical evidence to this effect. For example, when Thailand imposed export taxes on rice, some evidence suggests that workers moved from agricultural work to cities and to other sectors (Ayal, 1965; Warr, 2001). However, several factors suggest that adverse effects could persist.

First, stranded equipment is not necessarily reusable or redeployable. Our model highlights that export taxes can render production tiers uneconomic. However, the property, plant, and equipment used in those sectors is not necessarily useable elsewhere. For example, oil extraction equipment is only apt to be used for oil extraction.

Second, human capital is not instantly redeployable. Modern-day commodities production is a high skill, technologically advanced, field. It often involves specialized skills. If an export tax eliminates production tiers, those individuals might reskill, or use their skills laterally. However, given that human capital is mobile, those individuals would also plausibly move overseas. Furthermore, if the individual remains local, but shifts sector, it is not obvious their productivity would be maintained. Instead, it is readily plausible that an individual who was highly specialized, who must now move into a different field, might be less productive than they previously were. This means that overall tax revenue, for example, would fall even if employment is preserved.

Third, export taxes increase operational risk. The risk flows directly decision to impose an export tax, thereby undermining corporate profits, devaluing existing operations, and potentially eliminating production sectors. Phrased differently, the decision to impose an export tax and undermine existing corporate activities sends a signal that the government will interfere in productive sectors. Given that an export tax is most desirable, from the government's perspective, when prices (and profits) are high, this sends a signal that the government will undermine corporate profits during 'good times'. This is especially harmful in commodities industries, which rely on good periods to offset lulls: reducing, or removing, upside gains significantly increases risks in addition to reducing cash flows.

Fourth, in resources sectors, the reduction in production tiers also reduces resource rents and potential royalties. Thus, even if human and financial capital is redeployed to other sectors, the reduction in resource rents persists. This reduction in royalties exacerbates the reduction in corporate income taxes discussed within the model.

4 A numerical example

We start with a numerical illustration of how export taxes can indeed *reduce* government revenue and can undermine supply. We highlight the impact of there being different production methods with different cost bases. More expensive production is viable only at certain price levels. The key insight is that export taxes can undermine production by rendering unviable production that would have been viable.

4.1 The model

In our scenario, we have a resource producer. The logic applies regardless of resource type. We use numbers approximately calibrated to oil production prices. However, the model applies to any commodity with a stepped production schedule. We use round numbers for simplicity and for illustration purposes. We assume in this scenario that the prevailing world price is $P_w = \$100$ and is determined by international factors that the specific country does not control.

We assume three types of supply: easy onshore, offshore, and unconventional. Conventional production is viable if the price is at least $30. However, there is only so much production capacity: It maxes out at 30 units. Middle-difficulty (offshore) production becomes viable at $50. This offers another 50 units of capacity. Unconventional, or difficult, production becomes viable at a price of $80. The heterogenous production types result in supply plateaus at certain price points. The tiers are inspired by those in Aguilera (2014), with prices broadly corresponding real world oil production prices (see e.g., Busby, 2024; Exarheas, 2026).[5] These arise where production of one type is maximized but the price is insufficient to justify the next type of production.

We illustrate the production schedule in Figure 1. We must necessarily make assumptions about supply elasticity, which we summarize below. While changing the supply elasticity does change the model's precise results, the insights remain qualitatively similar at different elasticities. We summarize the supply schedule as follows.

[5] We note that there are significant complexities estimating oil production break even prices, which can arise from (inter alia) fluctuating input costs and supply chains (Callen, 2023).

Uneconomic to start Too costly to produce	→	$\{Q_s = 0 \quad \text{if } P < 30$
Cheap onshore production Available to 30 units	→	$\begin{cases} Q_s = 3(P - 30) & \text{if } 30 \le P \le 40 \\ Q_s = 30 & \text{if } 40 \le P \le 50 \end{cases}$
Offshore production Available up to 80 units	→	$\begin{cases} Q_s = 30 + 2.5(P - 50) & \text{if } 50 < P \le 70 \\ Q_s = 80 & \text{if } 70 \le P \le 80 \end{cases}$
Unconventional & costly	→	$\{Q_s = 80 + 1.5(P - 80) \quad \text{if } P > 80$

The domestic demand structure is as follows. We assume that the producer produces according to their supply curve. If domestic demand is exhausted, they can sell internationally. The prevailing market price is $P_w = 100$. We assume that the world market price is largely independent of the domestic demand and is set by global factors. This assumption is realistic for companies with small production levels. However, becomes less realistic for large producers (i.e., Saudi Arabia for oil). For our purposes the domestic demand curve is given by $Q_d = 120 - 0.5P$ (and the inverse demand curve is $P = 240 - 2Q$). Thus, at a world price of $P_w = 100$, the quantity demanded is 70 units.

In this case, the producer finds it viable to start unconventional and costly production. In this case, the quantity supplied is $Q_s = 80 + 1.5(100 - 80) = 110$. Now, suppose there is a 25% export tax, then the price the producer receives falls to 75. This is because the domestic price will move, in equilibrium, to the world price the producer would receive less the tax. At this price, that unconventional and costly supply becomes non-viable. So, we only have cheap onshore and offshore production. This means that the quantity supplied becomes $Q_s = 80$. The quantity supplied thus falls when the export tax is imposed.

The export tax in this scenario shifts us towards autarky: the quantity demanded domestically under the export tax scenario would exceed the baseline quantity supplied. This means that domestic consumption will absorb all production. In this case, the export tax becomes irrelevant: there are no exports. So, to obtain the market clearing price, we check the price when we land on the 'plateau' of 80 units production. This gives $80 = 120 - 0.5P$, or a domestic price of $P = 80$.

We next analyze how export taxes impact welfare. We depict the welfare effects in Figure 2. Here, we show the impact of the export tax on consumer surplus, producer surplus, and the resultant deadweight loss.

We can start with the consumer. The consumers are superficially better off. The consumer surplus is the area under the demand curve and above the price, from $Q = 0$ to $Q = Q_d$. The inverse demand curve is $P = 240 - 2Q$ (recall that the demand curve is $Q_d = 120 - 0.5P$). So, the consumer surplus before the export tax was 4900.[6] Now, the consumer surplus after is 6400.[7] This is an increase of 1500. Now, this appears to be better for domestic consumers *if* we ignore the fact that producers are also owned by consumers, meaning that it is erroneous to simply assume that consumers gain when those same consumers own the producers which could also lose.

We can now look at what happens to the producer. Suppose that the quantity produced is between zero and 30, then the marginal cost curve is $MC = 30 + \frac{Q}{3}$. From 30 to 80 it is $MC = 38 + \frac{2}{5}Q$. From 80 units it is $MC = \frac{80}{3} + \frac{2}{3}Q$. We then integrate from the prevailing price to the supply (or marginal cost) curve. That is $\int_a^b (P - MC)dQ$. With no export tax, at a prevailing price of $P_w = 100$, all three production tiers are active and the producer surplus is 4,250. However, after the export tax, the price falls to $80. Only the first two production tiers are active. Producer surplus falls to $2350.

The question is then what this means for government revenue. Before the export tax, there was no export tax revenue, but corporate income tax receipts were $1275 = 4250 × 30% at a corporate tax rate of $\tau_c = 30\%$. After the export tax, there are no exports (i.e., the tax renders the exports uneconomic). Thus, the export tax does not raise revenue. However, because the tax forces sales to a domestic market, and the producer earns less surplus (i.e., $2350), corporate income tax receipts fall to $705. Thus, total government revenue falls by $570.

[6] $\int_0^{Q_d}(240 - 2Q - P)dQ = \int_0^{70}(240 - 2Q - 100)dQ = [140Q - Q^2]_0^{70} = 4900$

[7] $\int_0^{Q_d}(240 - 2Q - P)dQ = \int_0^{80}(240 - 2Q - 80)dQ = [160Q - Q^2]_0^{80} = 6400$

4.2 Sensitivity analysis

This section explores the welfare effects, and fiscal revenue effects, of adjusting the export tax rate and the world price. This section highlights that net fiscal revenue becomes negative at even low export tax rates. We also highlight that an export tax might only generate revenue at high relative world prices, which themselves are inherently unstable.

4.2.1.1 Varying export tax rates

We next look at the impact of varying the export tax rate (T) on welfare and total tax revenue. We depict the impact of tax rates in Figure 3. In this sensitivity analysis, we assume that the world price (P_w) is \$100, a corporate tax rate (τ_c) of 30% and a cost structure as in the foregoing numerical example

The sensitivity analysis offers a low end estimate of the adverse impacts of export taxes. It does not incorporate additional downstream impacts (i.e., to parts suppliers as production shuts down). Furthermore, it does not incorporate the costs associated with mothballing production. We document the critical tax thresholds in Table 1. There are several key insights.

First, the tax rate that maximizes export tax gross revenue is approximately 10% in this scenario. This is in Panel (c) of Figure 3. The export tax maximizing rate does depend on the production schedule. However, the key insight is that the rate is below the initial baseline rate of 25%, meaning that regulators must carefully calibrate a rate. Furthermore, as we will see, while export tax revenue is maximized, total tax revenue is not.

Second, the tax rate that maximizes total tax revenue is approximately 2%. This is in Panel (f) of Figure 3. This is notably below the rate that maximizes export tax revenue. This comes from the reduction in corporate tax revenue as higher export taxes reduce producer surplus (i.e., profit), which reduces corporate tax receipts.

Third, the tax rate at which total tax receipts become negative is approximately 3.9%. That is, at an export tax rate of 3.9%, the loss in corporate tax more than offsets the gain in export taxes. This is clearly from Panel (f) of Figure 3, which highlights the relationship between the total net fiscal position and export tax rates. Furthermore, total tax receipts fall even before autarky commences. This implies that export tax receipts do not per se increase with export tax rates and that higher export tax rates can raise less revenue than lower rates (and this is due to the impact of the rates on corporate activity).

Fourth, the tax rate that kills exports is approximately 20%. In our scenario, this also eliminates tier three production. This rate is above both the export tax revenue maximizing rate (10%) and the total tax maximizing rate (2%). This suggests that tax receipts start declining even before exports stop. Furthermore, in our scenario, the export tax rate of 25% eliminates exports.

The foregoing analysis indicates that a 25% export tax rate in this scenario is deeply negative. At such a rate, total tax receipts fall and autarky commences. While not in the model, the elimination of such exports would also have longer lasting impacts. As indicated, we also anticipate further downstream impacts, including from mothballed production and suppliers to producers.

4.2.1.2 Varying world price

We can further explore what happens as the world price changes. Here, we assume that the export tax rate is 25% and the corporate tax rate is 30%. Recall from the foregoing that an export tax rate of 25% and a world price of $P_w = 100$ results in autarky in this scenario. The sensitivity analysis to varying the world price is in Figure 4. Focusing on Panel (f), the following key thresholds emerge.

First, for any world price $P_w < 107$, we get autarky at a world export tax rate of 25%. Given that exports are zero, gross export tax receipts are also zero. The government loses (per the foregoing tax sensitivity analysis) and is worse off than without the export tax.

Second, for a world price $107 \leq P_w < 134$, exports survive but the government still loses. In this range, the producer will still export. The government will collect export tax revenue. However, producer surplus has fallen and this more than offsets the increase in export tax receipts.

Third, if $P_w \geq 134$, the government finally benefits through increased export tax revenue. Here, corporate tax receipts have fallen. However, the export tax receipts more than offset the decline in corporate tax income.

The key implication from this analysis is that export taxes are not a reliable source of revenue and are sensitive to world prices. For example, if world prices decline, then the existence of an export tax can *reduce* total government revenue and total government revenue only increases at high price levels.

4.3 Conclusions

Export taxes are frequently proposed as a mechanism to raise government revenue and reduce domestic prices in commodity markets, including oil and gas. In this paper, we develop a partial-equilibrium model to examine the impact of ad valorem export taxes on industries with tiered production costs, where different extraction methods, such as conventional onshore, offshore, and unconventional production, have sharply different breakeven prices and finite capacity. This stepped cost structure is characteristic of extractive industries including petroleum, natural gas, and minerals.

We establish three main results. First, an export tax can trigger a discrete regime switch from an exporting equilibrium to autarky. When the tax-adjusted price falls below the breakeven of the marginal production tier, that tier exits entirely, and the resulting supply contraction can be sufficient for domestic demand to absorb all remaining output. In this regime, the export tax generates zero direct revenue. Second, the reduction in producer surplus caused by the export tax lowers corporate tax receipts, and this effect can more than offset any export tax revenue, even at low tax rates. In our calibration using petroleum production cost parameters, the government's net fiscal position turns negative at tax rates as low as 4%, and the export-revenue-maximizing rate of 10% already produces a net fiscal loss. Third, at commonly proposed rates, such as 25%, all exports are eliminated and reduces total government revenue by approximately 45% relative to the no-tax baseline, with the entire loss borne through reduced corporate tax receipts.

Several qualifications of the analysis should be noted; however, these largely strengthen and reinforce the findings in our paper. The model is a partial equilibrium model and does not capture the full general equilibrium effects of the export taxes. However, in such a framework, the adverse effects of export taxes would persist. These include the dynamic effects of production tier shutdowns, including the irreversibility of decommissioning, the loss of specialized human capital, and the long lead times required to restart mothballed capacity. These dynamic effects would amplify the welfare losses documented here. Additionally, the model does not capture the sovereign risk channel: the imposition of an export tax signals regulatory unpredictability, which raises the cost of capital for future resource investment and may deter exploration and development beyond the direct price effect.

The model also assumes a price-taking economy; for large exporters with significant market share, the terms-of-trade effect would partially offset domestic welfare losses. Even when a country has market power, stepped production costs still create discontinuities. A terms-of-trade gain from an export tax may coexist with tier exit, implying that the fiscal and welfare effects remain ambiguous and potentially negative.

The results are directly relevant to policy debates surrounding export taxes. Such debates have often centered on oil and gas production. However, export taxes have also been applied to agricultural commodities, such as soybeans, beef, and rice. Our results are generalizable across commodity-type. We highlight that policy makers should exercise caution before considering export taxes, including in mining, agriculture, and energy commodities.

The policy implications are clear. Export taxes on commodities with heterogeneous production costs are a substantially more harmful fiscal instrument than standard smooth-supply analyses suggest. This implies that export taxes are substantially more fragile fiscal instruments than conventional tax policies, with revenue outcomes highly sensitive to price fluctuations and cost heterogeneity. The maximum net revenue is small, and the downside risks, autarky, stranded capacity, and net fiscal loss, are large. Policymakers considering such taxes should account not only for the direct export tax revenue but also for the indirect erosion of the corporate tax base, which in our analysis dominates at all but the lowest tax rates.

5 Tables

Table 1: Critical tax thresholds

This table reports the critical export tax rate thresholds and their effects on welfare and government revenue. The baseline parameters are: world price P_w= \$100/bbl, corporate tax rate τ_c = 30%, demand Q_d = 120 − 0.5P, and supply thresholds P_0 = \$30, P_1 = \$40, P_2 = \$50, P_3 = \$70, P_4 = \$80 with tier slopes s_1 = 3.0, s_2 = 2.5, s_3 = 1.5. Net fiscal is defined as export tax revenue plus the change in corporate tax receipts. Pre-tax exports are 40 units and pre-tax government revenue (corporate tax only) is \$1,275.

Tax Rate	Event	Net Fiscal Impact
2%	Total fiscal revenue maximized	+\$6.9
3.9%	Net fiscal revenue turns negative	\$0
10%	Export tax revenue (cf. total fiscal revenue) is maximized	-\$107.5
20%	Exports eliminated	-\$570
25%	Proposed policy rate	-\$570

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6 Figures

Figure 1: Production schedule

Piecewise linear supply curve with capacity plateaus. The supply curve reflects three production tiers — conventional onshore (breakeven $30/bbl), offshore ($50/bbl), and unconventional ($80/bbl) — each with finite capacity. Between tiers, supply is vertical: existing capacity is exhausted but the price is insufficient to justify the next tier's infrastructure. Capacity ceilings are $\bar{Q}_1$ = 30 (conventional) and $\bar{Q}_2$ = 80 (conventional + offshore). Parameters: s_1 = 3.0, s_2 = 2.5, s_3 = 1.5.

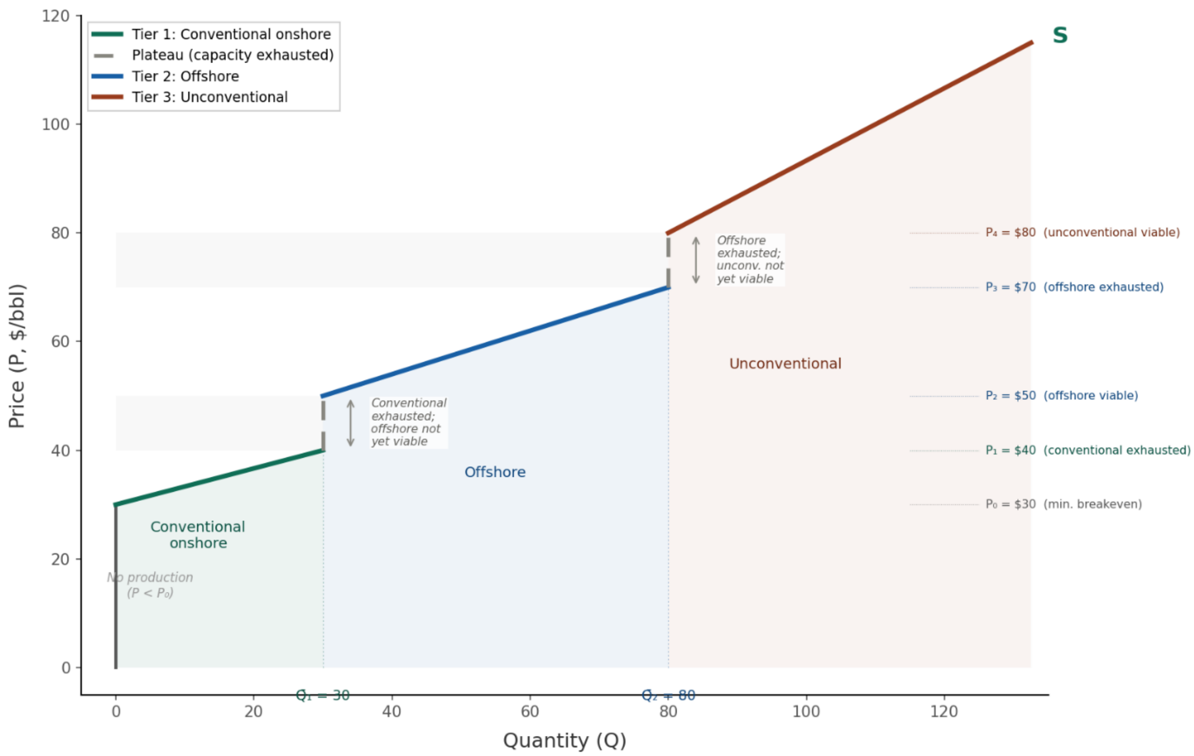

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Figure 2: Supply and Demand

Supply, demand, and welfare effects of a 25% export tax. The stepped supply curve reflects three production tiers with breakeven prices at $30, $50, and $80/bbl. Before the tax, the world price of $100 supports 110 units of supply, 70 of domestic demand, and 40 units of exports. The export tax drives the domestic price to $80 (the autarky equilibrium), eliminating Tier 3, contracting supply to 80, and absorbing all output domestically. Area A represents the consumer surplus gain; areas B and C represent consumption and production deadweight loss respectively. The hatched region denotes stranded Tier 3 capacity.

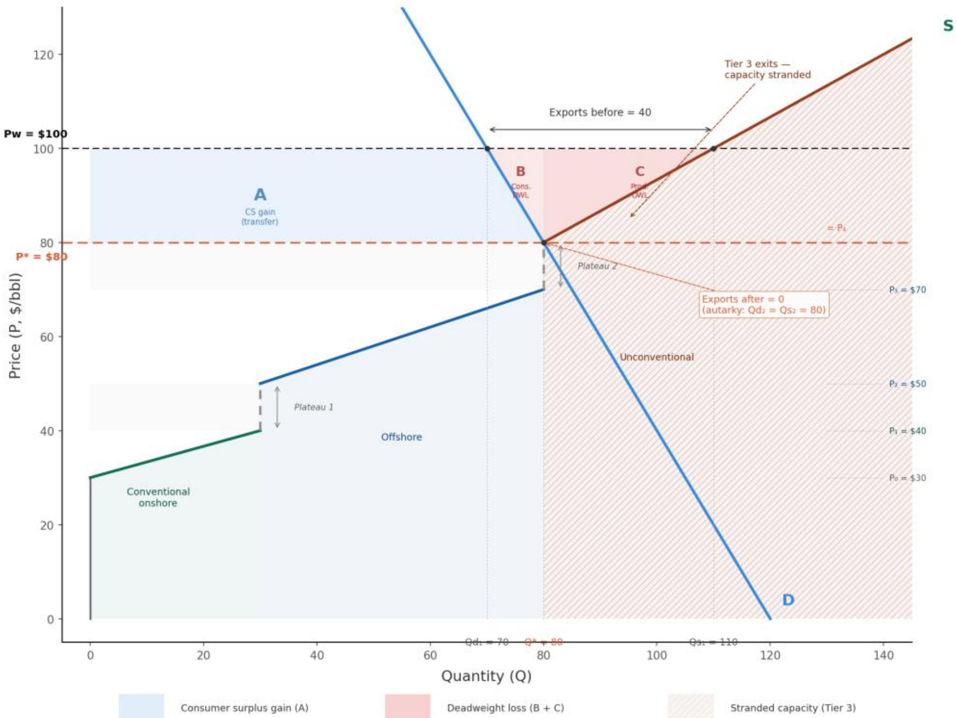

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Figure 3: Export tax sensitivity

Each panel shows the response of a key variable to export tax rates from 0% to 50%, holding the world price at $P_w = \$100/bbl$ and the corporate tax rate at τ_c = 30%. The vertical dashed line marks the export-killing threshold (T = 20%), beyond which the economy enters autarky. Panel (a): effective domestic price. Panel (b): export volume. Panel (c): export tax revenue, which peaks at approximately T = 10%. Panel (d): changes in consumer surplus, producer surplus, and export tax revenue. Panel (e): deadweight loss. Panel (f): net fiscal position (export tax revenue plus change in corporate tax receipts), which turns negative at approximately t = 4% and reaches −\$570 in autarky. All other parameters as in Table 1.

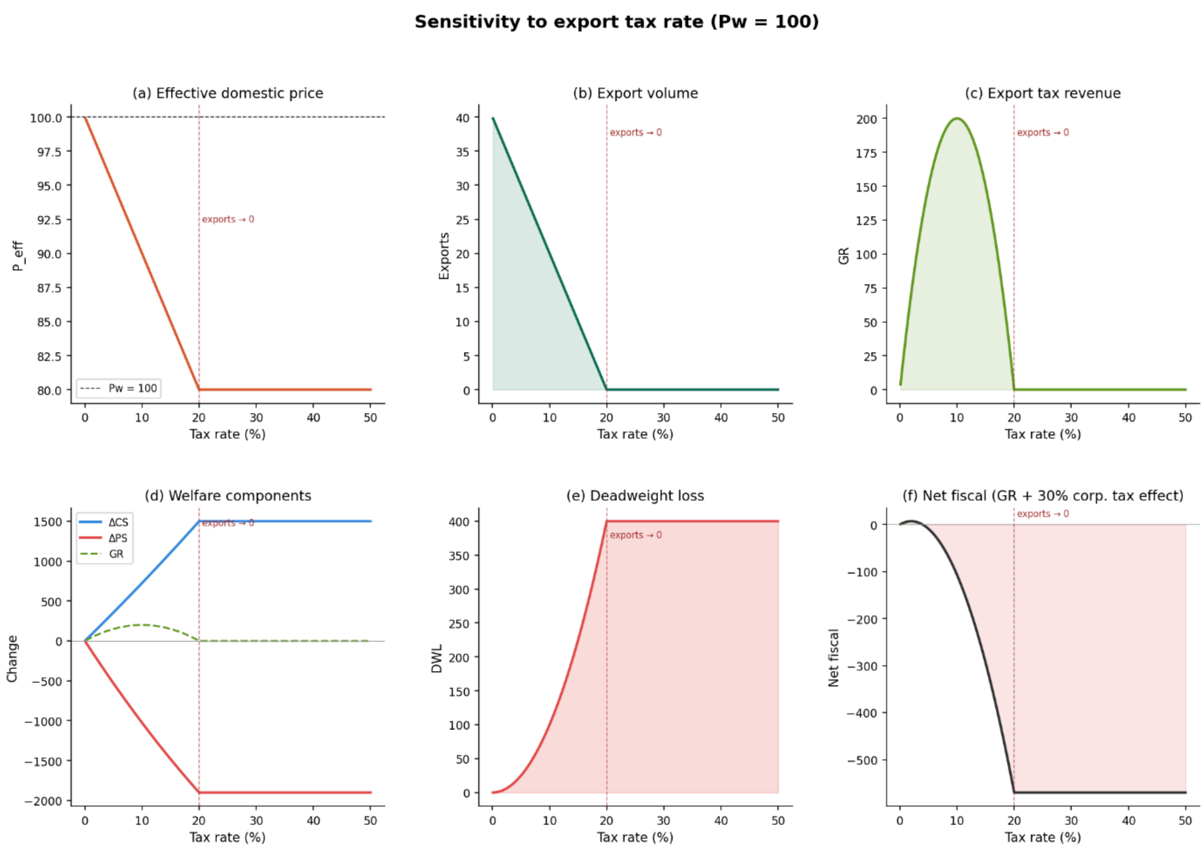

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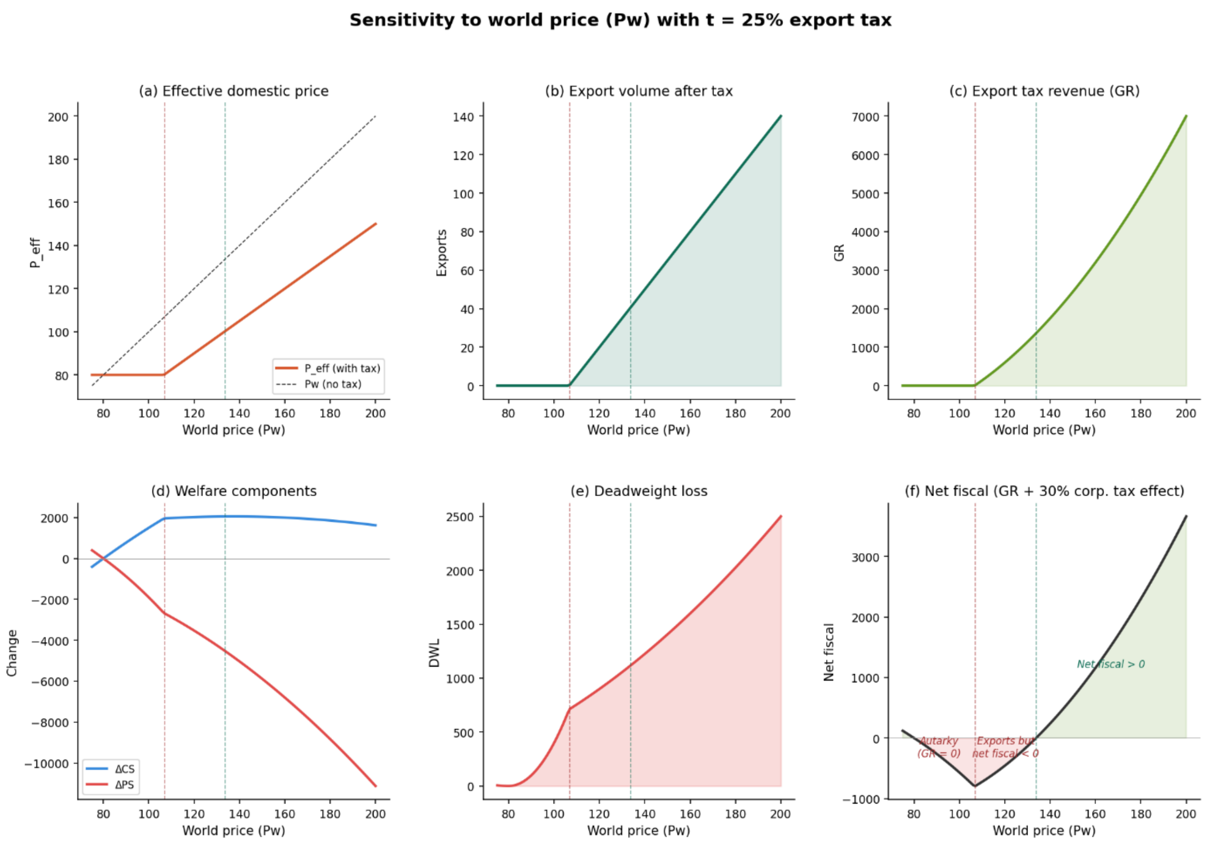
Figure 4: Varying world price

Each panel shows the response of a key variable to world prices from \$75 to \$200/bbl, holding the export tax rate at T = 25% and the corporate tax rate at τ_c = 30%. The red dashed line marks the price at which exports resume ($P_w = \$107$), and the green dashed line marks the price at which the net fiscal position turns positive (P_w = \$134). For P_w < \$107, the economy is in autarky: the export tax generates zero revenue and the government loses through reduced corporate tax. For $\$107 \leq P_w < \$134$, exports survive but the net fiscal position remains negative. Only above $P_w = \$134$ does the 25% tax generate positive net revenue. All other parameters as in Table 1.



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