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Illusory Revenues: Import tariffs in Resource-Rich and Aid-Rich Economies

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Illusory Revenues: Import tariffs in Resource-Rich and Aid-Rich Economies

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Abstract

Where imports are financed predominantly by rents from resource extraction or aid, the revenue generated by tariffs is illusory. Revenue earned by the tariff is offset by a reduction in the real value of aid and resource rents. Revenue is however moved between accounts in the government budget which, in the case of aid, may reduce the burden of donor conditionality. We demonstrate this proposition for a simple central case and show that the result is not overturned by generalisations around this case. We argue that trade policy formulation in such economies should recognise the illusory nature of tariff revenues.

Keywords: Aid, natural resources, import tariffs

JEL classification: F1, F35, Q3.

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1. Introduction:

In this paper we analyze the true fiscal consequences of import tariffs for governments with large revenues from resource exports or foreign aid. We show that in such countries the revenues generated by tariffs are offset by unrecorded reductions in the real values of resource rents and aid flows, so that the apparent revenues are illusory. It is possible that tariffs even reduce true revenue, and in the process they have the usual negative effects on real income and export diversification. Despite this, there is no evidence that resource or aid rich economies have lower tariff rates than do other countries at similar levels of income[1].

The revenue argument for tariffs has become increasingly powerful as old arguments for protection have been discredited, and concern about loss of government revenue may be a powerful impediment to further trade liberalization. This concern receives support from some orthodox sources. The IMF advises resource-rich economies to focus on the 'non-resource fiscal balance' (IMF 2007). Since tariffs transfer revenue from the resource account to the non-resource account this advice inadvertently encourages trade restrictions. Similarly, in measuring the fiscal deficit the IMF treats aid as a financing item whereas tariff revenue is classified as revenue. These practices have the unintended effect of making tariffs appear prudent even if, as we will show in this paper, their true effects are to be revenue-neutral and economically damaging.

Although import tariffs may not raise government's total real revenue they do raise tariff revenue at the expense of reducing real revenue from aid or resources. This conversion of aid flows into tariff revenues creates a revenue stream free of burdensome donor conditions, so is a route for fungibility that has not previously been considered in the literature. Tariffs have the effect of shifting real revenue from the budget head of aid, on which donors set such conditions, to a category which donors recognize as the government's 'own' revenues and which are thereby free of conditions. Similarly, resource revenues may be released from constitutional rules governing their distribution between provinces within the country or otherwise constraining their use. To the extent that they recognize these effects, governments with high aid receipts or resource revenues may choose higher tariff levels than they would otherwise see as desirable.

Why is the revenue effect of tariffs in resource-rich and aid-rich countries likely to be illusory? The central analytical idea is simple: resource exports and aid are rents which accrue to the government and, while tariffs raise their own revenue, they also reduce the real

[1] There is weak evidence that the height of tariffs is *positively* related to the importance of resource revenues, see Collier and Venables (2008).

value of these rents. Consider an economy that has an exogenously determined supply of foreign exchange coming from resource revenues or from aid. Import demand depends on the price of imports relative to other goods, and this relative price is determined by the equality of imports to the given supply of foreign exchange. Import tariffs raise the price of imports but, since they cannot change their *relative* price, they also increase domestic prices proportionately. So while the import tariff raises revenue it also reduces the domestic purchasing power of the resource or aid revenues, effects that, in the simplest case, exactly net out. An alternative intuition comes from Lerner symmetry (the equivalence of import tariffs and export taxes[2]). Taxation of inelastic foreign exchange flows (resource rents and aid flows) has no direct effect on government revenues if these flows would in any case accrue to government.

Our central result – that tariff revenue is entirely illusory – is derived in an extremely simple economy, but we show that natural generalisations of the economy can leave the result intact. For example, if the private sector purchases some of the natural resource then the import tariff may *reduce* real government revenue. Relaxing the assumption that the supply of foreign exchange is perfectly price inelastic has ambiguous effects, but is not inconsistent with the central result of the paper. We therefore suggest that trade policy formulation in aid or resource-rich economies needs to recognise the likelihood that import tariffs do not necessarily raise revenue for government.

2. The model

We build a minimal analytical model, just rich enough to capture our main argument and explore its robustness. The model has three goods, one non-tradable and two tradable, one of which may be a natural resource.[3] There are private agents and government. Government revenue can come from aid, from ownership of a fraction of the fixed factor in the resource sector, and from import tariffs. The private sector sells labour and sector specific factors.

The non-tradable good is produced by labour alone; we set labour input per unit output at unity, so its price is equal to the wage rate, w. The export good is labelled X and is sold at fixed world price p. Production is described by a revenue function $R^X(p, w)$

[2] Lerner symmetry is an implication of the fact that, in the absence of nominal rigidities, equilibrium quantities depend only on relative prices. See **xx** for a recent statement. It holds in economies with real distortions.
[3] This 3-sector structure is similar to the classic study of resource booms by Corden and Neary (1982).

with $R_p^X > 0, R_w^X \leq 0$ [4]. We will usually think of the X sector as the natural resource producing sector, so $R^X(p,w)$ is resource revenue, i.e. the rent accruing to the X-sector specific factor. The import competing good we label M; it has fixed world price of unity and is subject to tariffs at tariff factor t, so the domestic price is t and free trade is $t = 1$. It has revenue function $R^M(t,p,w)$, with $R_t^M > 0, R_w^M < 0, R_p^M \leq 0$, indicating that the sector uses as inputs labour, the non-tradable (with price w), and possibly good X (with price p) as an intermediate.

Private and public sector budget constraints are respectively

$$E(t,p,w)u = wL + R^M(t,p,w) + (1-\beta)R^X(p,w), \tag{1}$$

$$E(t,p,w)g = A + \beta R^X(p,w) + (t-1)m(t,p,w;v). \tag{2}$$

$E(t,p,w)u$ is private consumption expenditure with homothetic preferences, utility u, and price index $E(t,p,w)$ which is increasing in prices of M and X sector goods, t and p, and the price of the non-tradable, w. The private sector receives wage income wL (L is the fixed labour force), the whole of revenue accruing to the fixed factor in the M-sector, and fraction $(1 - \beta)$ of resource rents. Eqn. (2) is the public sector budget constraint. Real government consumption (or 'utility'), g, has the same price index (unit cost function) as private utility[5]. It is financed by international transfer A, share β of resource rents, and by tariff revenue on imports. Imports are $m(t,p,w;v) \equiv E_t(t,p,w)v - R_t^M(t,p,w)$, where v denotes total utility, $v \equiv u + g$, and subscripts denote partial derivatives, so the terms are demand for imports in private and public consumption minus M-sector supply.

We need one further equilibrium condition and the simplest to use is labour market clearing. This is

$$L = E_w(t,p,w)v - R_w^M(t,p,w) - R_w^X(p,w) \tag{3}$$

where the terms on the right hand side are labour used in non-tradeable production, $L^N = E_w(t,p,w)v$ [6]; in the M-sector, $L^M = -R_w^M(t,p,w)$; and in the X-sector,

[4] For simplicity, we do not allow it use good M as in input, although note that the fixed world output price p can be defined net of any imported inputs that are not subject to tariffs.
[5] It is simplest to think of g as lump sum transfer to households; we discuss the implications of relaxing this assumption later in the paper.
[6] Labour used in non-tradable production is equivalent to consumption of leisure.

$L^X = -R_w^X(p,w)$. Eqns (1) – (3) characterise equilibrium, implicitly defining values of endogenous variables *w*, *u* and *g*. What is the effect of a change in the tariff, *t,* on the equilibrium, and in particular on real government revenue *g*?

2.1 Lump sum aid and resource rents:

The simplest case is that in which foreign exchange earnings are lump sum transfers (i.e. perfectly price inelastic) and accrue entirely to government. We capture this by assuming that there is no *X*-sector and all foreign exchange earnings are contained in *A*. In this case payments balance is simply $A = m(t, p, w; v)$ so the public sector budget constraint (2) is

$$E(.)g = A + (t-1)A \quad \text{or } e(w/t)g = A. \qquad (2')$$

The second equation uses the fact that *E*() is homogenous of degree one and, since it no longer depends on *p*, we can define function *e*() such that $te(w/t) = E(t,w)$ for all *t, w*. Writing the public sector budget constraint this way makes it clear that – in this special case – *g* depends only on *A* and *w/t*. Furthermore, labour market clearing (3) becomes

$$L = e'(w/t)v - r'(w/t) \qquad (3')$$

where $r(w/t)$ is constructed analogously to $e(w/t)$, so $tr(w/t) = R^M(t, p, w)$. Eqn (3') makes it clear that *w/t* is independent of *t*, since the relative price of the two goods in the domestic economy has to remain unchanged to clear the labour market. Given this, eqn (2') indicates that *g* is simply proportional to *A*, so is unaffected by tariffs. However, while the tariff has no real effect, it does have a nominal effect. In terms of the numeraire, total government revenue is *tA*, of which aid receipts are *A* and import tariffs are (*t* – 1)*A*, so proportion (*t* – 1)/*t* of government revenue accrues as tariff revenue. Increasing *t* shifts revenue between government accounts, but as *t* increases so *w* and the price index increase equi-proportionately, leaving *g* unchanged.

3. Tax and cost effects

Does the simple result of the preceding sub-section survive when foreign exchange earnings are more than simple lump sum transfers to government? To address this we return to the more general model by reinserting the *X*-sector. Answers come from the public sector budget constraint, (2), and by looking only at changes in the neighbourhood of free trade, *t* =

1. Since this economy has no imperfections such changes have no effect on total utility and $dv = 0$.[7] Differentiating (2) around $t = 1$,

$$E.dg = mdt + \beta R_w^X dw - \left(E_t dt + E_w dw\right)g \,. \qquad (4)$$

This says that real government consumption adjusts (dg) in response to a change in tariff revenue; a change in wages that affects costs in the X-sector and hence government receipts of resource revenue; and via the price index effect, measuring the changing cost of government consumption.

Eqn (4) can be written in a more useful way. Using $d(w/t) = dw - wdt$ (around $t =$ 1) and homogeneity of revenue and expenditure functions[8], (4) becomes

$$E.dg = \left[m + \beta\left\{R^X - pR_p^X\right\} - g\left\{E - pE_p\right\}\right]dt - \left[E_w g - \beta R_w^X\right]d(w/t) \,. \qquad (4b)$$

Payments balance is

$$m = \left\{pR_p^X + pR_p^M - pE_p v\right\} + A = \left\{pR_p^X + pR_p^M - pE_p v\right\} + Eg - \beta R^X \qquad (3b)$$

where the term in curly brackets is the value of exports of X (production minus domestic intermediate usage and consumption); the second equation uses the public sector budget constraint, (2), to substitute for A. Using (3b) in (4b) gives

$$E\frac{dg}{dt} = \left[(1-\beta)pR_p^X - \left\{pE_p u - pR_p^M\right\}\right] - \left[E_W g - \beta R_W^X\right]\frac{d(w/t)}{dt} \,. \qquad (5)$$

(+/-) (+) (+/-)

Δ real revenue = *tax effect* – *cost effect*

This expression is equivalent to equation (4), and its derivation is essentially an application of Lerner symmetry, converting the import tariff into an equivalent export tax. It is useful because it separates out two effects. The ***domestic tax effect*** is the first term on the right hand side and depends on private sector net sales of good X, the base of an export tax. The second is the domestic relative ***cost effect***, capturing the effect of a change in the wage (and price of non-tradables) on the cost of government consumption ($E_w g$) and the government's resource rents ($-\beta R_w^X$). Evidently the sign of dg/dt depends on these two effects, and we look at each in detail.

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[7] Easily checked by differentiating (1) and (2) and calculating $du + dg$.

[8] $pR_p^X + wR_w^X = R^X$, $pE_p + wE_w + tE_t = E$

3.1 The domestic tax effect

To focus on the domestic tax effect we set $d(w/t)/dt = 0$ and rearrange (5) as

$$E\frac{dg}{dt} = pR_p^X\left[(1-\beta) - \left\{pE_p u - pR_p^M\right\}/\,pR_p^X\right]. \qquad (5a)$$

.

The right hand side of this equation is private net sales of good X. pR_p^X is the value of X output, of which fraction (1- β) is owned by the private sector, and fraction $\left\{pE_p u - pR_p^M\right\}/\,pR_p^X$ is used by the private sector. Evidently, these nets sales may be positive or negative. They are negative if β is close to unity and the private sector uses a substantial share of X output in consumption and as an intermediate, in which case an increase in the tariff reduces real government revenue. The intuition is that the government is a net seller of X to the domestic private sector so an import tariff (equivalently export tax) which reduces the domestic price of X thereby lowers government receipts.

Illustrative numbers for the government share of rent from a natural resource are in the range 70 – 80% for most hydrocarbon producers; they are typically lower for minerals, although Botswana takes 70% of diamond rents. [9] (1 - β) can therefore be thought of as being less than 30% for many resource rich countries. The share of resource output used for private sector consumption and intermediate use varies according to the commodity and country. While close to zero for Botswana's use of diamonds, for oil the share can be much higher, amounting to 38% in Iran, 19% in Saudi Arabia, 13% in Nigeria.[10] Of course, these numbers are illustrative and depend on resource prices and country circumstances. They nevertheless make the point that the tax effect can be positive or negative, so results may lie on the side of the 'central case' of section 2.

3.2 Tariffs and domestic costs

The second effect in eqn. (5) is the ***cost effect***, giving the effect of a change in the wage (relative to the tariff) on the cost of government consumption ($E_w g$) and the government's resource rents ($-\beta R_w^X$). Both these terms are non-negative since government is a purchaser of labour for use in public consumption and in X-production. The effect is therefore to

[9] See IMF (2007)

[10] BP Statistical Review, CIA Factbook. These figures are inclusive of government consumption of the oil, for which data is not available, so are overestimates of domestic private sector use.

increase (decrease) real government revenue according as wages go up proportionately less than (more than) the tariff.

This equilibrium response $d(w/t)/dt$ can be derived from the labour market clearing condition, (3). We have already seen, in section 2.1, how homogeneity implies that w and t have to move equiproportionately, if the X-sector is absent. More generally, the response comes from differentiating eqn. (3) (given p and L, and in the neighbourhood of free trade so $t = 1$ and $dv = 0$) to give

$$0 = \{E_{ww}v - R^M_{ww} - R^X_{ww}\}dw + \{E_{wt}v - R^M_{wt}\}dt\,. \qquad (6)$$

Once again using $d(w/t) = dw - wdt$ together with homogeneity[11] gives

$$\{R^M_{ww} + R^X_{ww} - E_{ww}v\}\frac{d(w/t)}{dt} = p\{R^X_{wp} + R^M_{wp} - E_{wp}v\}. \qquad (6b)$$

The term in brackets on the left hand side is positive by the curvature properties of revenue and expenditure functions, so the sign of $d(w/t)/dt$ is that of the right hand side. This depends on whether or not an increase in the wage (price of non-tradables) increases exports of good X, given utility. The first term in brackets gives the effect of the wage on X-sector output effect and is negative; an increase in one of the input prices reduces output. In a Cobb-Douglas example $R^X(p,w) = (1-\alpha)p(\alpha p/w)^{\alpha/(1-\alpha)}K^X$, where α is the share of labour and K^X is the quantity of the specific factor, and the second order partial derivative is $R^X_{wp} = -(R^X/pw)\alpha/(1-\alpha)^2 \le 0$. Notice the share of labour, α, may be very small in a resource sector. The magnitude of this effect is then small, as local costs have little effect on production of the resource. The second term gives the effect of an increase in w on demand for X as an input in M-sector production and is positive with a Cobb-Douglas technology. The revenue function is $R^M(t,p,w) = (1-\gamma-\delta)t\left((\gamma t/w)^\gamma(\delta t/p)^\delta\right)^{1/(1-\gamma-\delta)}K^M$, where γ is the share of labour, δ the share of X, and K^M is the specific factor. The second order partial derivative is $R^M_{wp} = (R^M/pw)\delta(\gamma+\delta)/(1-\gamma-\delta)^2 > 0$, reflecting the fact that (given output price t) the two inputs are substitutes. The final term $E_{wp}v$ captures whether non-tradables and X-sector output are complements or substitutes in consumption. Either is possible, so combining this with R^X_{wp} with R^M_{wp} gives ambiguity of the sign of $d(w/t)/dt$.

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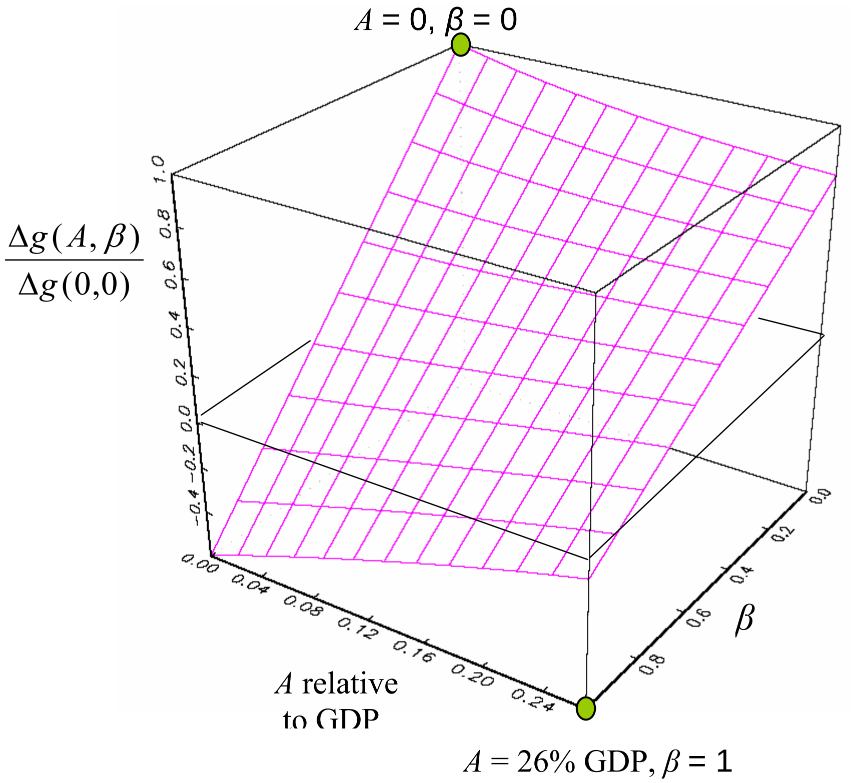
[11] $pR^X_{pw} + wR^X_{ww} = 0,\ pR^M_{pw} + tR^M_{tw} + wR^M_{ww} = 0,\ pE_{pw} + tE_{tw} + wE_{ww} = 0$

Once again, natural generalisation of the model indicates that effects can lie on either side of our central case. While our central argument is based on what appear to be extreme assumptions, its conclusion is robust to relaxation of these assumptions.

3.3 Combining effects

We have argued that in aid- or resource-rich economies import tariffs may not raise real government revenue. Our model is a standard specific factors model with a non-tradable sector, and with the two crucial extensions that government receives some lump sum transfer of foreign exchange, *A*, and a share of resource rents, *β*. How do changes in these parameters affect our results? There is no clear analytical way to answer this (it is essentially asking for the general equilibrium second order partial derivative of *g* with respect to *t* and *A* or *β*). However, figure 1 presents findings from a numerical example which illustrates the answer.

Figure 1: Varying aid and government's share of resource rents.



The simulation uses Cobb-Douglas preferences, CES production technologies, and generalises the model slightly by allowing for a specific factor in the non-tradable sector. The model and parameter values are outlined in the appendix. Fig. 1 has parameters *A* and *β* on the horizontal axes so the point $A = 0, \beta = 0$ is a 'standard' trade model with neither aid nor resource rents, and in which the tariff has a positive effect on g. Δg is the change in real revenue associated with increasing the tariff factor from $t = 1.1$ to 1.2, and the height of the surface expresses this for each value of A, β, relative to Δg in the model with $A = 0$, $\beta = 0$ ($\Delta g(0,0) > 0$). As illustrated, giving government either of the rents, $A > 0$ or $\beta > 0$, reduces the real revenue raised by the tariff increment, as the surface falls away from the point $A = 0$, $\beta = 0$. The surface is negative for large enough values of β, so there is a locus of value of A and β along which the tariff change has no effect on g.

4. Extensions

Non uniform tariffs: Our core model has a single import good and single tariff rate. What happens if there are different import goods with different tariffs ? In our central case (section 2.1) the effect of dividing the import sector into two identical sectors, only one of which is subject to the tariff, is that an increase in the tariff strictly reduces g. The reasoning is as follows. Consider a small tariff increase around free trade. For total imports to remain equal to the fixed supply of foreign exchange the volume of the untaxed import must increase by the same amount as the taxed one declines. This requires equal but opposite sign changes in the prices of the untaxed import, $1/w$, and the taxed import, t/w (both these prices expressed relative to w), so $d(1/w) = - d(t/w)$, i.e. $dw/w = dt/2$, from which it follows that $dE/E = dt/2$. This means that the real value of non-tariff revenue is eroded at rate $dt/2$, as compared to rate dt in section 2.1. Turning to the tariff revenue, if there were no substitutability in demand between the two imports, then this too would increase at half the rate. However, demand substitution from the taxed to the untaxed import means that tariff revenue increases at less than half the rate. Thus, while in the basic model of section 2.1 $dg = 0$, in this case the relatively slower growth of tariff revenue gives $dg < 0$.

This reasoning evidently depends on symmetry of the two import sectors, but nevertheless illustrates the more general intuition that the extra margin of substitution means that revenue is lost as consumers substitute out of the taxed import.

Export Diversification: Many aid- and resource-rich countries are seeking to diversify their exports. To capture this, we add a second export sector to the model. Numerical simulation (not reported) illustrates the following intuitive effects. At low levels of t, increases are associated with an increase in real government revenue. The reason is that it now takes a smaller increase in w to restore payments balance because non-resource exports fall in response to the import tariff. However, as t increases exports fall to the point at which the sector no longer exists, at which point the model reverts to that analysed, and further increases in tariffs have little or no impact on real government revenue. Having destroyed the export industry, tariffs then simply transfer revenue between government accounts.

The composition of government expenditure: We have assumed that the unit expenditure function (cost function) is the same for government as it is for the private sector, a simplification that allows us to interpret government expenditure as lump sum transfers for the private sector. The effects of relaxing the assumption are clear. The unit expenditure function has three arguments, $E(t, p, w)$. As t is increased p remains unchanged and w increases more or less than in proportion to the increase in t. The impact of tariff induced price changes on the public sector are therefore greater (or less) than on the private sector according as the public sector consumption is more (or less) intensive in goods subject to the trade tax or non-traded goods/ labour, relative to X-sector output.

5. Conclusions:

We have shown that in resource-rich and aid-rich economies it is likely that import tariffs do not generate net revenue. The revenues shown in government budgets are illusory because they are offset by reductions in real revenues from resource or aid rents, these losses not appearing in the budget as a line item. The central case is that in which the impact on net revenues is strictly zero, and we have shown that in more general economies net revenues can either decrease or increase, supporting the presumption that for resource-exporting economies tariff revenues are illusory. Since aid is a form of foreign exchange rent accruing to the government, the same analysis applies. Hence the relevant measure to determine whether our analysis is pertinent in a particular context is the sum of resource rents and aid relative to the value of imports. For many low-income economies this combination of resource exports and aid is the predominant source of finance for imports.

As in other contexts, tariffs (when they have a real effect) reduce aggregate welfare and may also frustrate export diversification. There is thus a strong case that countries in which tariff revenue is illusory should have lower tariff rates than those in which they generate genuine revenue, yet there is no evidence of such a tendency. This suggests that tariffs are excessive either because of political advantages accruing to a shift of revenue between budget headings or – perhaps more likely – the illusory nature of revenue is not appreciated.

Appendix: Numerical simulations.

Unit expenditure is Cobb-Douglas,

$$e(p_X, p_M, p_N) = p_X^{\alpha_X} p_M^{\alpha_M} p_N^{\alpha_N}, \quad \alpha_X + \alpha_M + \alpha_N = 1.$$

Production has CES unit cost functions, using labour and a specific factor.

$$c^i = \left(b_i w^{1-\sigma_i} + (1-b_i)\rho_i^{1-\sigma_i}\right)^{1/(1-\sigma_i)}, \qquad i = M, X, N.$$

Where b_i is a measure of factor shares, σ_i is the elasticity of substitution, and ρ_i is the rate of return on the specific factor. Parameter values are set as:

$\alpha_M = 0.3$, $\alpha_X = 0.1$, $\alpha_N = 0.6$, $b_M = 0.66$, $b_X = 0.25$, $b_N = 0.9$. $\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_N = 0.7$, $K_M = 2$, $K_X = 4$, $K_N = 3$, $L = 9$, A ε [0,11], β ε [0,1].

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