The Marginal Value of Public Funds in a Federation

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The MVPF and Federalism

Welfare analysis using the MVPF

- The MVPF has been recently popularized as a way to map causal effects of policies to welfare analysis (Hendren, 2016; Finkelstein and Hendren, 2020; Hendren and Sprung-Keyser, 2020)
  - **MVPF**: ratio of the marginal willingness to pay for a policy to the net marginal cost to the government

Local policies & interjurisdictional spillovers

- Public finance and benefit-cost analysis often assume policies "are made by a unitary government with a fixed group of households and firms" (Wildasin, 2021)
- But open economy concerns are important for state and local policies
  - Mobility, spatial misallocation, fiscal competition, fiscal spillovers
- Local governments do not account for these spillovers, but presumably a federal government will

How does welfare analysis differ from the perspective of the local or federal government?

Our paper

We construct a unifying framework for
quantifying the welfare effects of fiscal policy – both taxes and spending – in a federation

Open vs. Closed

- How does the MVPF in a closed economy differ from in an open economy ($\approx$ local vs. national policies)?

Local vs. Social

- Given interjurisdictional spillovers, when will a federal planner's MVPF be larger / smaller than a local gov.'s MVPF?

Empirical

- What additional causal effects must a researcher estimate when using the MVPF for local policies?
  - Apply our MVPFs to examples from the tax and education literature

Basics of the MVPF

General definition

- The MVPF has a long history. In its simplest form, it can be expressed as:

$$MVPF = \frac{\text{Beneficiaries' willingness to pay}}{\text{Net cost to government}} = \frac{WTP}{1 + FE}.$$

  - WTP: willingness to pay of inframarginal recipients for each dollar of the program
  - FE: fiscal externality per dollar increase in the mechanical expenditures per inframarginal beneficiaries

But how does mobility affect the MVPF?

- How are WTP and FE altered?

Intuition: how mobility affects the MVPF

Consider the example of a 1M$ income tax cut in **Massachusetts**.

Effects on MA: Inflow of residents

- Increases migration into MA, which raises additional revenue there
- Movement of people also may increase the costs of local public services due to congestion
- Changes wages, house prices & (potentially) profits: fiscal effects *and* affects WTP

Effects on Connecticut (and other states): Outflow of residents

- Effects qualitatively opposite to MA's effects
- Direct WTP for tax cut, if CT residents pay nonresident taxes in MA (e.g., commuting)

Perspective of the federal government

- Unlike MA's local MVPF, the federal planner accounts for the effects of mobility and spillovers.

General framework

The model in a nutshell

A federation composed of several jurisdictions interacting through
(1) household and firm mobility, (2) tax/public service spillovers, and (3) cross-ownership of firm profits

Households

① imperfectly mobile

② consume tradable goods, housing, and congestible public services

③ benefit from home-jurisdiction public services and services from other states

④ subject to standard local taxes

Firms

① imperfectly mobile

② produce goods possibly subject to agglomeration economies

③ utilize business public services in jurisdiction and elsewhere (e.g., roads)

④ subject to profit taxes

- This is a very general model to derive the MVPF, featuring the key aspects of state and local public finance.

Households

Utility

- Utility of a resident of jurisdiction i is given by:

$$U_i + e_i \equiv U_i(x_i, h_i, \ell_i, \mathbf{g}) + e_i$$

where

x_i: composite numeraire good h_i: housing size/quality ℓ_i: labor supply

$\mathbf{g} = (g_1, \ldots, g_J)$: vector of public goods in all the jurisdictions

Budget constraint

- Her budget constraint is:

$$(1 + t_i^h)p_i h_i + (1 + t_i^x)x_i = y_i + (1 - t_i^\ell)w_i \ell_i - t_i^n$$

where

t_i^h: property taxes t_i^x: commodity tax

t_i^ℓ: labor tax t_i^n: head tax, or cash transfer if negative

Production

Firms

- m_i mobile firms produce the numèraire good. Firm production function:

$$f_i + \epsilon_i = f_i\left(l_i, L_i, \mathbf{z}\right) + \epsilon_i$$

  l_i: labor employed by each firm
  L_i: total employment in the jurisdiction (agglomeration economies)
  $\mathbf{z} = (z_1, \ldots, z_M)$: vector of business public services in all jurisdictions

- Net profit $(1 - t_i^{\pi})\pi_i$ is reduced by the profit tax t_i^{π}

Housing production

- Housing is supplied according to a general nondecreasing supply function $H(p_i)$

Public production

- Congestible public goods/inputs (Scotchmer, 2002) produced with cost function $c_i(g_i, n_i\,;\, z_i, m_i)$

The variety of MVPFs

Policy Impacts on Welfare

Basic local MVPF formula

- The GE defines the population n_i, the number of firms m_i, the housing rent p_i, the wage w_i and the other variables in each jurisdiction i as a function of the policy instruments of all jurisdictions
- The local MVPF in jurisdiction i of policy $\mathrm{d}\tau_i$ consisting of a change in $\tau_i = t_i^x, t_i^\ell, t_i^h, t_i^n, t_i^\pi, g_i, z_i$ is:

$$MVPF^i_{\tau_i} = \frac{WTP^i_{\tau_i}}{G^i_{\tau_i}} \equiv \frac{\text{marginal willingness to pay for } \mathrm{d}\tau_i \text{ in dollar}}{\text{marginal net cost for } \mathrm{d}\tau_i \text{ in dollar}}$$

  - $WTP^i_{\tau_i}$: marginal impact of τ_i on the aggregated indirect utility: $n_i U(x_i, h_i, \ell_i, \mathbf{g})$
  - $G^i_{\tau_i}$: marginal policy impact of τ_i on net cost to gov't: $c_i - n_i\left(t_i^\ell w_i \ell_i + t_i^h p_i h_i + t_i^x x_i + t_i^n\right) - m_i t_i^\pi \pi_i$

How do mobility and spillovers...

- ...shape the local willingness to pay and the local net government cost?
- ...entail "social" effects that might significantly differ from "local" effects?

Policy impacts on local Willingness to Pay

The local WTP of the infra-marginal residents in the jurisdiction changing its policy τ_i:

$$\boxed{WTP^{i}_{\tau_i} = \mathrm{DE}^{i}_{\tau_i} + \mathrm{IE}^{i}_{\tau_i} + \mathrm{OE}^{i}_{\tau_i}}$$

① Direct effect DE_{τ_i} formulas

Positive [Negative] for public service provision [taxation]

② Disposable income effect $\mathrm{IE}^{i}_{\tau_i}$

$$(1 - t_i^{\ell}) L_i \frac{\partial w_i}{\partial \tau_i} - \left(1 + t_i^{h}\right) H_i \frac{\partial p_i}{\partial \tau_i}$$

Capitalization due mobility & behavioral responses. Ambiguously signed.

③ Profit ownership effect $\mathrm{OE}^{i}_{\tau_i}$

$$n_i \frac{\partial y_i}{\partial \tau_i}$$

Change in profits in both locality i and the other localities.

Policy impacts on local net cost

Impact of local policies on net cost to the government changing its policy τ_i:

$$G^i_{\tau_i} = \mathrm{ME}^i_{\tau_i} + \mathrm{BE}^i_{\tau_i} + \mathrm{LE}^i_{\tau_i} + \mathrm{PE}^i_{\tau_i} + \pi\mathrm{E}^i_{\tau_i}$$

① Mechanical effect $\mathrm{ME}^i_{\tau_i}$ formulas

Positive [Negative] for an expenditure [revenue]

② Behavioral effect $\mathrm{BE}^i_{\tau_i}$

$$-n_i \left(t^x_i \frac{\partial x_i}{\partial \tau_i} + t^h_i p_i \frac{\partial h_i}{\partial \tau_i} + t^\ell_i w_i \frac{\partial \ell_i}{\partial \tau_i} \right)$$

Tax revenue change due to behavioral responses

③ Locational effects $\mathrm{LE}^i_{\tau_i}$

$$\left(\frac{\partial c_i}{\partial n_i} - r_i \right) \frac{\partial n_i}{\partial \tau_i} + \left(\frac{\partial c_i}{\partial m_i} - t^\pi_i \pi_i \right) \frac{\partial m_i}{\partial \tau_i}$$

Attraction of households/firms ↑ revenue & congestion

④ Price effect $\mathrm{PE}^i_{\tau_i}$

$$-n_i \left(t^\ell_i \ell_i \frac{\partial w_i}{\partial \tau_i} + t^h_i h_i \frac{\partial p_i}{\partial \tau_i} \right)$$

Capitalization due to mobility

⑤ Profit effect $\pi\mathrm{E}^i_{\tau_i}$

$$-n_i m_i t^\pi_i \frac{\partial \pi_i}{\partial \tau_i}$$

Change in profit tax revenues

Local MVPF: from theory to practice

Many useful causal estimates are already available in the literature

- Mobility effect on government revenue
  - Recent literature on tax-induced migration, mainly for high-income earners, but large literature on education sorting
- Housing price and wage capitalization
  - Estimates for various policies: e.g. schooling expenditure, state earned income tax credits
- Mobility effect on congestion of public services
  - Older estimates based on structural approaches, possibly can be extended using structural IO tools
- Distribution of profits needed for willingness to pay.
  - Local data on ownership might be used

External policy impacts on jurisdiction $k \neq i$

MVPF numerator (WTP)
DE: direct effect
IE: disposable income effect
OE: ownership effect

MVPF denominator (G)
BE: behavioral effect
LE: locational effect
PE: price effect
πE: profit effect

Impact on external WTP

$$WTP^k_{\tau_i} = \mathrm{DE}^k_{\tau_i} + \mathrm{IE}^k_{\tau_i} + \mathrm{OE}^k_{\tau_i}$$

formulas

- Taxes/public services may have direct effects on nonresidents (e.g., spillovers of public services, commuting, cross-border shopping).

Impact on external net cost

$$G^k_{\tau_i} = \mathrm{BE}^k_{\tau_i} + \mathrm{LE}^k_{\tau_i} + \mathrm{PE}^k_{\tau_i} + \pi\mathrm{E}^k_{\tau_i}$$

- Location effect: Mobility affects revenue and costs of providing services in other jurisdictions. This is the classic interjurisdictional fiscal externality in the tax competition literature.

Social MVPF

- Social MVPF (federal planner) accounts for all interjurisdictional externalities:

$$SMVPF_{\tau_i} \equiv \frac{WTP^i_{\tau_i} + \sum_{k \neq i} WTP^k_{\tau_i}}{G^i_{\tau_i} + \sum_{k \neq i} G^k_{\tau_i}}$$

  - Remark: to convert the SMVPF from dollars to welfare units, use jurisdiction-specific social weights

Social MVPF: from theory to practice

What do we need more causal estimates of?

- Need to know the interjurisdictional effects on prices, valuations, and mobility of other jurisdictions:

① How much do prices adjust *elsewhere* from mobility in/out?

② How much do others value nearby public services?

- While spillover benefits have long been acknowledged (Case, Hines and Rosen, 1993), their estimation has not been a focus.

③ How large is the classic interjurisdictional fiscal externality?

- Literature on local policy choice has focused on confirming the existence of strategic interactions, at the expense of estimating interjurisdictional fiscal externalities (Agrawal, Hoyt and Wilson, 2022 JEL)

Social MVPF: from theory to practice

How to estimate fiscal externalities if they are localized?

- Let b_{jt} denote the tax base and assume instrumental variables are available (Buettner, 2003):

$$b_j = \alpha + \beta_j \tau_j + \sum_{k \neq j} \beta_k \tau_k + \mathbf{x}_j' \boldsymbol{\gamma} + \epsilon_j$$

- Higher taxes at home expand own-jurisdiction tax revenues ($\beta_j > 0$), but decrease elsewhere ($\beta_k < 0$). Assumption of **local** mobility allows the researcher to restrict the summation to nearby jurisdictions.

How to estimate spillover benefits? (hedonic approach)

- Let PV_{hj} denote the property value of property h in jurisdiction j:

$$PV_{hj} = \alpha + \beta_j g_j + \sum_{k \neq j} \beta_k g_k + \mathbf{x}_{hj}' \boldsymbol{\gamma} + \epsilon_{hj}$$

If the jurisdiction is small, β_k will provide an estimate of the MWTP.

The variety of MVPFs

MVPF numerator (WTP)
DE: direct effect
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MVPF denominator (G)
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Closed-economy local MVPF

$$MVPF^{ci}_{\tau_i} = \frac{\mathrm{DE}^{i}_{\tau_i}}{\mathrm{ME}^{i}_{\tau_i} + \mathrm{BE}^{i}_{\tau_i}}$$

Operational if mobility costs become large and prices are exogenous

Open-economy local MVPFs

$$MVPF^{i}_{\tau_i} = \frac{\mathrm{DE}^{i}_{\tau_i} + \mathrm{IE}^{i}_{\tau_i} + \mathrm{OE}^{i}_{\tau_i}}{\mathrm{ME}^{i}_{\tau_i} + \mathrm{BE}^{i}_{\tau_i} + \mathrm{LE}^{i}_{\tau_i} + \mathrm{PE}^{i}_{\tau_i} + \pi\mathrm{E}^{i}_{\tau_i}}$$

It accounts for the local mobility effects of the policy

Social MVPF

$$SMVPF_{\tau_i} = \frac{\sum_k \left(\mathrm{DE}^{k}_{\tau_i} + \mathrm{IE}^{k}_{\tau_i} + \mathrm{OE}^{k}_{\tau_i}\right)}{\sum_k \left(\mathrm{ME}^{k}_{\tau_i} + \mathrm{BE}^{k}_{\tau_i} + \mathrm{LE}^{k}_{\tau_i} + \mathrm{PE}^{k}_{\tau_i} + \pi\mathrm{E}^{k}_{\tau_i}\right)}$$

Large empirical literature on mobility, capitalization, tax competition can provide key estimates

A simplified model

A simplified household model

MVPF numerator (WTP)
DE: direct effect
IE: disposable income effect

MVPF denominator (G)
BE: behavioral effect
LE: locational effect
PE: price effect

Focus on household policies

- Two-jurisdiction model with mobile households but immobile firms.
  Inelastic individual labor supply & housing demand. Absentee ownership of firms & no profit tax.
- Assume strong agglomeration economies
- Consider a household tax cut by jurisdiction i (Massachusetts): $\mathrm{d}s_i = -\mathrm{d}\tau_i > 0$, with $\tau_i \in \{t_i^n, t_i^x, t_i^\ell, t_i^h\}$:

Local MVPF

$$MVPF_{s_i}^k = \frac{\mathrm{DE}_{s_i}^k + \mathrm{IE}_{s_i}^k}{\mathrm{ME}_{s_i}^k + \mathrm{BE}_{s_i}^k + \mathrm{PE}_{s_i}^k + \mathrm{LE}_{s_i}^k},$$

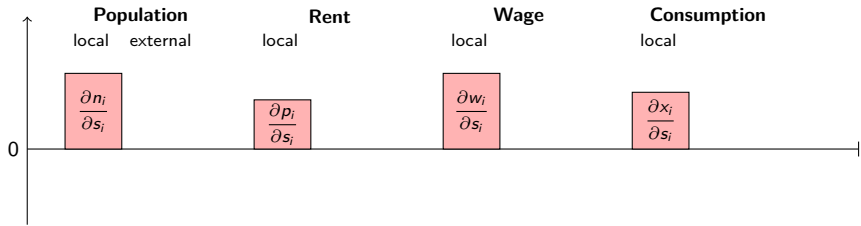
Only the profit effects are absent because of absentee ownership & no profit tax

Proposition

For a household tax cut, the local MVPF overstates the social MVPF.

Responses to household tax cut

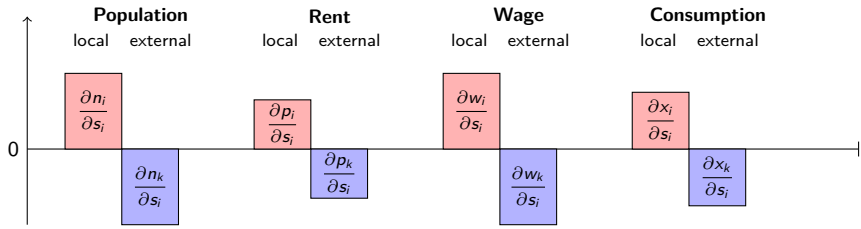
- What is the effect of a household tax cut $\mathrm{d}s_i$ in jurisdiction i (Massachusetts) on the key economic variables



- **In jurisdiction i (Massachusetts)**:
  Tax cut attracts new residents, increases the wage and housing rent, and allows residents to consume more

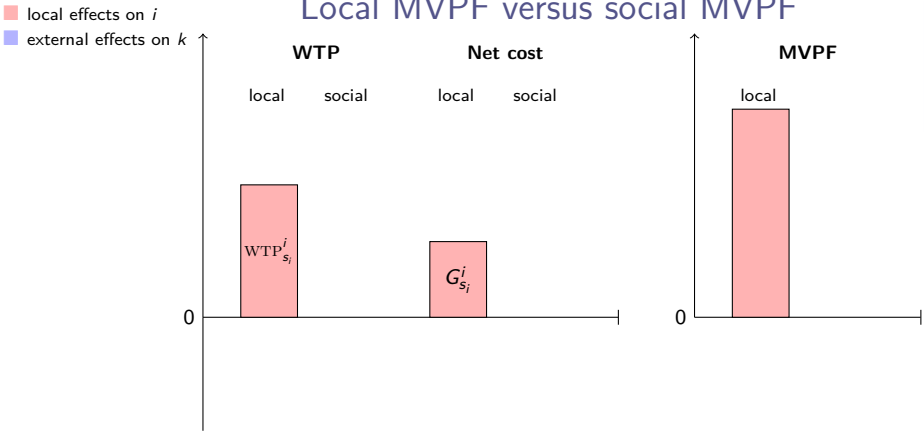
Responses to household tax cut

- What is the effect of a household tax cut $\mathrm{d}s_i$ in jurisdiction i (Massachusetts) on the key economic variables



- **In jurisdiction i (Massachusetts)**:
  Tax cut attracts new residents, increases the wage and housing rent, and allows residents to consume more
- **In jurisdiction k (Connecticut)**:
  Opposite effects as individuals move to Massachusetts.

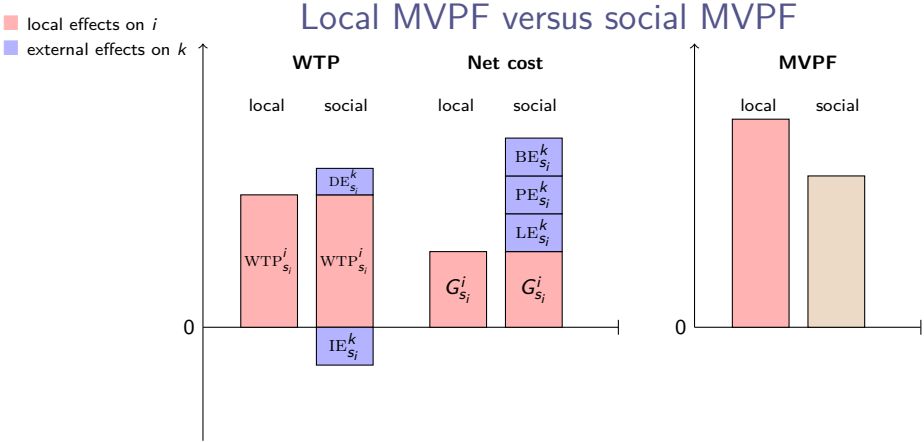
Local MVPF versus social MVPF



MVPF numerator (WTP)
DE: direct effect
IE: disposable income effect

MVPF denominator (G)
BE: behavioral effect
LE: locational effect
PE: price effect

Local MVPF versus social MVPF



MVPF numerator (WTP)
DE: direct effect
IE: disposable income effect

MVPF denominator (G)
BE: behavioral effect
LE: locational effect
PE: price effect

- The local MVPF of jurisdiction i overstates the social MVPF
  - Household outflow from k reduces agglomeration gains in k.

Empirical application

Subsidy Competition for the Volkswagen Plant by Tennessee

Policy experiment

- A bid (English auction) by Tennessee for the Volkswagen plant conditional on bids of other states. If TN does not bid, plant goes to observed runner-up (Alabama).

Should TN enter bidding competition based on its *LMVPF* and the *SMVPF*?

Local MVPF of Tennessee

- The *WTP* is equal to value of plant to TN v^{TN}
- The net cost to TN includes the bid b^{NT} & the fiscal externality FE^{TN}

$$LMVPF^{TN} = \frac{v^{TN}}{b^{TN} + FE^{TN}}$$

  - Caveat: The v^i in Slattery (2020) might be interpreted as the perceived valuations (by politicians) rather than the actual economic benefits. But it captures all the effects in our numerator.

Subsidy Competition for the Volkswagen Plant by Tennessee

Social MVPF

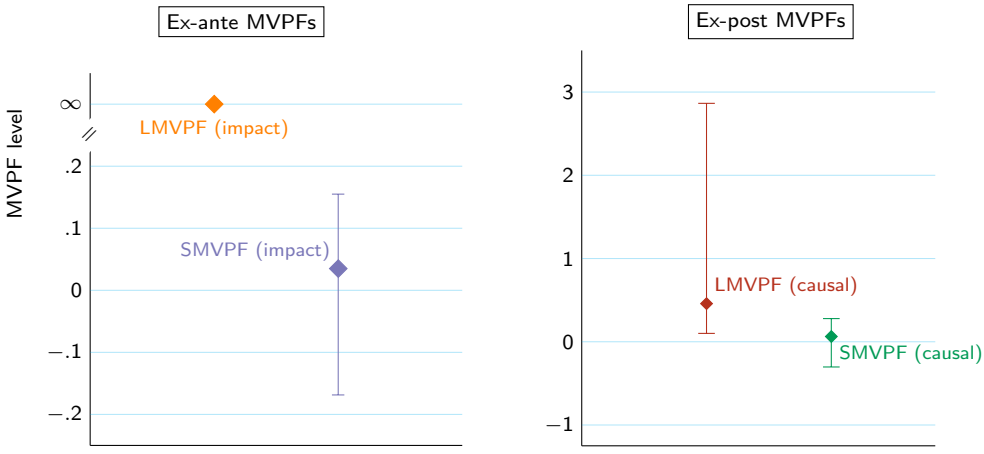
- The social MVPF of Tennessee bidding and attracting the plant includes the opportunity costs due to the fact that Alabama does not attract the plant:

$$SMVPF = \frac{v^{TN} - v^{AL}}{b^{TN} + FE^{TN} - \left(b^{AL} + FE^{AL}\right)}$$

Calculating the MVPFs

- The bids are observed
- Following Slattery (2020) we can operationalize v by $v^i = \alpha_1 x^i + \alpha_2 z^{VW} + \alpha_3 x^i z^{VW} + \varepsilon^i$ where $i = TN, AL$, x^i are state/local characteristics and z^{VW} are firm (Volzwagen) characteristics.
- To calculate FE, we take 2 approaches:
  1. **Impact estimates** traditionally based on the assumption of new jobs + multiplier effects
  2. **Causal estimates** of new jobs that crowd-out or have no effect on other jobs (Slattery & Zidar, 2020)

Results: LMVPF and SMVPF



Conclusion

Conclusion

When thinking about the MVPF, it is important to answer the question of "whose MVPF?".

- Although not all parameters necessary to construct our MVPFs may be currently estimated (or convincingly estimated) in the literature, our MVPF derivations provide a way forward by making it clear what parameters are necessary.
- We hope that our derivations will spur a new wave of policy research that focuses on interjursidictional externalities, measurement of the spillover benefits, and capitalization in order to provide elusive evidence on the welfare effects of fiscal competition.

Exploiting the staggered adoption of policies for empirical identification is something that is generally only possible in federalist countries.

- Given this literature naturally exploits subnational policy changes, which inevitably have mobility, capitalization, and spillover effects, a next step is to convert the plethora of causal effects estimated using staggered policy adoptions to LMVPFs/SMVPFs.

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Appendix: Local direct effects

$$
\begin{aligned}
\mathrm{DE}_{t_i^b} &= -n_i \mathrm{B}_i^b, \\
\mathrm{DE}_{t_i^\pi} &= -n_i m_i \theta_i^i \pi_i, \\
\mathrm{DE}_{g_i} &= \frac{n_i}{\lambda_i} \frac{\partial U_i}{\partial g_i}, \\
\mathrm{DE}_{z_i} &= 0
\end{aligned}
$$

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Appendix: Local mechanical effects

$$\mathrm{ME}_{t_i^b} = -n_i \mathrm{B}_i^b$$

$$\mathrm{ME}_{t_i^\pi} = -m_i \pi_i$$

$$\mathrm{ME}_{g_i} = \frac{\partial c_i}{\partial g_i}$$

$$\mathrm{ME}_{z_i} = \frac{\partial c_i}{\partial z_i}$$

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Appendix: External direct effects

$$\mathrm{DE}^{k}_{t_i^b} = 0$$

$$\mathrm{DE}^{k}_{t_i^\pi} = -n_k m_i \theta^i_k \pi_i,$$

$$\mathrm{DE}^{k}_{g_i} = \frac{n_j}{\lambda_j} \frac{\partial U_j}{\partial g_i}$$

$$\mathrm{DE}^{k}_{z_i} = 0$$