Fear of Crowds in WTO Disputes:
Why Don't More Countries Participate?

Leslie Johns and Krzysztof Pelc

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Dispute- and state-specific payoffs

Assume that the expected payoffs for each player i for case j can depend on factors besides the player's trade stake, τ_i. Then payoffs are as follows:

	Settlement	Litigation
Join	$R_{ij}(\tau_i) + b_{ij}\tau_i$	$L_{ij}(\tau_i) + v_{ij}\tau_i$
Don't Join	$R_{ij}(\tau_i)$	$L_{ij}(\tau_i)$

where $R_{ij}(\tau_i) \equiv L_{ij}(\tau_i) + v_{ij}\tau_i + \rho_{ij}$.
Player i thus has the following expected utility functions if $\widehat{n}$ other countries join as third parties:

$$\begin{aligned} EU_i(\text{Join}|\widehat{n}) &= s(\widehat{n}+1)\left[L_{ij}(\tau_i) + v_{ij}\tau_i + \rho_{ij} + b_{ij}\tau_i\right] + \left[1 - s(\widehat{n}+1)\right]\left[L_{ij}(\tau_i) + v_{ij}\tau_i\right] \\ EU_i(\text{Don't Join}|\widehat{n}) &= s(\widehat{n})\left[L_{ij}(\tau_i) + v_{ij}\tau_i + \rho_{ij}\right] + \left[1 - s(\widehat{n})\right]L_{ij}(\tau_i) \end{aligned}$$

The benefit of joining when $\widehat{n}$ other countries join is thus:

$$\Delta_{ij}(\widehat{n}, \tau_i) = v_{ij}\tau_i + s(\widehat{n}+1)(\rho_{ij} + b_{ij}\tau_i) - s(\widehat{n})(v_{ij}\tau_i + \rho_{ij})$$

Then:

$$\begin{aligned} \frac{\partial \Delta_{ij}(\widehat{n}, \tau_i)}{\partial \tau_i} &= \left[1 - s(\widehat{n})\right]v_{ij} + s(\widehat{n}+1)\,b_{ij} > 0 \\ \lim_{\tau_i \to 0} \Delta_{ij}(\widehat{n}, \tau_i) &= \left[s(\widehat{n}+1) - s(\widehat{n})\right]\rho_{ij} < 0 \\ \lim_{\tau_i \to \infty} \Delta_{ij}(\widehat{n}, \tau_i) &= \lim_{\tau_i \to \infty} \left\{\left[1 - s(\widehat{n})\right]v_{ij}\tau_i + s(\widehat{n}+1)\,b_{ij}\tau_i\right\} > 0 \end{aligned}$$

By the intermediate value theorem, each $(i, j, \widehat{n})$-triplet has a unique cutpoint $\widehat{\tau}_{ij}(\widehat{n}) > 0$ such that $\Delta_{ij}(\widehat{n}, \widehat{\tau}_{ij}(\widehat{n})) = 0$. So $\Delta_{ij}(\widehat{n}, \tau_i) < 0$ for all $\tau_i < \widehat{\tau}_{ij}(\widehat{n})$ and $\Delta_{ij}(\widehat{n}, \tau_i) > 0$ for all $\tau_i > \widehat{\tau}_{ij}(\widehat{n})$.
Define the following difference function:

$$\begin{aligned} \Psi_{ij}(\widehat{n}, \tau_i) &\equiv \Delta_{ij}(\widehat{n}, \tau_i) - \Delta_{ij}(\widehat{n}+1, \tau_i) \\ &= \left[s(\widehat{n}+1) - s(\widehat{n}+2)\right](\rho_{ij} + b_{ij}\tau_i) - \left[s(\widehat{n}) - s(\widehat{n}+1)\right](v_{ij}\tau_i + \rho_{ij}) \end{aligned}$$

Note that $\Psi_{ij}(\widehat{n}, \tau_i) > 0$ when b_{ij} is relatively large. Note also that $\Psi_{ij}(\widehat{n}, \tau_i) < 0$ when v_{ij} is relatively large.
Also, when b_{ij} is relatively large, $\widehat{\tau}_{ij}(\widehat{n}) < \widehat{\tau}_{ij}(\widehat{n}+1)$ for every $\widehat{n}$.

Entry costs

Suppose there is a small cost, $\epsilon > 0$, to joining the dispute. Then payoffs are as follows:

	Settlement	Litigation
Join	$R(\tau_i) + b\tau_i - \epsilon$	$L(\tau_i) + v\tau_i - \epsilon$
Don't Join	$R(\tau_i)$	$L(\tau_i)$

where $R(\tau_i) \equiv L(\tau_i) + v\tau_i + \rho$.
Player i thus has the following expected utility functions if $\widehat{n}$ other countries join as third parties:

$$\begin{aligned} EU_i(\text{Join}|\widehat{n}) &= s(\widehat{n}+1)[L(\tau_i) + v\tau_i + \rho + b\tau_i] + [1 - s(\widehat{n}+1)][L(\tau_i) + v\tau_i] - \epsilon \\ EU_i(\text{Don't Join}|\widehat{n}) &= s(\widehat{n})[L(\tau_i) + v\tau_i + \rho] + [1 - s(\widehat{n})]L(\tau_i) \end{aligned}$$

The benefit of joining when $\widehat{n}$ other countries join is thus:

$$\Delta(\widehat{n}, \tau_i) = v\tau_i + s(\widehat{n}+1)(\rho + b\tau_i) - s(\widehat{n})(v\tau_i + \rho) - \epsilon$$

Then:

$$\begin{aligned} \frac{\partial \Delta(\tau_i)}{\partial \tau_i} &= s(\widehat{n}+1)b + [1 - s(\widehat{n})]v > 0 \\ \lim_{\tau_i \to 0} \Delta(\widehat{n}, \tau_i) &= [s(\widehat{n}+1) - s(\widehat{n})](\rho) - \epsilon < 0 \\ \lim_{\tau_i \to \infty} \Delta(\widehat{n}, \tau_i) &= \lim_{\tau_i \to \infty} \{s(\widehat{n}+1)b\tau_i + [1 - s(\widehat{n})]v\tau_i\} > 0 \end{aligned}$$

By the intermediate value theorem, each $\widehat{n}$ has a unique cutpoint $\widehat{\tau}(\widehat{n}) > 0$ such that $\Delta(\widehat{n}, \widehat{\tau}(\widehat{n})) = 0$. So $\Delta(\widehat{n}, \tau_i) < 0$ for all $\tau_i < \widehat{\tau}(\widehat{n})$ and $\Delta(\widehat{n}, \tau_i) > 0$ for all $\tau_i > \widehat{\tau}(\widehat{n})$.
Define the following difference function:

$$\begin{aligned} \Psi(\widehat{n}, \tau_i) &\equiv \Delta(\widehat{n}, \tau_i) - \Delta(\widehat{n}+1, \tau_i) \\ &= [s(\widehat{n}+1) - s(\widehat{n}+2)](\rho + b\tau_i) - [s(\widehat{n}) - s(\widehat{n}+1)](v\tau_i + \rho) \end{aligned}$$

Note that $\Psi(\widehat{n}, \tau_i) > 0$ when b is relatively large. Note also that $\Psi(\widehat{n}, \tau_i) < 0$ when v is relatively large. Also, when b is relatively large, $\widehat{\tau}(\widehat{n}) < \widehat{\tau}(\widehat{n}+1)$ for every $\widehat{n}$.

Filing strategies (Article XXII versus XXIII)

Note that the analysis above holds for a generic small value of ϵ. Suppose that there are two possible values: $0 < \epsilon_L < \epsilon_H$. When the complainant makes her filing decision, she is in effect choosing the value of ϵ. Note that:

$$\Delta(\widehat{n}, \tau_i, \epsilon_L) - \Delta(\widehat{n}, \tau_i, \epsilon_H) = \epsilon_H - \epsilon_L > 0$$

So for any given value of $\widehat{n}$, $\hat{\tau}(\widehat{n}, \epsilon_L) < \hat{\tau}(\widehat{n}, \epsilon_H)$.

Litigation costs

Suppose there is a small cost, $\phi > 0$, to joining a dispute that goes to litigation. Then payoffs are as follows:

	Settlement	Litigation
Join	$R(\tau_i) + b\tau_i$	$L(\tau_i) + v\tau_i - \phi$
Don't Join	$R(\tau_i)$	$L(\tau_i)$

where $R(\tau_i) \equiv L(\tau_i) + v\tau_i + \rho$.
Player i thus has the following expected utility functions if $\widehat{n}$ other countries join as third parties:

$$\begin{aligned} EU_i(\text{Join}|\widehat{n}) &= s(\widehat{n}+1)\left[L(\tau_i) + v\tau_i + \rho + b\tau_i\right] + \left[1 - s(\widehat{n}+1)\right]\left[L(\tau_i) + v\tau_i - \phi\right] \\ EU_i(\text{Don't Join}|\widehat{n}) &= s(\widehat{n})\left[L(\tau_i) + v\tau_i + \rho\right] + \left[1 - s(\widehat{n})\right]L(\tau_i) \end{aligned}$$

The benefit of joining when $\widehat{n}$ other countries join is thus:

$$\Delta(\widehat{n}, \tau_i) = v\tau_i + s(\widehat{n}+1)(\rho + b\tau_i) - s(\widehat{n})(v\tau_i + \rho) - \left[1 - s(\widehat{n}+1)\right]\phi$$

Then:

$$\begin{aligned} \frac{\partial \Delta(\tau_i)}{\partial \tau_i} &= s(\widehat{n}+1)\,b + \left[1 - s(\widehat{n})\right]v > 0 \\ \lim_{\tau_i \to 0} \Delta(\widehat{n}, \tau_i) &= \left[s(\widehat{n}+1) - s(\widehat{n})\right](\rho) - \left[1 - s(\widehat{n}+1)\right]\phi < 0 \\ \lim_{\tau_i \to \infty} \Delta(\widehat{n}, \tau_i) &= \lim_{\tau_i \to \infty} \left\{s(\widehat{n}+1)\,b\tau_i + \left[1 - s(\widehat{n})\right]v\tau_i\right\} > 0 \end{aligned}$$

By the intermediate value theorem, each $\widehat{n}$ has a unique cutpoint $\widehat{\tau}(\widehat{n}) > 0$ such that $\Delta(\widehat{n}, \widehat{\tau}(\widehat{n})) = 0$. So $\Delta(\widehat{n}, \tau_i) < 0$ for all $\tau_i < \widehat{\tau}(\widehat{n})$ and $\Delta(\widehat{n}, \tau_i) > 0$ for all $\tau_i > \widehat{\tau}(\widehat{n})$.
Define the following difference function:

$$\begin{aligned} \Psi(\widehat{n}, \tau_i) &\equiv \Delta(\widehat{n}, \tau_i) - \Delta(\widehat{n}+1, \tau_i) \\ &= \left[s(\widehat{n}+1) - s(\widehat{n}+2)\right](\rho + b\tau_i + \phi) - \left[s(\widehat{n}) - s(\widehat{n}+1)\right](v\tau_i + \rho) \end{aligned}$$

Note that $\Psi(\widehat{n}, \tau_i) > 0$ when b is relatively large. Note also that $\Psi(\widehat{n}, \tau_i) < 0$ when v is relatively large.
Also, when b is relatively large, $\widehat{\tau}(\widehat{n}) < \widehat{\tau}(\widehat{n}+1)$ for every $\widehat{n}$.

General functional forms

We now consider general function forms of $\rho(\tau_i)$ and $s(n, \tau_i)$.
Payoffs are as follows:

	Settlement	Litigation
Join	$R(\tau_i) + b\tau_i$	$L(\tau_i) + v\tau_i$
Don't Join	$R(\tau_i)$	$L(\tau_i)$

where $R(\tau_i) \equiv L(\tau_i) + v\tau_i + \rho(\tau_i)$.

Player i thus has the following expected utility functions if $\widehat{n}$ other countries join as third parties:

$$\begin{aligned} EU_i(\text{Join}|\widehat{n}) &= s(\widehat{n}+1,\tau_i)[L(\tau_i) + v\tau_i + \rho(\tau_i) + b\tau_i] + [1 - s(\widehat{n}+1,\tau_i)][L(\tau_i) + v\tau_i] \\ EU_i(\text{Don't Join}|\widehat{n}) &= s(\widehat{n},\tau_i)[L(\tau_i) + v\tau_i + \rho(\tau_i)] + [1 - s(\widehat{n},\tau_i)]L(\tau_i) \end{aligned}$$

The benefit of joining when $\widehat{n}$ other countries join is thus:

$$\Delta(\widehat{n},\tau_i) = v\tau_i + s(\widehat{n}+1,\tau_i)[\rho(\tau_i) + b\tau_i] - s(\widehat{n},\tau_i)[v\tau_i + \rho(\tau_i)]$$

Then:

$$\begin{aligned} \frac{\partial\Delta(\tau_i)}{\partial\tau_i} &= v + s(\widehat{n}+1,\tau_i)[\rho'(\tau_i) + b] + \frac{\partial s(\widehat{n}+1,\tau_i)}{\partial\tau_i}[\rho(\tau_i) + b\tau_i] \\ &\quad - s(\widehat{n})[v + \rho'(\tau_i)] - \frac{\partial s(\widehat{n},\tau_i)}{\partial\tau_i}[v\tau_i + \rho(\tau_i)] \end{aligned}$$

This is positive if b is relatively large and $\frac{\partial s(\widehat{n}+1,\tau_i)}{\partial\tau_i} \geq 0$. This latter condition holds in Johns and Pelc (2014).

Also:

$$\lim_{\tau_i\to 0}\Delta(\widehat{n},\tau_i) = \lim_{\tau_i\to 0}[s(\widehat{n}+1,\tau_i) - s(\widehat{n},\tau_i)]\rho(\tau_i)$$

This is negative if $\rho(0) > 0$; that is, if players receive some benefit from having the case resolved even when they do not have an economic interest in the dispute.

Finally:

$$\lim_{\tau_i\to\infty}\Delta(\widehat{n},\tau_i) = \lim_{\tau_i\to\infty}\{[1 - s(\widehat{n},\tau_i)]v\tau_i + s(\widehat{n}+1,\tau_i)b\tau_i - [s(\widehat{n},\tau_i) - s(\widehat{n}+1,\tau_i)]\rho(\tau_i)\}$$

When this quantity is positive, then the intermediate value theorem ensures that each $\widehat{n}$ has a unique cutpoint $\widehat{\tau}(\widehat{n}) > 0$ such that $\Delta(\widehat{n},\widehat{\tau}(\widehat{n})) = 0$. So $\Delta(\widehat{n},\tau_i) < 0$ for all $\tau_i < \widehat{\tau}(\widehat{n})$ and $\Delta(\widehat{n},\tau_i) > 0$ for all $\tau_i > \widehat{\tau}(\widehat{n})$.

Define the following difference function:

$$\begin{aligned} \Psi(\widehat{n},\tau_i) &\equiv \Delta(\widehat{n},\tau_i) - \Delta(\widehat{n}+1,\tau_i) \\ &= [s(\widehat{n}+1,\tau_i) - s(\widehat{n}+2,\tau_i)][\rho(\tau_i) + b\tau_i] - [s(\widehat{n},\tau_i) - s(\widehat{n}+1,\tau_i)][v\tau_i + \rho(\tau_i)] \end{aligned}$$

This is positive if b is relatively large, and negative if v is relatively large.