

Title: **Firm Behavior Under Quantity Controls: A Virtual Quantity Analysis of Input Regulation and Capital Stuffing In A Malaysian Fishery**

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Abstract: How should firm behavior be evaluated in a positive framework when there are multiple quantity controls on inputs and outputs? The answer to this question informs the design of public regulation of individual fishing firms. For example, Dupont (1991) considered the relationship between an input fixed by command-and-control regulation and a variable input (capital stuffing), and Asche, Gordon, and Jensen (2007) considered the relationship between a transferable output quota that is a property right and an unregulated variable output when the former is quasi-fixed during a production period.

The virtual quantity framework allows the positive analysis of individual firm behavior under existing multiple quantity controls to better design public regulation. This ex-post approach is dual to the ex ante virtual price framework (Fulginiti and Perrin 1993, Squires 1994, Squires and Kirkley 1996), and is used to extend the properties of the elasticity of intensity (Diewert 1974, Dupont 1991). The virtual quantity framework is applied to a Malaysian common resource regulated by license limitation. Program success depends on whether firms can circumvent regulations by substituting unrestricted inputs for the quantity-controlled inputs. The results demonstrate little or no potential for firms to circumvent command-and-control quantity controls on inputs aimed at achieving sustainable use of the common resource. The pervasive input complementarity instead points to quantity controls that can lower harvest pressures on the common resource stock. This result is particularly comforting for a developing country with limited regulatory capacity that precludes output controls or transferable property rights on catches and must instead rely on input controls.

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