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TRADE PERFORMANCE AND REGULATORY REGIMES

TRADE BALANCE EFFECTS OF INFRASTRUCTURE SERVICES LIBERALIZATION … AND OF THEIR REGULATION

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Abstract:

This paper addresses the relation between the design of incentives to firms under regulation, mainly the rule for adjusting tariffs, and international trade performance of the country. We also explore whether this influence is relevant or not for a typical developing economy like Argentina. We find it is. To address these issues we perform comparative static numerical explorations using a CGE model where service obligation and no entry in regulated industries are assumed. We show that the capital account openness and the rate of exchange regime could be key elements to match with the regulatory regime. The potential inconsistency between the international trade regime and the regulatory regime should not be rejected a priori

Keywords: Computable General Equilibrium, Utilities regulation, Public Services.

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Trade Balance Effects of Infrastructure Services Liberalization… and of Their Regulation

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I. Introduction

During the 1990s, in most regions of the world, governments restructured their infrastructure sectors to facilitate some form of private participation in the operation and financing of the sector. These reforms were generally associated with other macroeconomic reforms which included the liberalization of international capital, goods and services flows. These changes have often initially produced significant foreign direct investments flows to small countries. Overtime, however, they also seem to be associated with reverse flows of profits when things go well and of capital when business deteriorates as in the case of international financial crisis. These flow reversals are increasingly putting pressure on the service trade balances and contribute to explain why trade in services are now at the top of the WTO agenda forum. They also point to the need to try to improve our understanding of the interactions between the privatisation of infrastructure monopolies and associated trade flows.

The main policy instruments used to influence the behaviour of monopolies is their regulation. Reformers have the choice between two basic forms of regulation: a price cap or rate of return/cost plus regimes. [5] The first one is expected to give an incentive to operators to cut costs and are organized to eventually share the costs savings with users. In exchange the operators take on all the commercial risks associated with the service. The alternative regime guarantees a rate of return on assets but in general this return is expected to be lower than under the price cap regime.

While there are a few studies of the impact of the choice of the regulatory regime on variables such as efficiency, equity or the fiscal balance, there are no studies of the interactions between the choice of the regulatory regime and the trade performance of a

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[5] In most cases, reformers have chosen to try to promote incentives for efficiency in these sectors rather than to guarantee return through cost plus regimes In Latin America, according to a data base put together by Guasch (2003) on 954 concessions contracts awarded from the mid 1980s to 2000, 56% of the contracts were regulated under a price cap regime, 20% under rate of return regulation. For 24% of the contract, the regime is a hybrid one.

country.[6] This is because the regulation of the privatised monopolies is usually analysed in partial equilibrium frameworks that ignore many of the indirect interactions of the regulated sectors with the rest of the economy, in particular, its effects on the trade balance. [7] The main purpose of the paper is to help close that gap. We do so by analysing the experience of Argentina, the former poster boy of privatisation and the first country to have a rather encompassing reform of the infrastructure sector, through simulations of a general equilibrium model built to assess the impact of regulatory regimes on the trade balance.[8]

The structure of the paper is the following. First, we motivate the use of a general equilibrium approach to the analysis and explain why we believe that a Ricardo-Viner framework is a useful way of modelling the importance of regulated traded services. Second, we motivate the need to also model explicitly service obligations imposed on operators for social reasons since they limit the scope of action of operators and can result in significant investment requirements which can be financed within the sector through cuts or through foreign capital flows. In section III, we present the formal structure of the model.

In section IV we present comparative static numerical explorations comparing the effects of price cap and of rate of return regulation[9] with the basic characteristics of the Argentine economy which regulators need to address.. Section V compares an alternative mechanism of service obligation: the use of a new technology. Section VI summarizes the main findings of the paper .

II. The analytical framework

The analysis is based on a general equilibrium model because it is the only way to analyse explicitly and quantitatively the interactions between the regulated sector and the rest of the economy. The model needs to reflect the fact that regulation influences prices and that traditional trade theory shows that factor rewards respond to any price changes, including those initiated by regulators, under given factor endowments. The model also needs to reflect the fact that factor mobility assumptions should influence these price changes and interact with the regulator's job. Since this factor mobility is highly specific to the regulated industries, we need to model this specificity explicitly. A Ricardo-Viner framework allows us to do this. This general equilibrium model which recognizes the

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[6] Chisari et al (1999), Navajas (2000), and the papers included in Ugaz and Waddams (2003),

[7] It seems rational to expect that the recognition of the presence of a third party such as the rest of the world, exchanging goods and (capital) services with the regulated party is likely to influence the optimal contract between the regulator and the regulated operator. These optimal contracts are typically modelled in a Principal-Agent framework in the regulation literature. For an overview see for instance Laffont and Martimort (2002) or Laffont and Tirole (1993)

[8] To some extent, a rule for determining the tariff can be modelled as a distortion that modifies optimal trade policy (see Bhagwati *et al.* (2000), Ch.20). We are leaving aside the financial and temporal considerations; in fact, it could happen that a rate-of-return regulation favoured an bigger initial inflow of foreign capital.

[9] We adopt Piggott´s viewpoint, "that CGE models are theoretical models with numbers".

specificity of production factors provides the analytical framework needed to assess the impact of changes in the regulated industries on the rest of the economy and vice versa. .[10]

Our main concern is that comparative static effects can easily become undetermined when accounting for too many factors under the standard assumptions of the model. In particular, since we need to model the regulatory rule followed to determine prices in the infrastructure sectors, the net effect cannot be determined qualitatively directly. We thus suggest to assess it by adding up numerical (non-linear) impacts.

We focus our attention on two questions, qualitative and quantitative respectively: (i) Is it possible that the regulatory mechanism, mainly the rule for adjusting tariffs, biases trade balance and the exchange rate? (ii) If so, how important can biases be for a typical developing economy such as Argentina's? There are two aspects that are relevant for addressing these questions: (a) the relative weight of price flexibility with respect to domestic or foreign ownership on trade performance, and (b) the comparative advantage of using more capital or covering the excess of marginal cost over tariff with internal resources of the firm.

Argentina provides an interesting case study for several reasons. First, Argentina's privatisation has been wide, deep, and privatised sectors have a significant role in determining relative prices. Secondly, the data is readily available for all regulated utilities. Finally, because Argentina relied on a currency board, it makes it easier to assess the relative importance of an exchange rule vs. regulation as factors driving outcomes in the privatised industries as well as the rest of the economy.

III. The need to model service obligations

To make the model as realistic as possible, it is important to model the fact that contracts with private operators generally specify explicit large service obligations because the services they deliver are often perceived as essential to the well being of the poorest. In our model, service obligation is interpreted as the passive adjustment of services supply to demand in the regulated sector. This assumption prevents need to rely on rationing which is quite realistic in the context of modern infrastructure reforms.[11]

Most regulatory regimes establish explicitly this obligation in the contract, and its violation has not only direct economic costs but also hinders on the reputation of the firm. Service obligation increases costs to the firm (real and expected) and is compensated with the tariff and, very often, with the commitment by the regulator of protecting incumbents by legally blocking the entry of new competitors. A temporary "no entry" condition is, in fact, a second important characteristics of modern infrastructure reforms, which

[10] Hoque (1997) discusses international trade theorems when there is factor mobility between countries, but not between sectors; he finds that international mobility of factors can be seen as a substitute for inter-sectoral mobility, making valid the Stolper-Samuelson and Rybczynski propositions. See also Jones and Kierzkowski (1986).

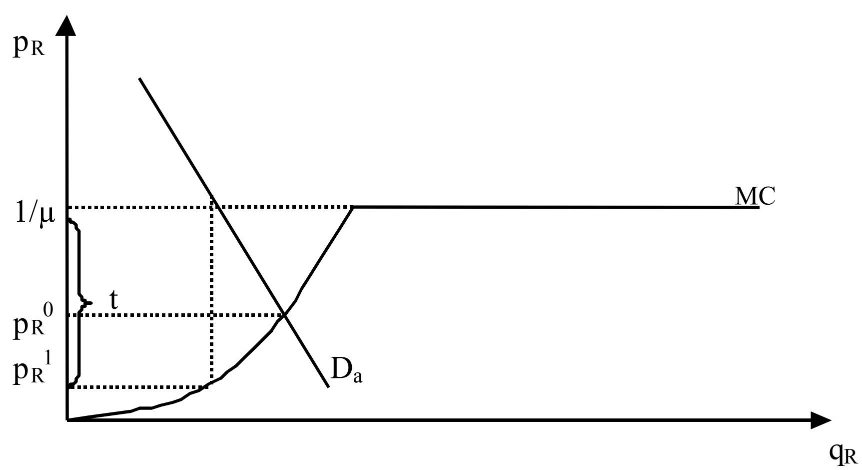
[11] If this assumption were not included, we would need to accept some form of rationing of customers (households or firms), and this will make the model much more complicated and ad-hoc.

guarantees a return on assets, when perceived commercial risk levels could be aggravated by the concern for entry and become a participation constraint for the private sector.

With the Service Obligation hypothesis, there are two possible cases. In the first case, there is enough installed capacity to cover the necessities of clients and the main issue is for the firm to get a subsidy to cover the difference between marginal cost and regulated price. In the second case, treated in section V, the capacity is insufficient and additional investment is needed. This second option (with constant marginal costs) is used exceptionally when demand becomes too high. For the first option, we assume that the subsidy is paid by the shareholders of the firm in the case of the price-cap regime. With this strategy, existence of equilibrium can be shown using the proofs already available for the standard general equilibrium models with taxes. The price-cap or the rate-of-return regulation can be interpreted as special mark-up rules that are in fact taxes for which the revenue accrues to (or is extracted from) the owners of the firms.

For clarity, it may be useful to complement the discussion with a graphic beginning with the model of alternative technology. In fact, Graph 1 shows the case of an alternative technology when demand (D_a) is low enough as to have excess of installed capacity. P_R and q_R denote the tariff in terms of the numeraire and the production level in the regulated sector, respectively. MC represents the marginal cost of the existing technology (the increasing segment) and an alternative technology (the constant marginal cost section of the curve), and 1/μ stands for the benchmark regulated price.

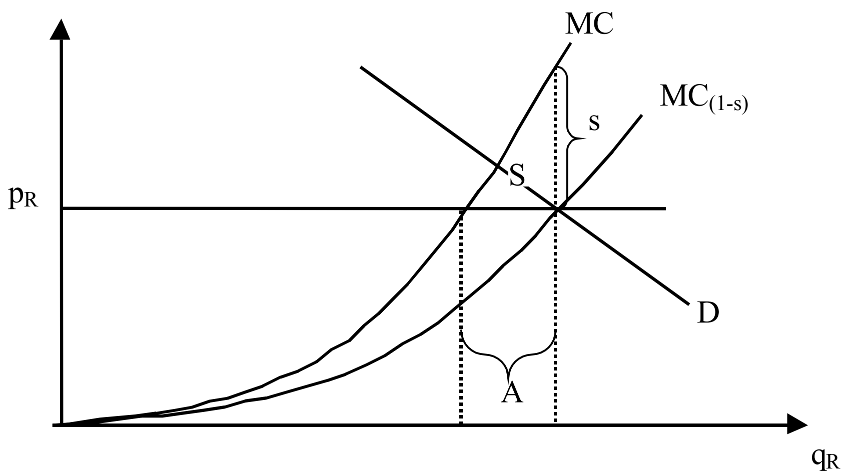
Graph 1: Non-operative price-cap



Given D_a, p_R should fall to p_R^0. However, a tax t is imposed (mark-up) to compensate owners of capital so that $p_R^1(1+t) = p_R^*$ = 1/μ. For that (t > 0) to be satisfactory for the firm, it must be assumed that demand is inelastic enough. In the case of the model we will simulate, since the regulated good is also used as an intermediate input for the rest of the economy, substitution in consumption will not prevent that the total revenue requirement be reached[12].

"Tax" revenue is transferred from customers to shareholders of the regulated firm. This t could be negative as it is shown in Graph 2, that it is a subsidy s. If an alternative technology does not exist, the firm will continue operating if the additional units (A) marginal costs are covered (triangle S). Since the obligation of service was established in the original contract between the regulators and shareholders, we assume that the shareholders cover the excess of costs –implicitly in the form of a subsidy to the operative management of the firm. This internal subsidy s is depicted in the figure below; in this case s is computed so that net price to customers equals the price-cap settled at level p_R.

Graph 2: Subsidy and alternative technology



In summary, Graph 2 shows the case of an internal subsidy, funded with a tax on the shareholders of the regulated firm. We will see later that when shareholders are foreign, this subsidy will be accompanied by an inflow of capital that reduces the need of trade surplus. Graph 2 also illustrates the case when the firm has the alternative of importing international capital. The incremental cost of the new technology is given by w^*A/μ, where w^* is the foreign factor reward and μ its average productivity. The firm will compare this cost with S, to choose the method for servicing the market. However, this will have consequences on the current account; if the firm covers the deficit with the existing technology there will be an inflow of capital (though temporary); instead if the alternative technology is employed, the additional reward of foreign factors will impose a burden.

[12] Alternatively, it can be assumed a LES utility function, with minimum standards of consumption for regulated goods.

III. The structure of the analytical model

As in any standard Ricardo-Viner model, each sector uses two different category of factors: one mobile, labor, and one non mobile, specific capital[13]. There are four domestic sectors of production (activities): I={1,2,N,R}, two of them are tradable sectors, T={1,2}, and the rest are producers of goods and services that are not tradable; sector N produces services and sector R represents sectors under regulation. Each activity produces only one commodity represented by J={1,2,N,R}. We assume that the utility and production functions correspond to the traditional neoclassical version. However, production sectors are related through input-output transactions, which play an important role in understanding the net impact of regulation on the economy. Prices of tradable goods are determined by the rest of the world[14], and domestic agents also import consumption goods that are imperfect substitutes of local production. Imports are not used for production.

The analytical representation of the aggregated regulated sector in this section deserves more attention. Though it is natural to think that the production function of that sector should exhibit some economies of scale or sub-additivity, we will assume that there are not non-convexities once specific capital is installed. This is a simplification with obvious theoretical costs, but it also contributes to concentrate our effort in determining the impact of regulatory mechanisms and not on the properties of the production set[15]. The main focus of the paper is in the short run, and when capital is installed the regulated sector is ex-post receiving a rent that compensates the initial investment. The alternative technology gives some hints on the long run effects; in that case, we assume constant returns to scale.

III.1 Domestic household

There is an only domestic agent that makes the decision on the consumption plan and receives all factor rewards (except for the regulated firm) and profits. So, we will not be paying attention to personal income distribution matters, though we can analyze factor distribution.

The domestic agent maximizes the utility function $u(c_1, c_2, c_N, c_R, m)$ subject to:

[13] A summary of the main characteristics of these models can be found in Bhagwati *et al*. (2000).

[14] The "small country assumption" in terms of Kehoe and Kehoe (1994).

[15] Dierker et al (1985) present an analysis of the existence of equilibrium when there are special pricing rules.

<1> $$\sum_{T} p_T c_T + p_R c_R + p_N c_N + p_m m = w\overline{L} + \sum_{I/\{R\}} r_I \overline{K}_I + \theta\pi^*_R + \theta t p_R G(L_R, K_R)$$

where θ is the share of domestic agents in profits of the regulated sector π^*_R and the last term corresponds to the compensatory transfer from domestic customers (t > 0) or to the firm from its shareholders (t < 0). In both cases, under price cap, t is computed so that $p_R = 1/\mu(1+t)$.

We obtain the familiar first order conditions for a maximum:

<2> $$u'_{c_T} / u'_m = p_T / p_m$$

<3> $$u'_R / u'_m = p_R / p_m$$

<4> $$u'_N / u'_m = p_N / p_m$$

c_T is consumption of domestic tradable goods, c_R is the consumption of goods and services under regulation and m are imports (a good produced abroad but not domestically) and p_T, p_R and p_m are their respective prices. w is the wage rate and r_I is the rate of return on capital in each sector. $\overline{L}$ and $\overline{K}$ represent the domestic agent endowments of labor and capital.

III.2 Domestic Production

Y, H and *G* are the production function of the tradable, non-tradable and regulated sectors, respectively. We assume constant returns to scales in all cases.

i. Tradable Sector

There is one firm that maximizes profits in each tradable sector. The net price for the firm is the price to consumers less the cost of intermediate inputs.

<5> $$\pi_T = \left[p_T - \sum_{J \neq T} a_{J,T} p_J - a_{R,T} p_R - a_{N,T} p_N \right] Y_T(L_T, K_T) - wL_T - \sum_T r_T K_T \text{ for every T=1,2}$$

and where $a_{R,T}$ and $a_{T,R}$ are input-output coefficients used to represent also technical gains due to privatization. A reduction in $a_{T,R}$ is an improvement of efficiency internal to the regulated firms, which reduces the requirement of intermediate inputs per unit of product. $a_{R,T}$ is a reduction of the requirement of regulated input per unit of tradable output (due to a better performance of private operators).

Note that firms observe the incentive given by the net price after paying intermediate inputs costs. The maximum profit conditions are:

<6> $$\left[p_T - \sum_{J \neq T} a_{J,T} p_J - a_{R,T} p_R - a_{N,T} p_N \right] Y_L = w$$

<7> $$\left[p_T - \sum_{J \neq T} a_{J,T} p_J - a_{R,T} p_R - a_{N,T} p_N \right] Y_K = r_T$$

In both cases, the value of marginal product (corrected for intermediate costs) is equalized to the reward of the factor.

ii. Non-tradable Sector

<8> $$\pi_N = \left[p_N - \sum_T a_{T,N} p_T - a_{R,N} p_R \right] H(L_N, K_N) - wL_N - r_N K_N$$

<9> $$\left[p_N - \sum_T a_{T,N} p_T - a_{R,N} p_R \right] H_L = w$$

<10> $$\left[p_N - \sum_T a_{T,N} p_T - a_{R,N} p_R \right] H_N = r_N$$

iii. Regulated Sector

As mentioned above, the regulated firm is treated as a neoclassical firm, and it behaves "competitively" though there is no entry. Net price is obtained as the difference between the regulated price and intermediate cost.

<11> $$\pi_R = \left[p_R - \sum_T a_{T,R} p_T - a_{N,R} p_N \right] G(L_R, K_R) - wL_R$$ where K_R is given.

The total rate of return of this sector is $r_R = \pi_R / K_R$. The optimal condition for profits is:

<12> $$\left[p_R - \sum_T a_{T,R} p_T - b_{N,R} p_N \right] G_L = w$$

$a_{R,T}$ and $a_{T,R}$ are input-output coefficients used to represent also technical gains due to privatization. A reduction in $a_{T,R}$ is an improvement of efficiency internal to the regulated firms, which reduces the requirement of intermediate inputs per unit of product. $a_{R,T}$ is the requirement of regulated input per unit of tradable output (due to a better performance of private operators).

III.3 Foreign Production

The rest of the world produces substitutes for our exports and import goods, using a factor of production F.

<13> $$\pi^*_m = p_m \alpha(F_m) - w^* F_m$$

<14> $$\pi^*_T = p_T \beta_T(F_T) - w^* F_T$$

<15> $$p_m \alpha' = w^*$$

<16> $$p_T \beta'_T = w^*$$

<17> $$m^s = \alpha(F_m)$$

<18> $$x^s = \beta_T(F_T)$$

where π_m^* and π_T^* represent profits in the foreign industries that produce import goods and perfect substitutes of tradables. w^*, the numeraire, is the wage rate of the only factor F used abroad.

F_m and F_T are factor quantities employed in the corresponding industries. The production functions: $\alpha(F_m)$ and $\beta_T(F_T)$ give the total supply in equations *<16>*, *<17>* and *<18>*. In the case of α' and β_T' constants, international terms of trade will be given by $p_T / p_m = \alpha / \beta_T$ (small economy assumption).

III.4 Foreign Agents

Foreign consumers receive the rents of foreign factors, including capital installed in the regulated sector as well as profits in that sector. They maximize a utility function $v(x_T, m^*)$ that depends on the consumption of our tradable goods and of import goods. The budget condition is:

<19> $$p_m m^* + p_T x_T = w^* \overline{F} + (1-\theta)\pi_R + \pi_m^* + \sum_T \pi_T^* + t p_R G(L_R, K_R)(1-\theta)$$

The foreign agent receives profits and capital return of the regulated sector, as well as the rate of return F given by w^* and the proceedings of the mark-up factor. X_T are exports, that is domestic tradable goods bought by the foreign agent. The last term in equation <19> stands for the endogenous mark-up (positive) or internal subsidy (negative) computed as the difference between the benchmark tariff 1/μ (as seen by customers) and P_R **(see section III.7).**

III.5 Market equilibrium conditions

Equations *<20>* to *<27>* represent the equilibrium conditions for factors used domestically, and <28> is the equilibrium condition for the foreign factor. Equations *<25>* to *<27>* correspond to equilibrium in markets for goods: regulated, non regulated and imports.

<20> $$\overline{L} = L_1 + L_2 + L_R + L_N$$

<21> $$\overline{K}_T = K_T \qquad (T = 1, 2)$$

<22> $$\overline{K}_N = K_N$$

<23> $$\overline{F} = F_m + \sum_T F_T$$

<24> $$G(L_R, K_R) + q_R = \sum_T a_{R,T} Y_T(L_T, K_T) + a_{R,N} H(L_N, K_N) + c_R$$

<25> $$Y_T(L_T, K_T) + x_T^s = a_{T,R} G(L_R, K_R) + a_{T,N} H(L_N, K_N) + c_T + x_T$$

<26> $$H(L_N, K_N) = \sum_T a_{N,T} Y_T(L_T, K_T) + a_{N,R} G(L_R, K_R) + c_N$$

<27> $$m^s = m + m^*$$

The solution includes determining the endogenous mark-up to cover differences between the current tariff and the one defined in the regulation in the price-cap case, i.e.: t such that $p_R = 1/\mu(1+t)$, or to cover the difference between the current overall rate of return on capital in the regulated sector and its benchmark in the rate-of return case, i.e.: t such that $\pi_R/K_R = w^*$.

III.6 Trade Balance

We can now see how the relation between the mark-up factor (and its mechanism of adjustement) and the trade balance arises in the model. From <1>***:***

$$p_R c_R + \sum_{I/\{R\}} p_I c_I + p^* m = w\overline{L} + \sum_{I/\{R\}} r_I \overline{K}_I + \theta\pi_R + \theta t P_R G(L_R, K_R)$$

and since:

$$p_R c_R + \sum_{I/\{R\}} p_I c_I + px = w\overline{L} + \sum_{I/\{R\}} r_I \overline{K}_I + \pi_R + t P_R G(L_R, K_R)$$

we get

<28> $$px - p^* m = (1-\theta)[\pi_R + t p_R G(L_R, K_R)]$$

The left hand side is the trade balance and the right hand is the foreign share in regulated sector profits.[16] While this equation shows the interactions between the regulatory regime and the trade account, it may be too restrictive. In fact, domestic ownership is not sufficient to break the link between regulation and trade; domestic agents could reveal preferences for foreign assets or goods, and put pressure on the trade balance anyhow. On the other hand, foreign ownership is not necessarily a source of stress on trade surplus, for example if profits are reinvested in the country. A more general model should include more elaboration on the domestic and foreign agents portfolio and investment decisions.

III.7 How does the mechanisms of Price-Cap and Cost-Plus work in this setting?

Basically, the endogenous tax on regulated goods consumption is a mark-up on sales and its proceedings are distributed between domestic and foreign owners of the firm according to their share in total assets.

Assume that the market price for the regulated firm were P_m and that this level were below the price-cap benchmark, given by w^*/μ, then the tax rate will be determined by:

$$t = (w^*/\mu P_m) - 1.$$

That is, we introduce an artificial tax system whose claimant is not the government, but the shareholders of the regulated firm.

If, instead of a benchmark for price we have a benchmark for the rate of return on assets, the tax function is adjusted endogenously again; the tax rate will be determined using the equation:

[16] The trade balance must compensate the current account result. Notice that it is not influenced by entrance and exit of capital "in the same period": the net impact is: - $r_R K_R$.

$$(t\ P_m\ Q_R + \pi_R) = w^* K_R$$

which means that total dividends to shareholders (left hand of the equation) match exactly normal rate of return abroad (right hand), w^*.

These equations are added to the general equilibrium system, so that we have one more equation and one more unknown, the tax rate.

The proof of existence of equilibrium in this case could become an issue. Fortunately, Shoven and Whalley (1973) have already given a proof of existence for a general case when the claimant of the mark – up revenue is the government. The natural requirement is that the mark-up function be homogenous of degree zero with respect to prices –see Ginsburgh and Keyzer (1997), for a summary of the approach.

Our rules for determining the tax rate fulfil this condition.

The tax could be negative if the market price is above the reference level $1/\mu$, or if the rate of return on assets, π_R/K_R is higher than w^*.

III.8 Simulation of shocks

In the next section we consider the following shocks for the economy:

i. Change in $a_{R,I}$

A reduction of $a_{R,I}$ could be interpreted as a savings obtained actively by the economy or as an improvement of quality of service or goods in the regulated sector supply that helps to reduce costs in other sectors. Domestic factors productivity increases and this consents a reduction of the price of exports or an increase in domestic profits and wages. This in turn increases the demand for regulated services and imports. The net effect is not well determined ex-ante.

ii. Change in $a_{I,R}$

Let us assume that regulated services use less inputs per unit of output. In turn, this reduces domestic costs through an increase of net supply of tradable goods and should encourage exports. However, prices of regulated inputs to domestic producers are only partially changed (rate-of-return) or not changed at all (price-cap) depending on the regulatory regime. It is expected an increase in domestic profits and in the flows of dividends paid abroad; this will impact on current account and will require a compensatory surplus in trade balance.

iii. Changes in terms of trade

An increase in the price of exports will foster production at the tradable sector, but the overall impact and response could depend on the indexation of critical inputs to the changing environment, like regulated goods[17]. The final response will depend on the size

[17] The literature on Dutch Disease shows how the assumptions on mobility and indexation of factor prices become crucial for the final results. One interesting aspect of this paper is that it emphasizes the role of the rule for determining tariffs in the final industrial structure. Dutch Disease literature focuses in the structure of the tradable sector itself, when one of the subsectors experiences a sudden and significant increase in its

of the tradable sector with respect to the economy and on whether the sector is intensive in the use of regulated inputs.

IV. Simulations for the Argentine economy.

Table IV-1 presents the Social Accounting Matrix of an economy that replicates the main features of the Argentine economy as of 1997[18]. We have left aside financial transactions, as well as government and imperfections, such as unemployment. What the matrix does, after that purification, is to show the relative intensity in the use of factors, the burden given by the dividends to be paid abroad and the relative weight of the regulated sector in total GDP.

Columns represent agents and rows correspond to markets for goods or services. S1 and S2 are tradable sectors, SN stands for the non-tradable producer, while SR is our aggregate regulated industry. HH represents domestic households, and RW indicates the Rest of the World "agent". A positive entry represents a sale and negative one corresponds to a purchase or payment of service; budget constraints oblige to balance when adding up the elements in a column. For example, sector S1 receives 13.2$ for selling C1, pays to the other industries 3.9$ for inputs, and uses 9.4$ to reward factors of production.

Balance must also be fulfilled when adding up elements in a row, in this case because a row represents a market and we are assuming that there is equilibrium in the benchmark. C1, C2, CN, and CR correspond to goods or services produced by tradable sectors, non-tradable and regulated industries, respectively. M1 and M2 are imports and L and K_i stand for factors of production. If we take the market for each K_i, we see that production sectors are contributing with 70.5$ each to pay for its services, 66.8$ go to domestic households and 3.7$ are dividends to the rest of the world.

Regulated sectors represent about 10%[19] of total GDP and total dividends paid abroad are estimated as 3% of GDP. We can see that Industry, Sector 2, is the heavier user of regulated sector products and services, followed by non-tradable sectors. Ownership of regulated firms is not concentrated in foreign agents as we assumed in the example; in fact, the profit tax (35%) itself explains why such assumption would not be tenable; our best approximation is θ = 0.5, in terms of the model of Section III.

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price. See for example Corden and Neary (1982). We explore these effects in the case of Argentina, where export sectors are not symmetrical in the degree of intensity they use regulated goods as imputs.

[18] Considering the information available from National Accounts and Input-Output estimations (INDEC, 2001)

[19] The sectors under regulation are Transports, Telecommunication, Electricity distribution, Gas distribution, and Water distribution. Although this sectors are indeed under different regulatory regimes we will assume that the aggregated sector is alternatively under Price-Cap or Rate of Return regulation.

Table IV-1:
A SAM based on Argentina (1997)

	S1	S2	SN	SR	HH	RW
C1	**27.27**	**-18.42**	**-0.38**	**-0.16**	**-2.40**	**-5.91**
C2	**-4.48**	**103.60**	**-16.55**	**-4.58**	**-59.08**	**-18.92**
CN	**-2.41**	**-18.66**	**171.23**	**-6.45**	**-143.71**	
CR	**-0.95**	**-9.35**	**-8.51**	**36.87**	**-18.06**	
L	**-4.83**	**-22.64**	**-64.48**	**-10.41**	**102.36**	
K1	**-14.60**				**14.60**	
K2		**-34.54**			**34.54**	
KN			**-81.31**		**81.31**	
KR				**-15.26**	**15.26**	**7.63**
M1					**-0.51**	**0.51**
M2					**-16.69**	**16.69**

Source: Own elaboration

The SAM shows the basic connecting link between the trade balance and regulations, given by the net impact on total capital outflows. Total exports amount to almost \$24 billion, while imports are slightly above \$17 billion; the difference corresponds to \$ 7.63 billion, attributed here to the return of factor KR. Remember that equation (28) is the analytical representation of these flows, basically that is the same relation but in qualitative terms.

Given that relation, the trade balance will have to accommodate changes in the regulatory framework as well as shocks in the industries under regulation since in the short run regulations are not reviewed; we will see that an optimistic point of view regarding the gains in efficiency stimulus fostered by a Price-Cap regime, should be counterbalanced with the demanding requirements on the trade surplus .

IV.1 What happens when the regulated industry enjoys a technological change?

Consider first the effects of technological progress that reduces the regulated good-intensity of the economy. Table IV-2 presents the results of assuming a 25% reduction in coefficient $a_{R,I}$, defined in previous sections. This case implies that the productivity of the rest of the economy is improving in relative terms and that the regulated firm is left behind and faces a deficit at the existing demand and price levels. This implies that the regulated price should fall; however, for contractual reasons, there are monopolistic rents to protect [20] Price levels of rates of return are set.

[20] Remember that in the real world, the cost of capital is what drives the decision of investors to enter the country or not. When risk levels are high, one way of reducing this cost of capital and avoiding a binding participation constraint of potential investors in the sector is to grant some temporary degree of protection by either restricting entry or guaranteeing implicitly (price cap) or explicitly (cost plus) a rate of return to the operator.

Total Domestic welfare[21] will be increased because the economy has a windfall gain in productivity. The differences in total GDP changes are not very significant, due to the absolute value of shocks. However, as expected, the rate of growth under "counterfactual" flexible prices is always higher than under any regulatory mechanism.

Under this setting, the focus of the discussion is directed to income distribution and trade performance.

It is critical to realize that in this exercise, the regulated sector is losing relative efficiency with respect to the rest of the economy and its rate of profit should fall in relative terms. Moreover, there will be increases in nominal wages due to gains of efficiency in manufactures and higher wages will impinge on the profits of the regulated sector too, particularly under Price-Cap.

Table IV-2 presents some key indicators for the economy. We have included Total Domestic Welfare (measured with the Equivalent Variation for domestic agents) as well as two variables that consent to appraise Foreign Agents Welfare: the rate of return on assets in the regulated sector, and the total revenue from mark-up (tax to or from shareholders) in terms of GDP. Since we have a "small economy", domestic changes affect only slightly foreign welfare, so we compute changes in the returns of assets foreigners own in the host country.

The workings of the link between profits of the regulated industry and trade surplus, given by equation <28>, can be checked comparing the rows corresponding to the rate of return r_R and to the Trade Balance, which give basically the same change.

[21] The welfare changes are computed in terms of the equivalent variation as a percentage of household income.

Table IV-2

Reduction (25%) in the economy requirements of the regulated good

	PL	PC	RR
Domestic Welfare	3.0	2.2	2.5
Mark-up Revenue /GDP	0	2.16	1.6
Wage rate	4.1	1.6	2.3
$\mathbf{r_R}$ **(3)**	-17.0	5.9	0.0
$\mathbf{P_R}$ **(2)**	-10.0	0.0	-2.7
Exchange Rate (1)	0.7	1.4	1.2
Exports	-2.1	4.3	2.7
Imports	4.8	3.9	4.1
Trade Balance (4)	-16.9	5.9	0.0
X / GDP (10%)	9.6	10.2	10.0
GDP	2.3	2.2	2.3

N.B.: changes in percentage levels, except for X/GDP (benchmark in brackets) and Mark-up/ GDP. PL: Walrasian model, PC: model with price cap regulation, RR: model with Rate of Return regulation.(1) Exchange Rate: weighted average price ratio between non-tradables and tradables (P_N/P_T); (2) P_R:Price of the regulated service; (3) r_R .total rate of return of the regulated service (4)Trade Balance: measured in percentage change

Source: Own elaboration

The table shows that domestic welfare enjoys the largest gain under the walrasian equilibrium. But since as explained earlier, the infrastructure industries need to be regulated, the ranking of the two regulatory regimes is what is of interest. In terms of household welfare and in terms of the welfare of the labor providers, the preferred choice would be rate of return/cost plus regulation. The RR regime increases welfare more than PC because the excessive profits are transferred to domestic customers via a reduction of price[22]. The other side of the coin is that from the view point of the owners of the regulated industry, clearly, a price cap regime would be better since it allows for a larger rate of return and entails the lowest decline in the average price.

From the point of view of growth, the price cap regime is only modestly less attractive. It is however quite interesting from an international trade viewpoint since it improves the terms of trade and promotes exports much more than the rate of return regime (with rate of return fixed in foreign currency).

The economy needs to increase its trade surplus to facilitate the international payments, so that exports may be increased, imports may be decreased or both. Relative prices of tradable goods versus non-tradable must increase, and this is what the simulation shows. The effort of the economy in terms of trade surplus is lower under the counterfactual walrasian solution.

The emerging story is clearly distributional. Policy makers need to chose between the users of the regulated good, the households and the workers on the one hand and the

[22] They become implicit shareholders who have to cover also the increase in wage rate that benefits only domestic agents

operators of the regulated industries and the exporters on the other. Price caps favors the second group, rate of return favors the first group.

Under PC, the price to the firm must be pushed back to its initial level in terms of foreign currency. This is accomplished, in terms of the model, with an additional tax or mark-up increase that is paid by domestic customers to the firm; dividends are sent to foreign shareholders, and this obliges the country to improve its trade balance.

Under Cost-Plus the mark up is moved up to restore the rate of return of capital to its initial level, given in terms of the numeraire (foreign currency). Since prices and profits of the regulated sector were falling, the additional mark up compensates regulated capital and therefore the same amount of dividends can be sent to shareholders. Notice that exports grow and this is due to the restoration of the mentioned flow of dividends. In fact, incentives to export are not inducing a reallocation of resources to export industries; non-tradable goods are appreciating in all scenarios with respect to tradable.

With Cost-Plus excessive profits are extracted from the firm and this reduces the flow of dividends abroad. We are not dealing here with the issue of balancing risk-sharing and asymmetries of information, which explain the preference for Price-Cap or Cost-Plus. Once the regimes are functioning, only performance is observed and according to this paper, performance must encompass trade surplus.

IV.2 What happens when the regulated industries become more efficient?

Technological shocks are however not that common for regulated industries (except maybe for the telecoms sector). The main cost savings in these sectors are through improvements in management and operational arrangements. The possibility of capturing and eventually sharing these gains is one of the main reasons why the price cap regimes have generally been initially very enthusiastically. Table IV-3 summarizes the results of the simulations of a 25% improvement in efficiency.

The efficiency gains in the regulated sector can be captured through reductions of $a_{I,R}$, the coefficient that represents inputs requirements from the rest of the economy, or by reductions in labor requirements per unit of output. Table IV-3 shows the results of assuming a 25% reduction of $a_{I,R}$. This is an internal gain of the regulated firm[23], normally expected as the result of a high-powered regulatory mechanism (price-cap).

A very interesting result is that domestic total welfare is not increased the most under PL, but under RR. The reason is that there is an efficiency gain obtained by the firm, but it is not allowed to keep it as part of its rate of return and it is fully transferred to domestic households and producers in the form of a price reduction. There is a pass-through from foreign agents to domestic agents[24].

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[23] Simulations considering efficiency loss of the same magnitude gave similar results but with the opposite sign.

[24] Owners of the firm will not necessarily have incentives to introduce the efficiency gains, however.

Table IV-3

Efficiency gains (25%) within the regulated industry

	PL	PC	RR
Domestic Welfare	1.7	0.9	1.9
Mark-up Revenue /GDP	0	2.4	-0.44
Wage rate	1.6	-1.2	2.1
r_R (3)	4.4	29.3	0.0
P_R (2)	-9.4	0.0	-11.0
Exchange Rate(1)	-1.1	-0.7	-1.1
Exports	2.4	9.3	1.2
Imports	1.6	0.4	1.8
Trade Balance(4)	4.4	29.3	0.1
X / GDP (10%)	10.1	10.7	10.0
GDP	1.8	1.8	1.7

N.B.: changes in percentage levels, except for X/GDP (benchmark in brackets) and Mark-up/ GDP. PL: Walrasian model, PC: model with price cap regulation, RR: model with Rate of Return regulation.(1) Exchange Rate: weighted average price ratio between non-tradables and tradables (P_N/P_T); (2) P_R:Price of the regulated service; (3) r_R .total rate of return of the regulated service. (4)Trade Balance: measured in percentage change

Source: Own elaboration

Table IV-3 shows that once more from the viewpoint households and workers, rate of return regulation is the preferred mode of regulation, and by a wide margin in this case. The same holds for the strong preference regulated operators and exporters for a price cap regime. Exports do not augment in the same proportion under RR than under PC because dividends are smaller and the domestic propensity to import is less than one. PC is more demanding of a domestic effort to repay the initial investment in the privatized sectors; in fact, the required increments under PC are very significant for this simplified model for Argentina: around 9%. This puts high pressure on the economy, not used to accessing easily international markets. The necessary increments under any of the rate-of-return adjustment mechanisms are much more modest, between 1 and 2%.

Though it is true that PC incentives efficiency, from the point of view of welfare improvement and exports effort, the domestic society could have reasons to adopt a low-powered incentive scheme when the efficiency gains are expected within the privatized sector.

Long run incentives to exports seem to be stronger under RR, quite close to PL. PN/PT is lower under RR than under PC. The RR regime (rate of return fixed in foreign currency) increases welfare more than PL because the excessive profits are transferred to domestic customers via a reduction of price[25]..

Though it is true that PC incentives efficiency, from the point of view of welfare improvement and exports effort, the domestic society could have reasons to adopt a low-powered incentive scheme when the efficiency gains are expected within the privatized sector.

[25] They become implicit shareholders who have to cover also the increase in wage rate.

IV.3 What happens when the terms of trade improve?

Table IV-4 illustrates the relevance of relative factor intensity for increases in price of exports. It shows the results of assuming a 10% increase in international prices of export primary goods and in international prices of export industrial goods. The impact on wages is different because primary goods do not use labor intensively. In fact, when primary goods price goes up, wages fall in terms of foreign currency (remember that we are assuming neither unemployment nor wage rigidities) though they grow in terms of non-tradable goods (the most labor-intensive sector of the economy).

There are no significant differences due to the regulatory regime, when it is primary exports prices that are increased, all of them imply a reduction in total exports. Exports fall because there is substitution of value added manufactured goods for raw primary exports.

Table IV-4:
Increase in price of exports

	10% Increase in price of primary exports			10% Increase in price of industrial exports		
	PL	**PC**	**RR**	**PL**	**PC**	**RR**
Domestic Welfare	0.3	0.2	0.3	**-0.2**	**0.6**	**0.1**
Mark-up Revenue /GDP	0	0.28	0.18	**0**	**-2.9**	**-1**
Wage rate	-1.0	-1.3	-1.2	**11.1**	**14.7**	**12.4**
r_R (3)	-1.7	1.2	0.0	**11.7**	**-20.8**	**0.0**
P_R (2)	-3.4	-2.3	-2.8	**3.2**	**-7.1**	**-0.7**
Exchange Rate (1)	-3.2	-3.1	-3.1	**3.1**	**2.7**	**2.9**
Exports	-4.0	-3.2	-3.6	**2.2**	**-6.0**	**-0.8**
Imports	-0.9	-1.1	-1.0	**-8.6**	**-7.4**	**-8.2**
Trade Balance (4)	-1.1	1.9	0.5	**33.6**	**1.5**	**22.1**
X / GDP (10%)	9.6	9.7	9.6	**10.3**	**9.4**	**10.0**
GDP	0.4	0.4	0.4	**-0.3**	**-0.4**	**-0.3**

N.B.: changes in percentage levels, except for X/GDP (benchmark in brackets) and Mark-up/ GDP. PL: Walrasian model, PC: model with price cap regulation, RR: model with Rate of Return regulation.(1) Exchange Rate: weighted average price ratio between non-tradables and tradables (P_N/P_T); (2) P_R:Price of the regulated service; (3) r_R .total rate of return of the regulated service. (4)Trade Balance: measured in percentage change

Source: Own elaboration

It is also important to take into account the relative size –see Table IV-4:- of the sectors: industry represents a higher proportion of total exports (considering primary manufactured goods as industrial). Notice that total welfare is being reduced in PL, but this indicator does not take into account the gains of foreign shareholders of privatized firms; under PC, when the regulated price is prevented from growing, the welfare improvement for domestic agents is maximum.

But it is also significant the difference in terms of welfare improvement under different regulatory regimes. We can see that the higher increase in domestic welfare is achieved under PC. This is because an increase in domestic costs, specially the wage rate, and the increment of costs cannot be passed to customers; instead they are absorbed by shareholders reducing the flow of dividends abroad or increasing the inflow of "subsidies" to the firm by their owners.

There are also several interesting comparative effects of the increase of prices of primary and industrial goods. The first implies a reduction of the price of non-tradable goods relative to tradable; the exchange rate is under-appreciated, and that appreciation is independent of the regulatory regime. Primary sectors are not intensive users of regulated goods and services. The situation is the opposite when it is manufactures export prices that are increased; the exchange rate depreciates because there is an increase in domestic demand for non-tradable goods[26].

V. An appraisal of the long-run solution

To represent the workings of the price-cap we have considered an alternative way for modeling service obligation. We have the case of a firm that has an alternative technology that substitutes local technology. The firm will choose the less costly between the internal subsidy or the alternative technology. This new investment could influence trade balance. However, notice that the net effect of the initial inflow and the final outflow (assumed to happen in the same period) is simply the opportunity cost of foreign capital.

Table V-1 presents the results of a reduction of efficiency of the firm. In this case we allow the firm to use a second technology to compensate the cost increase. Since $\boldsymbol{a_{I,R}}$ is a parameter under control of the regulated firm, the decision on how to cover deficits of the firm is in its shareholders´ hands, and it should be expected that they will choose the minimum cost strategy. This is specially important for the case of a loss of efficiency, for the firm could substitute the local methods for imported capital.

The use of a second technology can be cheaper but implies dividends outflows. This can be compared with the same exercise but financing the difference between the price cap and the marginal cost through a monetary contribution form shareholders (columns SU).

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[26] The simulations show also evidence of Dutch Disease, in terms of activity levels of tradable sectors that are not benefiting from price increases. In both cases, resources are reallocated to the booming sector and this implies reduction of the activity level of the other export industry. Corden and Neary (1982) consider two effects of a boom, a "resource movement effect" and a "spending effect", referred to the drawing of resources from the rest of the economy and to the extra spending due to higher real income.

Table V-1:
Efficiency loss 25% within the regulated industry in a model with price-cap regulation

	Argentine Model	
	NT	**SU**
Domestic Welfare	-1.0	**-0.9**
Mark-up Revenue /GDP	0	**-2.79**
Wage rate	-2.7	**1.4**
$\mathbf{r_R}^{(3)}$	-25.7	**-32.7**
$\mathbf{P_R}^{(2)}$	0.0	**0.0**
Exchange Rate$^{(1)}$	-1.3	**0.8**
Exports	13.0	**-10.3**
Imports	32.0	**-0.4**
Trade Balance $^{(4)}$	-25.7	**-32.5**
X / GDP (16.7% / 10.0%)	11.5	**9.2**
GDP	-1.6	**-2.0**

N.B.: changes in percentage levels, except for X/GDP (benchmark in brackets) and Mark-up/ GDP. SU Subsidy, NT: New Tecnology. (1) Exchange Rate: weighted average price ratio between non-tradables and tradables (P_N/P_T); (2) P_R:Price of the regulated service; (3) r_R .total rate of return of the regulated service (4)Trade Balance: measured in percentage change

Source: Own elaboration

In the Argentine case, under PC, the firm experiences a lower loss when the second technology is introduced (-26% instead of –33%) but that is a bad solution for the economy because in the second case exports have to grow 13%, *while in the first solution exports can fall*!

In the solution with an internal subsidy the economy is less productive, but the problem is covered by the shareholders who agree to subsidize the firm operation. This capital inflow helps to relax exports and leaves more goods in the hands of domestic households. There is no doubt that that solution is transitory; and it is clear that it cannot last too much. With respect to the long run incentives to export, the SU solution is harmful since relative price of tradable to non-tradable goods is falling.

VI. Final remarks

The problem of regulation encompasses the trade off between risk sharing and asymmetric information costs.

The choice between low and high-powered incentive regimes depends therefore on the relative weight of those elements on expected benefits and on the social costs ; the latter stem mainly from the distortion introduced in the economy when the regulated firm is subsidized with more taxes.

This paper helps to understand that:

1. Those costs may underestimate the true costs if international trade, the relation of the economy with the rest of the world, is not taken into account.
2. In this vein, the capital account and the rate of exchange regime could be key elements to select the regulatory regime. For example, a currency board regime (or the lack of domestic opportunities for profits reinvestment) could be too demanding on the trade account under a pure price-cap regime. That is, the potential inconsistency between the international trade regime and the regulatory regime should not be rejected a priori.
3. From the point of view of welfare improvement and exports effort, the domestic society could have reasons to adopt a low-powered incentive scheme when the efficiency gains are expected within the privatized sector.
4. There are also obvious differences between the short and the long run adjustments, and this has to be taken into account to evaluate the impact of temporary or permanent shocks. For example, a loss of comparative efficiency of the regulated sector could be faced with the same technology or with new investments; the first solution puts less pressure on the trade performance of the host country.
5. The response to an increase in industrial exports prices should be an increase in exports; however a price-cap regime could reverse that expected reaction. The booming of exporting industries increases domestic prices of inputs and factors; the regulated firm sees an increase in costs and a reduction of profits, reducing the pressure on the capital account, as well as on the necessary trade surplus.

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