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Privatization, International Asset Trade and Financial Markets

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Abstract

This paper evaluates the impact of privatization on the development of capital markets in a two-country general equilibrium model. We draw particular attention to two divestment techniques, share issue privatizations and voucher privatizations. It is shown how these two privatization methods can have an impact on private asset prices, supplies of private assets, demands for assets, market capitalizations and international asset allocation strategies. We show that even a non-marketed privatization (voucher privatization) has market-effects, by altering the portfolio choice of both domestic and foreign agents.

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1 Introduction

The stylized facts presented in Verdier and Winograd [1998] teach that the common way to implement the transfer of assets from the public sector to the private sector was in several eastern economies free distribution of public assets to private individuals.¹ For instance, the distribution of mass vouchers to the population was the dominant instrument of privatization in Czech Republic. In Poland, Slovak Republic and Romania, if a direct sale to managers and workers was implemented in a first phase of the privatization, a program of mass vouchers has been launched thereafter. In these transition economies, voucher privatization has brought about fundamental changes in the ownership of business assets. However, from a theoretical viewpoint, in a symmetric closed economy (where free shares of the privatized assets are uniformly distributed among agents), Bosi, Girmens, and Guillard [2001] show that voucher privatization has real effects but is financially neutral, as the new stocks issued are not exchanged at equilibrium. Privatization by free distribution of public assets may have an impact on financial markets, because of risk-sharing issues, if and only if distributed shares are exchanged at equilibrium, i.e. as soon as there is some heterogeneity among shareholders. A way to introduce heterogeneity is to consider an open-economy setup, with voucher distribution only to domestic agents. Foreign agents will be interested in this new diversification opportunity as soon as new stocks are imperfectly correlated with existing ones. Thus, voucher distribution to domestic agents adds endowments heterogeneity, and even though public assets are not directly sold on the financial market, privatization has financial effects.

Besides, in the stylized economy presented by Bosi, Girmens, and Guillard [2001], individuals want to smooth consumption of two types of good (private and public) across different states of nature. Public good provision is assumed to be initially not diversified across these states of nature. An efficient tax system removes this problem, always ensuring public good financing. Without efficient taxation, they show that an optimal privatization mix includes some share issue privatization (SIP)², whose revenues are invested in a diversified portfolio of private assets, in order to smooth public good provision across states of nature. The investment of privatization revenues in a diversified portfolio of private assets is not unrealistic. For instance in France, revenues from the privatization of the saving banks, as well as from the sale of licenses for UMTS mobile phone (interpreted as a waves privatization), are directed to a retirement reserve funds. The debate is still open, but the government recognizes that the need of better returns diverts these funds towards the stock market. Similarly, the United States and Canada are

¹This is one of the four principal divestment methods presented by Brada [1996]. He calls it *Mass* or *Voucher Privatization*. In such a privatization program, eligible citizens can utilize vouchers, distributed free or at a nominal cost, to bid for shares of state-owned enterprises and of other assets that are being privatized.

²In Brada [1996]'s taxonomy of privatization methods, the second one is *Privatization Through Sale of State Property*. According to Megginson and Netter [2001], this category takes two important forms. The first is *direct sales* of state-owned enterprises to an individual, an existing corporation, or a group of investors. The second form is *share issue privatizations* (SIPs), in which some or all of a government's stake in a state-owned enterprise is sold to investors through a public share offering.

equipped with such a retirement reserve funds, and consider that it should be partly invested on the stock exchange.

Thanks to a two-country general equilibrium model, this paper focuses on the impact of privatization on the development of capital markets, more precisely on the financial effects of the two alternative privatization methods described above:

- voucher privatization;
- SIP and purchase of a diversified portfolio by the government.

The analysis of these two polar cases helps also to understand what happens in intermediary situations. Most governments actually use SIPs without letting market mechanisms determine the price of the privatized asset. They underprice share offerings and then use targeted share allocations to favor domestic over foreign investors.

Our approach is related to the financial and macro-economic literature on incomplete asset markets and risk-sharing as well as to the literature on asset trade under uncertainty, among others to the papers of Acemoglu and Zilibotti [1997], Martin and Rey [2000], Pagano [1993] and Saint-Paul [1992]. However, and although the literature on privatization is rapidly growing³, this is an original approach to privatization for at least two reasons. First, privatization has been rarely analyzed in a general equilibrium setup⁴, even if some recent works have suggested this idea of privatization as a way of allocating risks across members of the economy (Maskin [2000], Perotti and van Oijen [2001]). Second, voucher privatization is often thought to have less interest than SIPs in terms of financial effects. Related literature is also empirical, either general, on stock market development (e.g. Demirguc-Kunt and Levine [1996]) and cross-border equity flows (e.g. Portes and Rey [2000]), or more specific, on governments' decisions to sell privatized companies on both international and domestic markets. (e.g. Bortolotti, Fantini, and Scarpa [2000]).

We show in this paper that at equilibrium, whatever kind of privatization is implemented, i.e. even under a free privatization, private asset relative price increases with privatization extent, not only in the country where privatization has been implemented, but also abroad. At the individual level, relative investment abroad decreases with privatization extent in the country where privatization has been implemented, and vice versa in the other one. At the aggregate level, market capitalization increases with privatization extent in both countries, but faster in the country where privatization has been implemented. In case of voucher privatization, relative foreign holdings of domestic assets decrease with privatization in the country where privatization

³For a recent and exhaustive survey, see Megginson and Netter [2001].

⁴Most of research on privatization actually analyzes the microeconomic efficiency of privatization. The key questions this stream of research has addressed are, among others, the relative economic performance of state-owned and privately owned firms, whether privatization programs are likely to improve the economic and financial performance of divested firms, whether investors who purchase privatizing share offerings experience positive returns, how privatization programs impact the development of corporate governance practices, etc.

has been implemented, and vice versa in the other one. In case of SIP, the impact on relative aggregate foreign holdings of domestic assets is ambiguous in the country where privatization has been implemented, and positive in the other one.

The rest of the paper is organized as follows. Section 2 presents some evidence. Section 3 derives the theoretical framework used. Section 4 analyzes the financial effects of voucher privatization. Section 5 investigates the properties of the model with SIP. Last section concludes.

2 Descriptive statistics

This short presentation of some evidence helps to quantify the weight of privatizations in domestic market capitalization in the French case, and to justify our modelling approach, in which government does not cross-list firms, but simply relies on markets integration to sell assets to foreign investors. Table 1 presents descriptive statistics for the fifteen french privatized firms quoted on the Paris stock exchange. More generally, Megginson and Netter [2001] notice that country that have launched large-scale share issue privatization programs have experienced rapid growth in their national stock market capitalization; privatized firms are one of the two or three most valuable companies in most non-US markets, and the 10 largest (and 30 of the 35 largest) share issues in financial history have all been privatizations.

Table 1

2.1 Privatizations and domestic market capitalization

In France, the fifteen privatized firms quoted on the Paris stock exchange weigh more than 300 billion euros in terms of market capitalization. Moreover, the biggest french firm in terms of market capitalization (France Telecom, more than 80 billion euros) is to be found among them. Eight of these firms belong to the CAC 40 index, grouping together the forty most important french firms, and their aggregate weight represents more than a quarter of this index. Considering wider stock market indexes, privatized french firms represent almost 24% of the SBF 120 index, and more than 22% of the widest index (SBF 250).

2.2 Cross-listed privatization and market integration

For two thirds of privatized french firms, public offerings took place only in the local currency, i.e. in French francs before 1999, in euros thereafter. Then, in most cases, privatization is not cross-listed, even if there are exceptions, e.g. France Telecom and Pechiney, simultaneously offered in French francs in Paris and in dollars in New York, as privatization occurred. However, this relative rareness of cross-listing does not mean that firms were sold only to domestic investors. Even firms only offered on the domestic market are now partly owned by foreign agents. AGF has been bought by Allianz (Germany). Motorola (USA), NEC and DNP (Japan) represent now more than 40% of the shares of Bull. The former Crédit Local de France has merged with groups of Belgium and Luxembourg to create Dexia. Aerospatiale Matra has merged with CASA (Spain)

and DaimlerChrysler Aerospace to create EADS. Seita has merged with Tabacalera (Spain) to create Altadis. Commerzbank (Germany) and Banco Bilbao Viscaya (Spain) hold shares of the Crédit Lyonnais, Vodafone (UK) and Deutsche Telekom (Germany) shares of France Telecom, etc.

2.3 Privatization extent

Firms are not necessarily completely privatized. For six of the fifteen french privatized firms quoted on the Paris stock exchange, French Government still appears among the top shareholders. For instance, it holds directly 56.80% of Air France, 55.70% of France Telecom and 44.22% of Renault.

3 A theoretical model

This two-period general equilibrium open-economy model is inspired by Martin and Rey [2000]. Consider two countries, A and B . There are n_A identical immobile private agents (indexed by $i = 1, \dots, n_A$) in country A and n_B private agents in country B (indexed by $k = n_A + 1, \dots, n_A + n_B$). They interact with the government of country A (indexed by $g = n_A + n_B + 1$). In the second period, there are S exogenously determined and equally likely states of nature indexed by $s \in \{1, \dots, S\}$, revealed at the beginning of the period.

3.1 Endowments and technology

In the first period each agent (including country A government) has a property right over a second-period stochastic endowment in private good. More precisely the endowment of agent z is equal to:

$$e_z(s) = \begin{cases} 1 & \text{if } s = z \\ 0 & \text{otherwise} \end{cases}$$

The property right in the first period can be interpreted as a firm, or as a specific risky project, which provides a return of 1 in a specific state of nature and of 0 otherwise. In this respect there is a complete specialization and no technological diversification at all. This property right can also be interpreted as an Arrow-Debreu security that pays only in one state of nature. The assumption may look quite extreme⁵. However, what is crucial here is not this identity between projects and states of nature, but that the different projects are imperfectly correlated and there are risk-sharing opportunities for risk-averse agents. We could envisage to replace the relation “one project - one state of nature” by n linearly independent payoff vectors (one for each agent), each individual project giving different returns in different states of nature. This would complicate the analytical solution of the model, without changing the qualitative results.

⁵Acemoglu and Zilibotti [1997] and Martin and Rey [2000] have a similar assumption of contingent projects.

With neither taxes nor financial markets, the only resource the government has at disposal is this stochastic endowment. This endowment in private good is used as input and converted in public good by a specific technology in the second period. By simplicity we consider an identity production function which transforms one unit of private good in one unit of public good. In country A , the size of the public sector (relative to the whole economy) is given by its weight in the initial property rights, equal to $1/(n_A + 1)$.

3.2 Preferences

There are two types of goods in country A (private and public) and only private consumption in country B :

$$\begin{aligned} U_A(c_i, G) &= u(c_i) + v(G) \\ U_B(c_k) &= u(c_k) \end{aligned}$$

Sub-utility functions v and w are specified as follows:

$$u(c) = c^\rho; v(G) = G^\rho$$

where

$$0 < \rho < 1$$

This specification allows for straightforward computations, but result generality is preserved as well as the main kind of transmission mechanism between privatization and financial indicators.

3.3 Financial markets

Shares of the property rights (claims on the stochastic endowments) can be traded on financial markets during the first period (this is the only economic activity during this period). p_z is the price of the asset issued by the agent z . $d_{zz'}$ is the demand of the agent z for assets issued by the agent z' . Agents do not cross-list firms: their assets are not quoted on foreign markets.⁶ They simply rely on market integration to sell assets to foreign investors.

3.4 Privatization

The government privatizes a share σ of its initial property right, treated as an exogenous variable: the privatization extent is not decided by the short run policy maker but exogenously fixed by an independent power such as a parliament, or by a prior electoral program of government's coalition; it belongs to a long-run strategy: by assumption the government is forced to distribute (voucher privatization) or to sell (SIP) a given amount σ .

⁶Suppose for instance that there is an arbitrarily small cost to list abroad.

3.5 Looking for the relevant market development indicator

Demirguc-Kunt and Levine [1996] present an array of stock market development indicators. They describe measures of market size, market liquidity, market volatility, market concentration, asset pricing efficiency, regulatory and institutional development. Some of them are relevant in our setup. The market capitalization (equals the value of listed shares) is frequently used as a measure of stock market size. In our model, it is defined as follows:

$$C_A \equiv \left(\sum_{i=1}^{n_A} p_i(1 - d_{ii}) \right) + p_g \sigma$$

$$C_B \equiv \sum_{k=n_A+1}^{n_A+n_B} p_k(1 - d_{kk})$$

Looking at the expressions of market capitalization in both countries, there is an obvious difference, as two types of assets are quoted on the market A , whereas there is only one type of asset quoted in country B . Consequently, there will be at least a positive direct effect of privatization on market capitalization in the country A , as soon as the new stocks issued are exchanged. This effect may be very strong if σ is close to one and if at the same time, the public sector initially represents a large share of the economy (if its weight in the initial property rights, equal to $1/(n_A + 1)$ is also sufficiently large). For country A , we define also the *private* market capitalization C'_A , excluding privatized assets, thus referring only to preexisting assets:

$$C'_A \equiv C_A - p_g \sigma$$

Second, the traded volume (equals total shares traded on the market) measures the organized trade of equities and should therefore positively reflect liquidity. In our model it is defined as follows:

$$V_A \equiv \sum_i \sum_{j \neq i} d_{ij} + \sum_k \sum_i d_{ki} + \sum_i d_{ig} + \sum_k d_{kg}$$

$$V_B \equiv \sum_k \sum_{h \neq k} d_{kh} + \sum_i \sum_k d_{ik}$$

$$i, j = 1, \dots, n_A$$

$$k, h = n_A + 1, \dots, n_A + n_B$$

As for market capitalization, there will be a positive direct effect of privatization on traded volume in country A , as soon as demands for the privatized assets (d_{ig} and d_{kg} in the above equation defining V_A) are positive.

Another measure of liquidity is the turnover ratio (equals traded volume divided by market capitalization). High turnover is often used as an indicator of low transaction costs. In our model it is defined as follows:

$$T_A \equiv V_A/C_A$$

$$T_B \equiv V_B/C_B$$

Finally, it is interesting to gauge whether markets price risk efficiently, i.e. to see if comparable assets (same risk, same expected return) have the same price. We guess already that in our setup, as there is no exogenous trading costs, no imperfections, assets with the same fundamentals keep the same price.

4 Market-effects of a non-marketed privatization

We focus on voucher privatization. The government freely distributes shares of its property right. This distribution occurs *ex ante*, i.e. before financial markets open. Each one of the n_A domestic private agents gets $1/n_A$ of the stocks issued. Only domestic agents get shares of the privatized project: this introduces some asymmetry between domestic and foreign agents in the model; this is a way to introduce endowments heterogeneity. Agents can trade shares of this additional property right on the domestic financial market. As privatization consists in a free distribution, there will be no privatization revenue (and in consequence no government budget constraint), and public good production occurs only in state $g = n_A + n_B + 1$. In this case, public good production is simply equal to $1 - \sigma$. Obviously, this is not an optimal policy in terms of public good provision diversification and thereby in terms of welfare.⁷ However, we take this policy as given, and focus on financial effects.⁸

In our simple two-period setup, we do not assume that private agents are obliged to keep the free shares they get during a given lapse of time. They can exchange them immediately on financial markets. This is a necessary condition to get financial effects in this two-period model. If somehow or other the securities issued by the government are not exchanged during the first period, there are no financial effects at all, as in the closed-economy case, where free shares of the privatized assets are uniformly distributed among agents, so that voucher distribution is financially neutral, as the new stocks issued are not exchanged at equilibrium.

Finally, notice that this model can also be interpreted as a closed economy, in which free shares are distributed to an exogenous fraction of the population (the insiders, e.g. managers and/or workers of the privatized firms), whereas the others (the outsiders) gets nothing. In this case, the percentage of insiders is simply given by:

$$\nu \equiv \frac{n_A}{n_A + n_B}$$

4.1 Equilibrium

We consider the case where $n_A + n_B + 1 \leq S$. In this case, there may be no production in some states of nature. Thereby, it will not be possible to eliminate all the risk by holding a portfolio of all traded assets. However, the need for assurance can be partially achieved through

⁷Empirically, Megginson and Netter [2001] actually confirm that voucher privatization is the least economically productive divestment method, but add that the governments that use it generally have few other realistic options.

⁸For optimal privatization designs and an analysis in terms of real effects in a closed-economy setup, see Bosi, Girmens, and Guillard [2001].

and only through financial choices, as there is a complete specialization and no technological diversification at all. Only financial diversification matters⁹.

4.1.1 Country *A* private agents

Agent *i* solves the following program:

$$\begin{cases} \max_{d_{iz}, z=1, \dots, n_A+n_B+1} Eu(c_i) + \overline{Ev} \\ \text{s.t.} \quad \sum_{z=1}^{n_A+n_B+1} p_z d_{iz} \leq p_i + p_g \frac{\sigma}{n_A} \end{cases} \quad (1)$$

where:

$$Eu(c_i) = \sum_{z=1}^{n_A+n_B+1} \frac{1}{S} v(d_{iz})$$

Notice that the expected utility of public good does not depend on the consumer's will. We get the following demand functions:

$$d_{iz} = \left(\frac{p_i}{p_z} \right)^{\frac{1}{1-\rho}} \frac{1 + \frac{p_g \sigma}{p_i n_A}}{\sum_{z=1}^{n_A+n_B+1} \left(\frac{p_i}{p_z} \right)^{\frac{\rho}{1-\rho}}}, \quad z = 1, \dots, n_A + n_B + 1$$

4.1.2 Country *B* private agents

Symmetrically, agent *k* solves the following program:

$$\begin{cases} \max_{d_{kz}, z=1, \dots, n_A+n_B+1} Eu(c_k) \\ \text{s.t.} \quad \sum_{z=1}^{n_A+n_B+1} p_z d_{kz} \leq p_k \end{cases} \quad (2)$$

where:

$$Eu(c_k) = \sum_{z=1}^{n_A+n_B+1} \frac{1}{S} v(d_{kz})$$

Let us briefly compare programs (1) and (2). The main difference lies in the right-hand side of the budget constraints: thanks to voucher distribution, country *A* agents get additional resources. For country *B* agents we get the following demand functions:

$$d_{kz} = \left(\frac{p_k}{p_z} \right)^{\frac{1}{1-\rho}} \frac{1}{\sum_{z=1}^{n_A+n_B+1} \left(\frac{p_k}{p_z} \right)^{\frac{\rho}{1-\rho}}}, \quad z = 1, \dots, n_A + n_B + 1$$

⁹For a model stressing the duality between financial and technological diversification, see Saint-Paul [1992].

4.1.3 General equilibrium

We have three market-clearing conditions, corresponding to the three types of assets, respectively those issued by country A private agents, those issued by country B private agents, and those issued by country A government (and then traded by private agents):

$$\begin{cases} \sum_{z=1}^{n_A+n_B} d_{zi} = 1, \quad i = 1, \dots, n_A \\ \sum_{z=1}^{n_A+n_B} d_{zk} = 1, \quad k = n_A + 1, \dots, n_A + n_B \\ \sum_{z=1}^{n_A+n_B} d_{zg} = \sigma \end{cases} \quad (3)$$

One of these equations will be redundant by the Walras law. Besides, it is easy to check that the equilibrium will be symmetric, i.e. we have:

$$\begin{aligned} p_i &= p_j \equiv P_A, \quad \forall i, j \in \{1, \dots, n_A\} \\ p_k &= p_h \equiv P_B, \quad \forall k, h \in \{n_A + 1, \dots, n_A + n_B\} \end{aligned}$$

We can normalize the price of the privatized asset. For $\sigma > 0$, we set¹⁰:

$$p_g \equiv 1$$

Consequently, the system (3) giving the equilibrium prices (P_A^*, P_B^*) reduces to:

$$\begin{cases} \frac{n_A \left(1 + \frac{\sigma}{n_A P_A}\right)}{n_A + n_B \left(\frac{P_A}{P_B}\right)^{\frac{\rho}{1-\rho}} + P_A^{\frac{\rho}{1-\rho}}} + \left(\frac{P_B}{P_A}\right)^{\frac{1}{1-\rho}} \frac{n_B}{n_A \left(\frac{P_B}{P_A}\right)^{\frac{\rho}{1-\rho}} + n_B + P_B^{\frac{\rho}{1-\rho}}} = 1 \\ \frac{n_A \left(1 + \frac{\sigma}{n_A P_A}\right)}{n_A + n_B \left(\frac{P_A}{P_B}\right)^{\frac{\rho}{1-\rho}} + P_A^{\frac{\rho}{1-\rho}}} \left(\frac{P_A}{P_B}\right)^{\frac{1}{1-\rho}} + \frac{n_B}{n_A \left(\frac{P_B}{P_A}\right)^{\frac{\rho}{1-\rho}} + n_B + P_B^{\frac{\rho}{1-\rho}}} = 1 \end{cases} \quad (4)$$

4.2 Asset prices and financial market development

4.2.1 Asset prices

We solve the system (4). That leads to:

$$P_A^* = P_B^* = \sigma^{1-\rho}$$

We notice first that privatization does not break the equality of asset prices, though the asymmetry introduced by voucher distribution to domestic agents. Prices stay fair, in the sense that comparable assets (same risk, same expected returns) have the same price. Besides, we notice that private asset prices are an increasing concave function of the privatization extent. But

¹⁰ p_g is not defined for $\sigma = 0$. As we are in the general equilibrium theory context, the numeraire can be chosen arbitrarily among the set of assets. In consequence, the choice of the privatized asset as the numeraire has no effect.

we must remember that these are relative prices, as we have normalized p_g to 1. Therefore, this implies that, not surprisingly, the relative price of the privatized assets (equal to P_A^{-1}) is a decreasing convex function of the privatization extent.

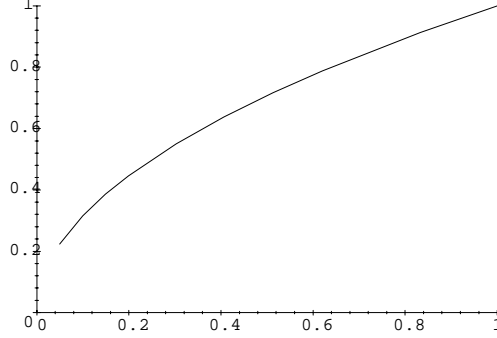


Fig. 1: private asset relative price as a function of σ .

Proposition 1 *Under voucher privatization, private asset relative price increases with privatization extent. Asset prices are always equal in both countries, for all privatization levels.*

4.2.2 Supply of private assets

Replace P_A and P_B by their equilibrium values in the supplies of private assets (in terms of share of the initial private property rights). In country A and country B , that leads respectively to:

$$\begin{aligned} 1 - d_{ii}^* &= 1 - \frac{1 + \frac{\sigma^\rho}{n_A}}{n_A + n_B + \sigma^\rho} \\ 1 - d_{kk}^* &= 1 - \frac{1}{n_A + n_B + \sigma^\rho} \end{aligned}$$

We notice first that:

$$1 - d_{ii}^* \leq 1 - d_{kk}^*$$

Besides we get that:

$$\frac{\partial(1 - d_{ii}^*)}{\partial\sigma} \leq 0; \quad \frac{\partial(1 - d_{kk}^*)}{\partial\sigma} \geq 0 \quad (5)$$

At first sight, $1 - d_{zz}$ seems to be a relevant indicator of financial market development: if $1 - d_{zz} = 0$ for every z , there is no financial market at all. Conversely, if $1 - d_{zz}$ is close to one, a large part of property rights is sold on the market. However, if we interpret $1 - d_{zz}^*$ as an equilibrium financial market development indicator the result (5) may be surprising: the impact of privatization would be positive on the foreign market, and negative on the domestic one!

On country B agents' side, an attractive argument is the following: risk-averse agents perceive privatization as a new risk-sharing opportunity. They will be interested in this new diversification opportunity as soon as new stocks are imperfectly correlated with existing ones (that is the case in our setup). The increasing relation between private supply and privatization is

due to this financial diversification effect. Consistently with the seminal work by Pagano [1993], where the entrepreneur who goes public increases risk-sharing opportunities for others, privatization adds diversification possibilities, which in turn encourages listing by private firms. This idea is also shared by Maskin [2000], who claims that “because different assets have different distributions of returns, privatization is a way of allocating risks across members of the economy”. However, in our setup these gains in market development could be the result of exogenous private listings as well.

Looking at other equilibrium demand for assets helps to understand the underlying general equilibrium mechanisms in both countries.

4.2.3 Demands for assets

It is more interesting to look not only at d_{ii}^* and d_{kk}^* , but at the same time to the other demand functions. The following table presents the results.

Country <i>A</i>	$\frac{\partial}{\partial \sigma}$	Country <i>B</i>	$\frac{\partial}{\partial \sigma}$
$d_{ii}^* = d_{ij}^* = d_{ik}^*$	(+)	$d_{kk}^* = d_{kh}^* = d_{ki}^*$	(-)
d_{ig}^*	(+)	d_{kg}^*	(+)

For country *A* agents, an increase in the privatization extent σ leads to an increase in all demands for assets. Intuitively, the additional resources they get thanks to the voucher distribution are allocated among all types of assets, including their own (wealth effect). That is why d_{ii}^* increases with σ , and consequently $1 - d_{ii}^*$ decreases. Country *B* agents have unchanged resources, as they do not receive free shares of the privatized firm. But at the same time, as seen above, there is a new diversification opportunity. That leads to a trade-off: they increase their demand for privatized assets, and decrease their demand for all private assets, including their own (portfolio reallocation effect). That is why d_{kk}^* decreases with σ , and consequently $1 - d_{kk}^*$ increases. Besides, we have:

$$d_{iz} \geq d_{kz}, \quad z = 1, \dots, n_A + n_B + 1$$

Because of their additional resources, country *A* agents invest more in all types of assets.

4.2.4 Market capitalization

At equilibrium, market capitalization in *A* is equal to:

$$C_A^*(\sigma) = n_A (1 - d_{ii}^*) P_A^* + \sigma$$

At first sight, the impact of privatization extent on domestic market capitalization might seem ambiguous, because one must consider different effects: $1 - d_{ii}^*$ is decreasing in σ , whereas P_A^* and σ are increasing. There is clearly a positive direct effect of privatization on market capitalization, thanks to the listing of a new firm on the market, as soon as its price is positive. This is the case here, as privatized assets are always exchanged at equilibrium, between country *A* and country

B agents. There is another effect (indirect and at first sight ambiguous), by the dependence of d_{ii}^* and P_A^* on σ . If we will be able later to prove that market capitalization is a strictly increasing function of privatization extent, we see already that the privatization impact on the *private* market capitalization (excluding the direct effect described above, thus referring only to preexisting assets) is ambiguous (there are parameter values such that it is clearly positive, other ones such that it is clearly negative).

In country B , equilibrium market capitalization is equal to:

$$C_B^*(\sigma) = n_B (1 - d_{kk}^*) P_B^*$$

It is unambiguously increasing in σ , as $1 - d_{kk}^*$ and P_B^* are increasing in σ , as explained above. Two effects are combined, the reduction of d_{kk}^* , to benefit from a new diversification opportunity at constant resources (portfolio reallocation effect), and the increase in P_B^* , as described above.

4.2.5 Traded volume

Equilibrium traded volume in A is given by:

$$V_A^*(\sigma) = n_A \left((n_A - 1) d_{ij}^* + n_B d_{ki}^* \right) + n_A d_{ig}^* + n_B d_{kg}^*$$

Some elements of this expression are increasing in σ . The rise of d_{ij}^* and d_{ig}^* in σ reflects the allocation of new resources by country A agents. But one must take into account the trade-off of country B agents: d_{ki}^* decreases, whereas d_{kg}^* increases. Similarly, equilibrium traded volume on the market B is given by:

$$V_B^*(\sigma) = n_B \left((n_B - 1) d_{kh}^* + n_A d_{ik}^* \right)$$

In this expression, d_{kh}^* is decreasing in σ (because of the country B agents portfolio reallocation), whereas d_{ik}^* is increasing (because of the optimal allocation of new resources by country B agents).

4.3 Voucher privatization and financial integration

This section focuses on international issues such as the impact of voucher privatization on international asset allocation strategies, competition among exchanges and financial integration.

4.3.1 Equilibrium holdings of privatized assets by foreign agents

In our model agents do not cross-list firms. They simply rely on market integration to sell assets to foreign investors. Furthermore, with free distribution of public assets to domestic agents, there is no direct relation between government and foreign agents. Thus, the question of cross-listed privatization is irrelevant in this setup. However, we can compute an equilibrium holdings level of privatized assets by foreign agents. Therefore, if we do not have cross-listed privatization

or sale of privatized assets to foreign agents by the government, after all we have a measure of the (indirect) transfer of assets from the public sector to foreign agents.

In the general equilibrium system (3), the market-clearing condition for privatized assets was:

$$\sum_{z=1}^{n_A+n_B} d_{zg} = \sigma$$

We define the equilibrium relative holdings of privatized assets by foreign agents as the equilibrium demand for privatized assets by country B agents divided by the equilibrium aggregate demand for privatized assets (equal to the supply of public assets, equal to privatization extent):

$$\psi \equiv \frac{\sum_{k=n_A+1}^{n_A+n_B} d_{kg}}{\sum_{z=1}^{n_A+n_B} d_{zg}}$$

At equilibrium, it can be rewritten:

$$\psi^*(\sigma) = \frac{n_B d_{kg}^*}{\sigma}$$

Replacing d_{kg}^* by its expression, we get that:

$$\psi^*(\sigma) = \frac{n_B}{n_A + n_B + \sigma\rho}$$

$\psi^*(\sigma)$ is increasing in n_B and decreasing in n_A . This is consistent with intuition: other things equal, the fraction of the stocks held by foreign investors depends on their relative absorption capacity; they will hold a large share if the relative absorption capacity of domestic agents is limited, due to various reasons (low level of savings, relative dimension of the privatized assets, etc.). Empirical evidence on the determinants of cross-border equity flows (Portes and Rey [2000]) confirms that market sizes are likely to be among the most important of these determinants.

The negative dependence in σ reflects the fact that, other things equal, an increase in resources for country A agents decreases the relative holdings by foreign agents.

Proposition 2 *Equilibrium relative holdings of privatized assets by foreign agents are increasing in the number of foreign agents, decreasing in the number of domestic ones, and decreasing in privatization extent.*

In our simple model, the (indirect) transfer of assets from the public sector to foreign agents can not be affected by political, legal, regulatory, reputation or institutional factors, although these effects find strong support in empirical analyses, for instance in Bortolotti, Fantini, and Scarpa [2000]. Besides, the determinants of equilibrium holdings by foreign agents we are able to identify would be the same if the seller would have a private identity.

4.3.2 International asset allocation strategies

In the program of a country A private agents (1), the budget constraint was:

$$\sum_{z=1}^{n_A+n_B+1} p_z d_{iz} \leq p_i + p_g \frac{\sigma}{n_A}$$

The left-hand side gives the portfolio structure of this agent. Thus, we can define the ratio of domestic investment over investment abroad as follows:

$$\delta_i \equiv \frac{\sum_{j=1}^{n_A} p_j d_{ij} + p_g d_{ig}}{\sum_{k=n_A+1}^{n_A+n_B} p_k d_{ik}}$$

At equilibrium, it can be rewritten:

$$\delta_A^*(\sigma) = \frac{n_A P_A^* d_{ij}^* + d_{ig}^*}{n_B P_B^* d_{ik}^*}$$

Replacing prices and demands by their expressions, we get that:

$$\delta_A^*(\sigma) = \frac{n_A + \sigma^\rho}{n_B}$$

Not surprisingly, relative domestic investment increases with σ : because of the privatization, at the individual level, country A agents are encouraged to invest more domestically, and less abroad. We can see that, symmetrically, country B agents are encouraged to invest more abroad, and less domestically, by defining a symmetric ratio. For country B agents, the ratio of domestic investment over investment abroad is:

$$\delta_k \equiv \frac{\sum_{h=n_A+1}^{n_A+n_B} p_h d_{kh}}{\sum_{i=1}^{n_A} p_i d_{ki} + p_g d_{kg}}$$

At equilibrium we get that:

$$\delta_B^*(\sigma) = \frac{1}{\delta_A^*(\sigma)}$$

Equilibrium relative domestic investment δ_B^* decreases with privatization extent σ in country B .

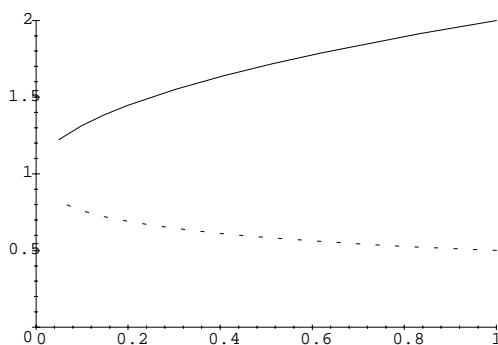


Fig. 2: equilibrium relative domestic investments as functions of σ .¹¹

On Fig. 2, if privatization extent is close to zero, in a symmetric environment ($n_A = n_B$), domestic investment over investment abroad tends obviously to one in both countries. As privatization extent increases, this ratio increases for domestic agents, up to 2 in case of total privatization. This is not a surprising result: with a total privatization, there are two assets quoted on the domestic market and only one on the foreign market. The optimal decision rule is therefore to invest two thirds of the portfolio on the domestic market. A similar rationale applies for country B agents: the ratio of domestic investment over investment abroad tends to one half as privatization extent tends to one.

Proposition 3 *At the individual level, equilibrium relative domestic investment increases with privatization extent in the country where privatization has been implemented, and vice versa in the other one.*

4.3.3 Competition among exchanges

How do privatizations affect competition among exchanges in integrated financial markets? Analytically, the answer is ambiguous in terms of order flows (because of the different effects involved in the evolution of traded volumes, as seen above), but we can show that in terms of market capitalization, voucher privatization increases the competitiveness and attractiveness of the domestic financial market. We compute the ratio C_A^*/C_B^* and after replacing prices and demands by their equilibrium expressions, we get that:

$$\frac{\partial(C_A^*/C_B^*)}{\partial\sigma} > 0$$

The proof is in Appendix A. Combining this result with the fact that C_B^* is increasing in σ , that removes the ambiguity on the relation between voucher privatization and domestic market capitalization. That indicates that the positive direct effect of privatization in terms of domestic market capitalization dominates the possibly indirect effect described above. These results together confirm the intuition that the impact of privatization in terms of market capitalization

¹¹Solid line represents country A and dots country B .

is greater in the domestic country than in the foreign one. At the aggregate level, world market capitalization obviously increases.

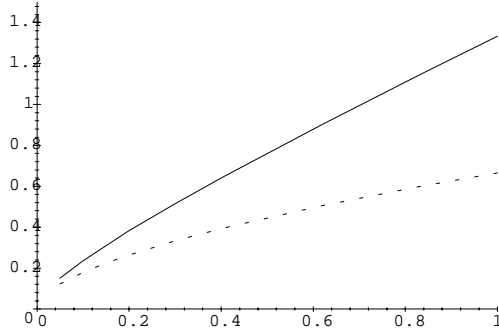


Fig. 3: market capitalizations as functions of σ .¹²

Proposition 4 *Under voucher privatization, market capitalization increases with privatization extent in both countries, but faster in the country where privatization has been implemented.*

4.3.4 Financial integration

We have seen that the equality between private asset prices remains true, for all σ .

Definition 1 *Two markets are said to be perfectly integrated if and only if comparable assets (same risk, same expected return) have the same price.*

This seems to be a standard, wide enough and well-accepted definition. Obviously, from this point of view, voucher privatization does not affect financial integration, in this setup without any imperfection. But we can consider another definition.

Definition 2 *The more assets foreign investors hold, the more a given financial market is said to be integrated.*

According to this definition, we define the ratio of relative holdings of domestic assets by foreign agents. Assets issued by country A private agents and those distributed by the government to these agents are quoted on the domestic market. In the system (3), the market-clearing conditions for these assets were:

$$\begin{cases} \sum_{z=1}^{n_A+n_B} d_{zi} = 1, i = 1, \dots, n_A \\ \sum_{z=1}^{n_A+n_B} d_{zg} = \sigma \end{cases}$$

We define ϕ_A , the ratio of relative foreign holdings of domestic assets, as follows:

$$\phi_A \equiv \frac{\sum_i \sum_k d_{ki} + \sum_k d_{kg}}{n_A + \sigma}$$

¹²Solid line represents country A and dots country B .

At equilibrium, that can be rewritten:

$$\phi_A^*(\sigma) = \frac{n_B (n_A d_{ki}^* + d_{kg}^*)}{n_A + \sigma}$$

Replacing d_{ki}^* and d_{kg}^* by their expressions, we get that:

$$\phi_A^*(\sigma) = \frac{n_B}{n_A + n_B + \sigma \rho}$$

Relative foreign holdings decrease with σ . The foreign demand for privatized assets (d_{kg}^*) increases, but that is more than compensated by the reduction in the foreign demand for private domestic assets (d_{ki}^*) and, at the same time (do not forget that ϕ_A is a *relative* ratio), the increases in domestic demands (d_{ig}^* and d_{ij}^*). Besides, we notice the expected signs in the dependence of ϕ in n_A (negative) and n_B (positive), as emphasized in the discussion on equilibrium holdings of privatized assets by foreign agents, and consistently with empirical evidence.¹³

Similarly, in the country B relative foreign holdings are given by:

$$\phi_B \equiv \frac{\sum_k \sum_i d_{ik}}{n_B}$$

At equilibrium that can be rewritten:

$$\phi_B^*(\sigma) = n_A d_{ik}^*$$

$\phi_B^*(\sigma)$ is increasing in σ , as d_{ik}^* is itself increasing in σ . In country B all forces play in the same sense, domestic demand decreases (portfolio reallocation effect, because of the new risk-sharing opportunity, at constant resources) while foreign demand increases (thanks to the additional resources, optimally allocated among all available assets).

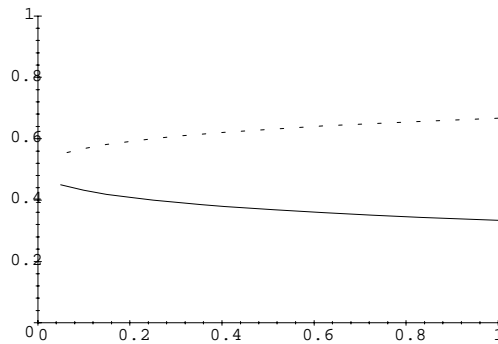


Fig. 4: equilibrium relative foreign holdings of domestic assets as functions of σ .¹⁴

¹³See Portes and Rey [2000].

¹⁴Solid line represents country A and dots country B .

On Fig. 4, in a symmetric environment ($n_A = n_B$), in both countries, foreign holdings over total domestic assets tends obviously to fifty percent as privatization extent tends to zero. Then, as privatization extent increases, relative foreign holdings of domestic assets decrease in country A and increase in country B .

Proposition 5 *At the aggregate level, relative foreign holdings of domestic assets decrease with privatization in the country where privatization has been implemented, and vice versa in the other one.*

The wealth effect described above increases with privatization extent. As a consequence, the share of country A agents in assets holdings increases in both countries.

5 Public risk-sharing and private asset markets

We keep assumptions on endowments, technology, preferences and financial markets, but we focus now on share issue privatizations. In the first period the government sells shares of its property right on a financial market. As the government sells, it gets a revenue from the privatization. We assume that, thanks to this first-period revenue, the government buys a diversified portfolio, which is precisely constituted by the assets sold by the private agents. We assume here that the government keeps its diversified portfolio at the end of the first period, and thereby may have an additional endowment in the second period, to be transformed in public good.

We take this policy as given, and focus on financial effects. As it maximizes the utility of a representative agent, the government now plays as a $(n + 1)$ th risk-averse agent on the financial market. Notice that if taxes are not available, it is the only privatization method that allows the diversification of public good provision across the different states of nature; it might even lead to the first best of this economy.¹⁵

5.1 Equilibrium

Agent i (of country A) now solves the following program:

$$\begin{cases} \max_{d_{iz}, z=1, \dots, n_A+n_B+1} & Eu(c_i) + \overline{Ev} \\ \text{s.t.} & \sum_{z=1}^{n_A+n_B+1} p_z d_{iz} \leq p_i \end{cases}$$

Compared to program (1), the budget constraint is modified, because private agents do not get free shares. This budget constraint is now perfectly similar to the one of agent k (of country B)

¹⁵This idea of privatization as a way of allocating risks is suggested in Maskin [2000] among others. For the optimal privatization combination and an analysis in terms of real effects in a closed-economy setup, see Bosi, Girmens, and Guillard [2001].

(see program (2)). Expected utilities expressions are not affected. Thus, analytically, we only have one type of private agent z ($z = 1, \dots, n_A + n_B$), solving the following program:

$$\begin{cases} \max_{d_{zz'}, z'=1, \dots, n_A+n_B+1} Eu(c_z) \\ \text{s.t.} \quad \sum_{z'=1}^{n_A+n_B+1} p_{z'} d_{zz'} \leq p_z \end{cases}$$

We get the following demand functions:

$$d_{zz'} = \left(\frac{p_z}{p_{z'}} \right)^{\frac{1}{1-\rho}} \frac{1}{n_A+n_B+1 \left(\frac{p_z}{p_{z'}} \right)^{\frac{\rho}{1-\rho}}}, \quad z' = 1, \dots, n_A + n_B + 1 \quad (6)$$

In addition, we have now to take into account the objective function, as well as the budget constraint of the country A government. It maximizes the utility of a representative agent, allocating resources taken from privatization among all available assets:

$$\begin{cases} \max_{d_{gz}, z=1, \dots, n_A+n_B} \overline{Eu} + Ev(G) \\ \text{s.t.} \quad \sum_{z=1}^{n_A+n_B} p_z d_{gz} \leq p_g \sigma \end{cases}$$

where:

$$Ev(G) = \sum_{z=1}^{n_A+n_B} \frac{1}{S} w(d_{gz}) + \frac{1}{S} w(1 - \sigma)$$

The general equilibrium system is also modified, because of the demands addressed by the government to private agents:

$$\begin{cases} \sum_{z=1}^{n_A+n_B+1} d_{zz'} = 1, \quad z' = 1, \dots, n_A + n_B \\ \sum_{z=1}^{n_A+n_B} d_{zg} = \sigma \end{cases} \quad (7)$$

5.2 Asset prices and financial market development

5.2.1 Asset prices

We will see that proposition 1 remains true. Besides, in this symmetric environment without exogenous trading costs, the result is the same that the one obtained in the closed-country case by Bosi, Girmens, and Guillard [2001].

One of the equations in system (7) is redundant by the Walras law. Once again, the equilibrium is symmetric, i.e. we have:

$$p_z = p_{z'} \equiv P, \quad \forall z, z' \in \{1, \dots, n_A + n_B\}$$

Private asset prices are equal in both countries. Normalizing the price of the privatized asset and using the relevant demand functions (6) as well as the second market-clearing equation in

the system (7), we get that:

$$\frac{(n_A + n_B) (P^*)^{\frac{1}{1-\rho}}}{(P^*)^{\frac{\rho}{1-\rho}} + n_A + n_B} = \sigma$$

Thus, unambiguously:

$$\frac{\partial P^*}{\partial \sigma} > 0$$

Therefore the general equilibrium price of private assets is always a strictly increasing function of the privatization extent. This price mechanism may be due here to a demand effect, related to the privatization mechanism, especially to government expenses in a diversified portfolio.

5.2.2 Supply of private assets

The result is the same that the one obtained in the closed-country case by Bosi, Girmens, and Guillard [2001].

Equilibrium supplies of private assets are given by:

$$1 - d_{zz}^* = 1 - \frac{1}{n_A + n_B + (P^*)^{\frac{\rho}{1-\rho}}}$$

Equilibrium supplies of private assets are increasing in the equilibrium private asset price, itself increasing in privatization extent, such that:

$$\frac{\partial (1 - d_{zz}^*)}{\partial \sigma} \geq 0, \quad z = 1, \dots, n_A + n_B$$

The financial diversification effect (other things equal, agents decrease all their demands, including the demand addressed to their own assets, thus mechanically increase the supply of these assets) is now supplemented by the demand effect: the demand expressed by the government for a diversified portfolio increases the price of private assets and their equilibrium supply.

5.2.3 Demands for assets

The equilibrium being symmetric, we have the following demand functions:

$$d_{zz'}^* = \frac{1}{n_A + n_B + (P^*)^{\frac{\rho}{1-\rho}}}, \quad z' = 1, \dots, n_A + n_B$$

$$d_{zg}^* = (P^*)^{\frac{1}{1-\rho}} \frac{1}{n_A + n_B + (P^*)^{\frac{\rho}{1-\rho}}}$$

We get consequently the evolution of these functions depending on privatization extent:

$$\frac{\frac{\partial}{\partial \sigma}}{d_{zz}^* = d_{zz'}^* \quad (-)} \quad (8)$$

$$\frac{\partial}{\partial \sigma} d_{zg}^* \quad (+)$$

Though the demand effect (increase in government demands, and in asset prices), there is a trade-off: private agents increase their demand for privatized assets, and decrease their demands for all private assets, including their own.

5.2.4 Financial market development

Either in the country where privatization has been implemented, or in the other one, market capitalizations increase. All effects play in the same sense: as seen above, asset prices and supplies increase in both countries. In addition there is the positive effect on the market where privatization has been implemented. Proposition 4 remains true: market capitalization increases in both countries, but faster in the country where privatization has been implemented. This time, the difference is only due to the quotation of privatized assets on the domestic market, *private* market capitalizations being similarly (and positively) affected in both countries. Obviously, this result does not hold if we allow a cross-listed privatization: in this case, market capitalization increases in both countries, but faster in the country where the government decides to sell the largest share of the privatized assets.

As in the model with voucher distribution, the privatization impact in terms of traded volume is ambiguous.

5.3 Share issue privatization and financial integration

5.3.1 Equilibrium holdings of privatized assets by foreign agents

If agents do not cross-list firms and rely on markets integration to sell assets to foreign investors, there is now a direct relation between government and foreign agents. Thus the question of cross-listed privatization, in the usual sense of the term is once again irrelevant, as we can not explain the decision to list or not abroad, but we can compute the percentage of capital to be sold (at equilibrium) to foreign investors by the government.

At equilibrium the ratio ψ is now equal to:

$$\psi^*(\sigma) = \frac{n_B d_{kg}^*}{n_A d_{ig}^* + n_B d_{ig}^*}$$

This economy is symmetric (in the sense that there is no difference between country A and country B agents), and there is no imperfection, such as trading costs; consequently, we get that:

$$\psi^*(\sigma) = \frac{n_B}{n_A + n_B}$$

This ratio is increasing in n_B , decreasing in n_A , as in the case of voucher distribution, and for the same reasons. Not surprisingly, it does not depend on privatization extent σ . For instance, in the case $n_A = n_B$, foreign agents obviously hold 50% of the privatized assets, for all privatization levels.

5.3.2 International asset allocation strategies

We will see that proposition 3 remains true. First, we get that the ratio of domestic investment over investment abroad by country A agents is equal to:

$$\delta_A^* (\sigma) = \frac{n_A + (P^*)^{\frac{\rho}{1-\rho}}}{n_B}$$

Not surprisingly, it is increasing in n_A , decreasing in n_B , and increasing in P^* , thus increasing in privatization extent σ . Symmetrically, on country B agents' side, we check once again that the ratio of domestic investment over investment abroad ($\delta_B^* (\sigma)$) is such that:

$$\delta_B^* (\sigma) = \frac{1}{\delta_A^* (\sigma)}$$

Thus proposition 3 remains true: equilibrium relative domestic investment increases with privatization extent in the country where privatization has been implemented, and vice versa in the other one.

5.3.3 Relative aggregate foreign holdings of domestic assets

Finally, we look at the ratio of relative foreign holdings of domestic assets, at the aggregate level. In country A , the privatization impact on this ratio is ambiguous, such that proposition 5 does not hold for this market. At equilibrium this ratio is equal to:

$$\phi_A^* (\sigma) = \frac{n_B (n_A d_{ki}^* + d_{kg}^*)}{n_A + \sigma}$$

d_{ki} is increasing in σ , whereas d_{kg} is decreasing. Because of mixed general equilibrium effects, there is no general result on the function $\phi_A^* (\sigma)$ in this three-players setup.

However, in country B , proposition 5 still holds. Quoted from the system (7), the clearing condition for this market is:

$$\sum_{z=1}^{n_A+n_B+1} d_{zk} = 1, \quad k = n_A + 1, \dots, n_A + n_B \quad (9)$$

Therefore, relative foreign holdings are given by:

$$\phi_B \equiv \frac{\sum_k \sum_i d_{ik} + \sum_k d_{gk}}{n_B}$$

At equilibrium that can be rewritten:

$$\phi_B^* (\sigma) = n_A d_{ik}^* + d_{gk}^*$$

Using (9), we notice that:

$$\phi_B^* (\sigma) = 1 - n_B d_{hk}^*$$

The demand for domestic assets by country B agents being decreasing in privatization extent (see table (8)), that leads to:

$$\frac{\partial \phi_B^*}{\partial \sigma} > 0$$

Relative foreign holdings of domestic assets increase with privatization in country B , as stated by proposition 5 in the case with voucher privatization.

6 Concluding remarks

This paper has presented a two-period general equilibrium model of an open-economy, in which we have introduced State-owned property rights to focus on financial effects of privatization. In this framework, we have shown that at equilibrium, whatever kind of privatization is implemented, i.e. even under a free privatization, private asset relative price increases with privatization extent, not only in the country where privatization has been implemented, but also abroad. At the individual level, relative investment abroad decreases with privatization extent in the country where privatization has been implemented, and vice versa in the other one. At the aggregate level, market capitalization increases with privatization extent in both countries, but faster in the country where privatization has been implemented. In case of voucher privatization, relative foreign holdings of domestic assets decrease with privatization in the country where privatization has been implemented, and vice versa in the other one. In case of share issue privatization, the impact on relative aggregate foreign holdings of domestic assets is ambiguous in the country where privatization has been implemented, and positive in the other one.

To take into account an exogenous initial imperfect integration, the theoretical framework developed here can be expanded with international trading costs. We can assume that asset buyers face an international trading cost, for instance reducing the dividend in the second period. This cost would capture the various costs to buy (or equivalently, to sell) assets to foreign agents, such as financial intermediation, exchange rate transaction costs or information costs and asymmetries.¹⁶ Equivalently, we can consider a trading cost proportionally increasing the foreign asset prices in the first period. Taking international trading costs into consideration would help to be more consistent with empirical analyses. When Portes and Rey [2000] present empirical evidence on the determinants of cross-border equity flows, they claim that the most important determinants are market sizes, as well as the efficiency of transactions, and distance (as a proxy for information asymmetries); consequently, in the equation they want to estimate, aggregate demand for country A assets from country B depends basically of the measure of the sizes of the countries and on a trading cost term (representing both information cost and the efficiency of the transaction technology). Moreover, we have seen that we can not have political, legal, regulatory, reputation or institutional effects although they find strong support in empirical analyses, for instance in Bortolotti, Fantini, and Scarpa [2000], but a trading cost parameter may precisely contain some of these effects.

¹⁶See Gordon and Bovenberg [1996], Martin and Rey [2000] and Portes and Rey [2000] among others.

With such costs, expected utilities and/or budget constraints expressions are altered, thereby modifying the general equilibrium system to be solved to get equilibrium prices. Taking trading costs into account, numerical simulations have to be performed to solve the system (unfortunately, the system can not be analytically solved). However, even if the equality between private asset prices is immediately broken, we guess that the results shown above are not dramatically inverted, but simply toned down as costs increase; finally, under very high costs, we simply tend to the closed-economy case. With free distribution of public assets, uniformly distributed property rights are not traded and privatization has no financial effects, neither in the country where it has been implemented, nor abroad. With share issue privatization, there will be financial effects, but concentrated in the country where privatization has been implemented.

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Appendix A. Proof of Proposition 4

Let us first remind the expressions of equilibrium market capitalizations:

$$\begin{aligned} C_A^*(\sigma) &= n_A (1 - d_{ii}^*) P_A^* + \sigma \\ C_B^*(\sigma) &= n_B (1 - d_{kk}^*) P_B^* \end{aligned}$$

The ratio C_A^*/C_B^* is equal to:

$$C_A^*/C_B^* = \frac{n_A (1 - d_{ii}^*) P_A^*}{n_B (1 - d_{kk}^*) P_B^*} + \frac{\sigma}{n_B (1 - d_{kk}^*) P_B^*}$$

Using the equilibrium prices $P_A^* = P_B^* = \sigma^{1-\rho}$ leads to:

$$C_A^*/C_B^* = \frac{n_A}{n_B} \left(\frac{1 - d_{ii}^* + \sigma^\rho/n_A}{1 - d_{kk}^*} \right)$$

where equilibrium supplies $1 - d_{ii}^*$ and $1 - d_{kk}^*$ are equal to:

$$\begin{aligned} 1 - d_{ii}^* &= 1 - \frac{1 + \frac{\sigma^\rho}{n_A}}{n_A + n_B + \sigma^\rho} \\ 1 - d_{kk}^* &= 1 - \frac{1}{n_A + n_B + \sigma^\rho} \end{aligned}$$

We notice then that:

$$\begin{aligned} 1 - d_{ii}^* + \sigma^\rho/n_A &= \left(1 + \frac{\sigma^\rho}{n_A} \right) \left(1 - \frac{1}{n_A + n_B + \sigma^\rho} \right) \\ &= \left(1 + \frac{\sigma^\rho}{n_A} \right) (1 - d_{kk}^*) \end{aligned}$$

As a consequence,

$$C_A^*/C_B^* = \frac{n_A}{n_B} \left(1 + \frac{\sigma^p}{n_A} \right)$$

And

$$\frac{\partial (C_A^*/C_B^*)}{\partial \sigma} > 0$$

The ratio C_A^*/C_B^* is increasing in σ . ■

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Table 1

Descriptive statistics for french privatized firms: market capitalization, weight in indexes, public offerings and top shareholders

		Market Cap <i>M EUR</i>	CAC WEIGHT	SBF120 WEIGHT	SBF250 WEIGHT	PUBLIC OFFERINGS Date		TOP SHAREHOLDERS As of	<i>foreign</i> % SHARES	French Government % SHARES
							<i>currency</i>			
1	AGF	12 708.85	1.230%	1.049%	0.979%	5/96	Ffr	December 31,1999	51.66	
2	AIR FRANCE	4 152.10		0.344%	0.322%	2/99	€	March 31,2000		56.80
3	AVENTIS	70 729.52	6.820%	5.820%	5.452%	3/87, 11/93, 10/97	\$			
4	BNP PARIBAS	42 579.57	4.108%	3.505%	3.282%	4/93	Ffr	December 31,1999		
5	BULL	459.54		0.038%	0.035%	5/97	Ffr	December 31,1999	40.30	17.30
6	CNP ASSURANCES	5 094.29		0.419%	0.393%	10/98	Ffr	December 31,1999		
7	CREDIT LYONNAIS	14 205.88	1.354%	1.156%	1.071%	7/99	€	December 31,1999	7.75	10.00
8	DEXIA	16 524.67	1.568%	1.339%	1.243%	11/96, 6/97, 6/00	Bfr, €	July 20,2000	29.81	
9	EADS	16 385.30	1.562%	1.333%	1.235%	7/00	€	August 30,2000	43.54	1.55
10	ELF AQUITAINE	47 006.81				2/94	\$	December 31,1999		
11	FRANCE TELECOM	88 613.20	8.403%	7.174%	6.655%	10/97	\$, Ffr	March 7,2001	11.60	55.70
12	PECHINEY	4 083.08		0.327%	0.303%	12/95	\$, Ffr	December 31,2000	26.63	
13	RENAULT	13 428.44	1.301%	1.111%	1.032%	11/94	Ffr	December 31,1999		44.22
14	SEITA	2 380.79				2/95	Ffr	February 12, 2001	86.20	(*)
15	USINOR	3 705.75		0.294%	0.270%	7/95	Ffr	December 31,1999	0.90	
	<i>total</i>	<i>342 057.79</i>	<i>26.346%</i>	<i>23.909%</i>	<i>22.272%</i>					

Source BLOOMBERG

(*) The French State sold its stock on October 2, 2000.

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