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Electronic Markets and Digital Divides: A preliminary approach

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Abstract

This paper provides a general framework to appreciate the potential impacts of the development of electronic markets on the digital divides in a small open economy. Starting from a basic distinction between two types of goods (commodities and services), we characterize the impact of Internet on the matching technologies of the different markets. We then integrate these different features in an equilibrium model. In particular, we investigate the role on firms' capabilities to master the Internet channel and on users' (demand) ability to transact on this channel.

Key words : Digital Divide – Heterogeneous Agents – Electronic Markets – Electronic Business
***JEL* Codes :** D3-D4-L1

1 Introduction

We can broadly define the notion of "digital divide" as any form of inequality caused by a initial difference in ICT endowment (cf. Rallet and Rochelandet (2004) for an overview). This general definition raises two questions: *i)* what are the sources of the digital divide and *ii)* what are its consequences? The causes of the digital divides are very diverse. One can however distinguish a first-level divide (linked to an idiosyncratic differences in ICT infrastructures endowment (PC equipment rate, standard, broadband access, etc.) from a second-level divide based on differences in usage. For example, Roycroft and Anantho (2003) elaborates on that dualism in the African case. The first point only relies on a quantitative approach (see e.g. O.E.C.D. (2001) for an illustration of this issue to developed countries). It supposes that ICT-users are all equally and instantaneously able to master ICT and to fully exploit its opportunities. On the other hand, the second point suggests that sociological and psychological factors may create differences in ICT usage (cf. Hargittai (2002), Akhter (2003)). In other words, ICT are new technologies and may be diversely embodied by its users.

The second question is about the potential *economic* consequences of the Digital Divides (for some econometric tests, see Dasgupta *et al.*). Again, these consequences may be diverse. Inside organizations, differentiated abilities to master ICT's may lead to differences in productivities that may in turn lead to "wage premiums" (see Kim (2003) for a endogenous growth approach built on differences in IT- labor intensity). Outside organizations, differences in Internet use may lead to inequalities between job searchers (e.g. in job search durations) as more and more businesses and employment agencies tend to use e-recruitment practices. Third, differences in usage and equipment rate influence the benefits derived from e-commerce, both on the demand side (*e.g.* ability to find the best price of a product) and on the supply side (ability to attract new customers through Internet sales). In a previous paper, we partially investigated this last issue and considered only the effects of a second level digital divide. In that study, we showed how differences in ICT usage may impact on the ability to exploit the opportunities brought by e-commerce. This led us to identify two distinct scenarios: one in which inequalities were temporary and disappear through time; another in which these inequalities become more structural. In this paper, we tackle the same issue but we use a macroeconomic treatment. Our aim is build a macroeconomic framework in order to appreciate the impact of electronic markets on the economic development of a small open country. As previously noted, our framework takes into account the double dimension of the digital divide (infrastructure *versus* usage). Besides, it should be noted that the nature of electronic markets (origin of customers, traded goods) may differ according to the traded commodities. That is why we start our analysis by a rapid categorization of such market according to a simple distinction between commodities and services.

Section 2 presents the different types of goods and markets. The relevant equilibrium concept is developed in *Section 3*. *Section 4* provides a general existence proof. Section 5 discusses some numerical examples illustrating the digital divide issue.

2 Goods and Markets

We describe a simplified economy where domestic firms produce two different types of goods labeled for convenience *commodities* and *services*. On the one hand, *commodities* are less technically elaborated and are more tangible than *services*: they are sufficiently standardized, so that an elementary description discards any uncertainty about their nature and quality. On the other hand, *services* exhibit symmetrical properties: they are highly immaterial and hence are much more differentiated than commodities. Further, they may embody a more sophisticated technological content. For that reasons, the intrinsic utility provided by services is not fully observable before they are used (cf. characteristics of experience goods).

Commodities and *services* are both produced by local firms. The demand for them is both local (domestic) and international (exportation). These two types of goods can be traded either by traditional channels (physical and localized markets, supported by sale representatives in the case of domestic markets, or by promotion agencies or national representations in the case of foreign markets) or by the use of electronic markets (via *e.g.* home pages, publicly sponsored inter-professional portals).

Because of the nature of these goods, the demand on traditional markets for commodities is both domestic and international, unlike traditional markets for services where the demand is only domestic. Symmetric conditions prevail on electronic markets: the demand for commodities on electronic markets is essentially international while the demand for services on electronic markets is both domestic and international (see Table 1).

	Commodities	**Services**
Traditional Markets	Domestic + International Customers	Domestic Customers
Electronic Markets	International Customers	Domestic and International Customers

Table 1: Origin of customers on traditional and electronic markets for commodities and services

21 Domestic and International Demands

Demand is differentiated according to three characteristics: the nature of the goods (*commodities* versus *services*), the geographical (or national) origin of customers (domestic *versus* international) and the nature of the markets (traditional *versus* electronic).

- Demand for commodities

On traditional markets, the demand for *commodities* is both international and domestic. In the short run, we will suppose that both are independent on the structure of internal production, on the size of the different markets and on economic policy measures. On the one hand, the

considered economy is a small open-economy. Consequently, the international demand is fixed in the short run. On the other hand, in this economy, the domestic demand for commodities represents basic needs so that it can be considered as relatively uncompressible and inelastic, hence constant. Let Y^d (*resp.* X^d) denote the domestic (*resp.* international) demand for commodities on traditional markets.

On electronic markets, the demand for *commodities* is only international and depends on exogenous factors relative to *i)* the ability of international consumers to find new commercial partners, *ii)* to be informed on prices and transportation costs. Let us capture these elements by a single parameter (noted ω, $\omega \in [0,1]$) that represents the level of exposition of locally produced commodities on electronic markets. Everything else being equal, Parameter ω shifts under two exogenous influences. First, private/public initiatives (coming from professional associations or governments) play a key role in the promotion of international electronic commerce. Second, the IT-equipment rate (especially quality and quantity of Internet connections) impacts on the exposition level of electronic market for commodities. These two influences are supposed to be invariable in the short run.

- Demand for services

Whatever would be the form of the market (traditional or electronic), *services* can be considered as "superior goods". As a consequence, the domestic demand for services is an increasing function of the upper part of income. If internal income mainly corresponds to wages and other production earnings, the upper part of income can be assimilated for socio-economical reasons with the part income generated by the production of services as a whole[1]. The international demand for services is only active on *e*-markets. Given the imperfect observability and standardisation of services, the international demand for *services* is more sensitive to the informative quality q of the websites services' providers of and to the effort consented by sellers concerning communication about quality.

Finally, we will suppose that the demand for imported *commodities* and *services* is a residual variable, which adjusts to the endogenous evolution of national product (including exports), and domestic consumptions.

22 Supply

The production of commodities and services is provided by a continuum of atomistic firms of unit mass. Production is instantaneous and corresponds to unit bundles of value y. Producing

[1] Services being relatively more elaborated than commodities and corresponding to advanced stages of satisfaction of needs, there exists a spill-over from the income distributed to the engineers and executives involved in the production of services and the internal part of the demand of services. This effect is active as well on the traditional market of services than on the electronic one.

commodities requires only basic and publicly available competencies and techniques. For that reason, we will suppose that firms are all equally able to produce commodities. This production is implemented at a constant marginal cost (constant return to scale) that we can hence further set to 0. On the contrary, producing services requires specific skills (human capital, formation and learning) so that firms are heterogeneously able to produce services. This heterogeneity on capability translates into an heterogeneity on the level of (constant) costs. We will thus suppose that firms are uniformly distributed on a unit segment. To produce services, a firm located at position x, further a "*x - firm*" $\left(0 \le x \le 1\right)$ incurs a linear production cost equal to yx.

At each period, firms take two decisions: what should be produced (services or commodities) ? Where should the produced item being sold (electronic or traditional markets). This makes 4 possible strategies. Let Indexes "T" and "E" refer to traditional and electronic markets respectively. Similarly, let indexes "C" and "S" refer to commodities and services respectively. The four strategies are then $\{C,T\}$, $\{C,S\}$, $\{E,T\}$ and $\{E,S\}$. Additionally, firms can choose inaction (no production, no sell, null payoff) noted $\varnothing$).

Neglecting the time-subscript, we will denote respectively V_{TC}, V_{EC}, $V_{TS}\left(x\right)$, $V_{ES}\left(x\right)$, and $V_{\varnothing}$ the intertemporal expected utilities of each possible strategies. Firms are rational and make rational expectations about their future intertemporal expected utilities on subsequent positions. We the get the following incentives conditions:

- Select $\{C,T\}$ if $V_{TC} \ge \sup\left[V_{TS}\left(x\right), V_{ES}\left(x\right), V_{EC}, 0\right]$
- Select $\{C,E\}$ if $V_{EC} \ge \sup\left[V_{TC}, V_{TS}\left(x\right), V_{ES}\left(x\right), 0\right]$
- Select $\{S,E\}$ if $V_{ES}\left(x\right) \ge \sup\left[V_{EC}, V_{TC}, V_{TS}\left(x\right), 0\right]$
- Select $\{S,T\}$ if $V_{TS}\left(x\right) \ge \sup\left[V_{EC}, V_{TC}, V_{ES}\left(x\right), 0\right]$
- Select $\{\varnothing\}$ if $0 \ge \sup\left[V_{EC}, V_{TC}, V_{ES}\left(x\right), V_{TS}\left(x\right)\right]$

Let us also note s^{TC}, s^{EC}, s^{TS}, s^{ES} and $s^{\varnothing}$ the proportion of firms choosing each 5 possible strategies. By definition, it then holds:

$$s^{\varnothing} + s^{TC} + s^{EC} + s^{TS} + s^{ES} = 1 \qquad (1)$$

23 Market matching technologies and income distribution

On supply-side, resources and workforce required to produce are supposed to be instantaneously available[2]. On the contrary, the outcome of the trading process depends on supplies, demands and on the organization of exchanges on the different markets.

- Transactions on traditional markets

Traditional markets are driven by supply and demand forces. Because of the existence of frictions, these markets do not perfectly adjust at each period. For a given level of supply, higher is demand, higher is the probability for a given firm to sell during the period; conversely, for a given demand, higher is supply, smaller is the probability to sell for a given firm. This general principle is valid for the two traditional markets (commodities, services).

On the traditional market for *commodities*, Demand is a parameter given by $\left(\overline{Y}+\overline{X}\right)$. In each period, the probability p^{TC} for an individual firm to reach a transaction is thus only influenced by one endogenous variable, namely the number s^{TC} of sellers on this market, expressed as a proportion of the total number of firms *y* :

$$p^{TC} = F^{X^d+Y^d}\left(s^{TC}\right) \qquad (2)$$

with (neglecting the subscripts) $F'(.)<0$, $F(0)=1$, $F(1)>0$

On the traditional market for *services,* the internal demand is determined by the level of income - thus by the dimension of the sector of services. Besides, competition among sellers can reduce the probability for an individual firm to reach a transaction. Hence, the probability p^{TS} for a firm to reach a transaction depends in each period on both the proportion s^{TS} (negatively) and on the proportion s^{ES} (positively) of sellers on this market.

$$p^{TS} = G\left(s^{TS}, s^{ES}\right)$$

- Transactions on electronic markets

Electronic markets do not exhibit the same type of frictions. Because electronic markets are network organized, we can assume that frictions on these markets are lower than that prevailing on traditional markets. On these markets, the main factors affecting the probabilities to transact are the level of income, the connectivity, traders' expertise and information about quality.

On the *commodity* segment of the electronic market, domestic producers only trade with international customers. Because the considered country is a small, it represents a small part of international trade. As a consequence we assume that demand is constant and focuses on supply

[2] The labor market is thus demand-side driven which implicitly assumes a positive under-employment level.

forces. The trading probability $\left(p^{EC}\right)$ takes two factors into account: first, the exposition level (amount of ICT's infrastructures, customers' ability to trade on the internet) captured by Parameter ω; second, a supply side effect captured by s^{EC}: as more suppliers are active on the market, competition is more fierce, and the probability for an individual firm to trade on this market decreases. Then, it follows:

$$p^{EC} = J\left(\omega, s^{EC}\right),\ \omega \in [0,1],\quad J'_{\omega} > 0,\quad J'_{s^{EC}} < 0 \tag{3}$$

On the electronic market for *services*, the probability to reach a transaction depends on the matching conditions on its domestic and international components. On the one hand, the domestic component is influenced by the level of consumers' income (services being superior goods) but also by the socio-cultural capability of consumers to access to electronic markets and to move themselves among more or less informative home-pages. The supply size has also an influence on the matching condition of this part of the electronic market of services. On the other hand, the international component is again determined by the conditions of exposition of domestic goods on the internationally oriented electronic market. But in this case, beyond the general effort to increase the quality of the presentation of domestic products as a whole on public or semi-public portals, more differentiated actions are necessary to improve the informative content of commercial web pages. These actions are essentially founded on producers' initiatives but they can as well generate positive externalities on the supply conditions as a whole of all national producers by the way of reputation effects concerning the technological national products.

The general form of the probability to reach a transaction during the period is thus following:

$$p^{ES} = H\left(s^{TS}, s^{ES}, \omega, q\right) \tag{4}$$

where *q* is a parameter describing the firms' ability to depict the characteristics of their product on the Internet.

with $\frac{\delta H(.)}{\delta s^{TS}} > 0$, $\frac{\delta H(.)}{\delta \omega} > 0$, $\frac{\delta H(.)}{\delta s^{ES}} < 0$, $\frac{\delta H(.)}{\delta q} > 0$

- Income distribution

The profits generated at time *t* are distributed and constitute the income of domestic consumers at time $(t+1)$. Let π^{TC}, π^{EC}, $\pi^{TS}(x)$, $\pi^{ES}(x)$ and $\pi^{\varnothing}$ represent the unit profit of firms having sold in each possible strategies. By definition, $\pi^{\varnothing} = 0$. Hence, the available income is then defined by:

$$Y = s^{TC}\pi^{TC} + s^{EC}\pi^{EC} + \int_0^{x^*} \pi^{EC}(x^*)\left(s^{TS} + s^{ES}\right)dx$$

3 The Equilibrium Concept

Without any further specification of the model, the economy could be in disequilibrium for different reasons: *i)* the rational decisions of the firms could be taken using quantities corresponding to non-rational decisions of the other firms; *ii)* the distribution of firms between the possible positions on the different markets may vary through time, *iii)* the intertemporal expected utilities corresponding to the possible positions for a *x*-firm may also vary though time, iv) income (and its distribution) may also vary, v) expectations used by firms may not be confirmed. We will choose to analyze the states of the economy where none of these forms of disequilibrium are experienced. We denote them *Nash Rational Expectation Competitive Stationary* (*NRECS*) *equilibria*. These equilibria should fulfill four series of conditions:

i) At *NRECS* equilibrium, the intertemporal expected utilities and the amount of global income are stationary.

This amounts to:

$$V_{\phi\varphi}^{t+1} = V_{\phi\varphi}^{t} \text{ for } \phi = \{T, E\} \text{ and } \varphi = \{C, S\} \text{ and } V_{\varnothing}^{t+1} = V_{\varnothing}^{t} \quad (5)$$

ii) At *NRECS* equilibrium, the distribution of firms among the five strategies is stationary. Then, stationarity conditions relative to the distribution of the population of firms fall as follows:

$$s_{\phi\varphi}^{t+1} = s_{\phi\varphi}^{t} \text{ for } \phi = \{T, E\} \text{ and } \varphi = \{C, S\} \text{ and } s_{\varnothing}^{t+1} = s_{\varnothing}^{t} \quad (6)$$

Considering an exogenous actualization rate $r \in [0,1]$, using Stationarity Equations (5)-(6), and replacing the trading probabilities by their definition equations (2)-(3)-(4) we can express the intertemporal expected utilities of the five different strategies (Bellman equations):

$$rV_{TC} = F^{X^d + Y^d}\left(s^{TC}\right)y \quad (7)$$

$$rV_{EC} = \omega y \quad (8)$$

$$rV_{TS}(x) = G(.)\left[y - yx\right] \quad (9)$$

$$rV_{ES}(x) = H(.)\left[y - yx\right] \quad (10)$$

$$V_{\varnothing} = 0 \quad (11)$$

Let us consider for instance Equation (1): the success rate of transaction on the traditional market for commodities is given by $F^{x^d+y^d}\left(s^{TC}\right)$. As a firm implements successfully a transaction on this market, it receives $\left(y+V_{TC}\right)$. In that case, its profit equals its sales equal (y) as it does not have any production cost while producing commodities. It then goes back to the production stage $\left(V^{TC}\right)$. On the contrary, as it fails trading on this market, it only receives V_{TC}. In that case, it does not receive any revenue and needs to stay at this stage until it succeeds trading). Its intertemporal expected utility on this market is given by $V_{TC}=\left[\left(F^{x^d+y^d}\left(s^{TC}\right)\right)\left(y+V_{TC}\right)+\left(1-F^{x^d+y^d}\left(s^{TC}\right)\right)\left(V_{TC}\right)\right]/\left(1+r\right)$ from which Equation (1) is deduced. The same reasoning applies to Equations (2) to (8).

iii) NRECS equilibria are competitive:

The utility generated by two markets providing the same type of goods is then necessarily equalized when each one is activated at equilibrium. If not, firms would have an incentive to switch to the other market. Taking into account corner solutions where at least one market is inactivated while expected utility is greater or equal for the other, we can formulate the following qualification conditions (12) for the market for commodities:

$$V_{TC}=V_{EC} \text{ and } \left\{0\le s^{TC}\le 1 \text{ and } 0\le s^{EC}\le 1\right\}$$
or
$$V_{TC}>V_{EC} \text{ and } \left\{0\le s^{TC}\le 1 \text{ and } s^{EC}=0, \text{ or } s^{TC}=1 \text{ and } 0\le s^{EC}\le 1\right\} \quad (12)$$
or
$$V_{TC}<V_{EC} \text{ and } \left\{s^{TC}=0 \text{ and } 0\le s^{EC}\le 1 \text{ , or } 0\le s^{TC}\le 1 \text{ and } s^{EC}=1\right\}$$

For the two markets for services, the qualification conditions are:

$$V_{TS}^{x}=V_{ES}^{x} \text{ and } \left\{0\le s^{TS}\le 1 \text{ and } 0\le s^{ES}\le 1\right\}$$
or
$$V_{TS}^{x}<V_{ES}^{x} \text{ and } \left\{0\le s^{TS}\le 1 \text{ and } s^{ES}=0, \text{ or } s^{TS}=1 \text{ and } 0\le s^{ES}\le 1\right\} \quad (13)$$
or
$$V_{TS}^{x}>V_{ES}^{x} \text{ and } \left\{s^{TS}=0 \text{ and } 0\le s^{ES}\le 1 \text{ , or } 0\le s^{TS}\le 1 \text{ and } s^{ES}=1\right\}$$

$\forall x, x \in \left[0, x^*\right]$, where x^* corresponds to the cost of the "marginal firm", *i.e.* to the firm for which the producing services is just equivalent from producing commodities.

Considering the definition of $F^{x^d+\gamma^d}\left(s^{TC}\right)$, we can first drop out the inaction strategy. Indeed, Conditions on $F^{x^d+\gamma^d}\left(s^{TC}\right)$ ensure that V_{TC} is always strictly positive. As a consequence, whatever their position on the unit segment, firms never choose inaction when they compare the intertemporal expected utility of each outcomes; as a consequence, $s^{\varnothing} = 0$. This deduction provides an additional equation:

$$s^{\varnothing} = 0 \tag{14}$$

As a consequence, the incentive conditions expressed in Section 22 define a potential marginal firm characterized by a critical *x* value (if positive) on the unit segment that separates the firms choosing to produce commodities (Strategies $\{C,T\}$ and $\{C,E\}$) from those choosing to produce services (Strategies $\{S,T\}$ and $\{S,E\}$). The value x^* is defined by:

$$x^* = s^{TS} + s^{ES} \tag{15}$$

Firm x^* is, by definition indifferent between producing services or commodities. According to incentive conditions and given the Bellman equations, firms above x^* choose to produce commodities while firms below x^* choose to produce services. This leads to the following qualification conditions:

$$\begin{aligned}
&V_{TS}^{x^*} = V_{TC} \text{ and } \left\{0 \le s^{TS} \le 1 \text{ and } 0 \le s^{TC} \le 1\right\} \\
&\text{or} \\
&V_{TS}^{x^*} > V_{TC} \text{ and } \left\{0 \le s^{TS} \le 1 \text{ and } s^{TC} = 0, \text{ or } s^{TS} = 1 \text{ and } 0 \le s^{TC} \le 1\right\} \\
&\text{or} \\
&V_{TS}^{x^*} < V_{TC} \text{ and } \left\{s^{TS} = 0 \text{ and } 0 \le s^{TC} \le 1 \text{ , or } 0 \le s^{TS} \le 1 \text{ and } s^{TC} = 1\right\}
\end{aligned} \tag{16}$$

One should note that Condition (16) is equivalent to $V_{ES}^{x} = V_{TS}$ since competitive conditions (12)-(13) are verified.

At last, we can rewrite the income distribution equation using $x*$ as follows:

$$Y = y\left\{\left[s^{TC}F^{\overline{Y}+\overline{X}}(.)+\omega s^{EC}\right]+\left[x^{*}-\frac{\left(x^{*}\right)^{2}}{2}\right]\left[s^{TS}G(.)+s^{ES}H(.)\right]\right\} \qquad (17)$$

4 Existence of *NRECS* Equilibria and coordination failures

An elementary outlook of the economy associated with conditions (1) to (17) provides an existence proof. The constraints on individual strategies and the matching properties of the market technologies are sufficient to guarantee the existence of at least one *NRECS* equilibrium. However, this equilibrium is not generically unique. The economy exhibits multiplicities that are obviously generated by the magnitude and the sense of interdependencies among markets from one hand, and by the direct spillovers inside markets (especially for markets for services).

Proposition 1: Under the conditions (1) to (17), and whatever the values of the whole set of coefficients, there exists at least one *NRECS* equilibrium in this economy.

Proof: Because $s^{\varnothing}$ always vanishes at equilibrium, let us simply consider the map (noted Γ) from $\left\{s^{TC}, s^{EC}, s^{TS}, s^{ES}\right\}$ into itself defined as follows :

$$\Gamma = \left\{\Gamma^{TC}\left(s^{TC}, s^{EC}, s^{TS}, s^{ES}\right), \Gamma^{TC}\left(s^{TC}, s^{EC}, s^{TS}, s^{ES}\right), \Gamma^{TC}\left(s^{TC}, s^{EC}, s^{TS}, s^{ES}\right), \Gamma^{TC}\left(s^{TC}, s^{EC}, s^{TS}, s^{ES}\right)\right\}$$

and such that *i)* $\Gamma^{TC}(.)\left(resp.\ \Gamma^{EC}(.), \Gamma^{TS}(.), \Gamma^{ES}(.)\right)$ represents the frequency of firms choosing Strategy {C,T} (*resp.* to Strategy {C,E},{S,T},{S,E}) when the composition of each sub-population of firms is expected to be $\left(s^{TC}, s^{EC}, s^{TS}, s^{ES}\right)$; *ii)* the link between the distribution of firms among the four active positions and the expected utility of firms verifies the qualification relations (12), (13) and (16).

The incentives conditions of *Section 2.2* are involved in the definition of the map which also integrates Bellman equations in the intertemporal utilities used by each agent to determine its choice at equilibrium. All equations and constraints being continuous, firms move gradually from one position to the other according to their *x* when s^{TC}, s^{EC}, s^{TS} and s^{ES} vary. The potential fixed points of this correspondence are then equivalent to the equilibria of the economy: these fixed points indeed constitute distributions of firms among the four activated strategies which fit with the optimal decisions founded on their own (rational, intertemporal and stationary) expectations. The continuity of the correspondence can easily be deduced from the properties the pay-off functions and the conditions of qualification. The compactness of the set

$\left\{s^{TC}, s^{EC}, s^{TS}, s^{ES}\right\}$ is deduced on the range of variation of each population, limited by the qualification condition between 0 and 1 and normalised by equation (1). One can then infer that $\Gamma^{TC}(.)$ admit at least one fixed-point on the definition set of s^{TC}, s^{EC}, s^{TS} and s^{ES} and deduce that whatever the values of the parameters it exists at least one *NRECS* equilibrium*, Q.E.D.*

According to *Proposition 1*, a *NRECS* equilibrium always exists. However, its unicity can be challenged, noticeably when "non-competitive" forces are dominant inside one or several transaction technologies. We can observe this situation when spillovers are strong enough inside the market for services. In this case, the development of the whole service sector improves the matching conditions of at least one of the transaction technologies of the markets for services (it would be relevant to suppose that it is the traditional market of services which is especially sensitive to internal demand). The consequence of these spillover effects is to generate forces that create in turn multiple equilibria and potential coordination failures. With the same values of the parameters of the model, the economy can be stuck at a low level equilibrium, as it concern the level of activity of services and the level of national income while it can as well be pushed at the high level where the level of activity of services and income are far different. This kind of situation corresponds to a coordination failure: there exists a multiplicity of rankable equilibria and no selection is possible through market mechanisms (i.e. where no *ex-ante* coordination is possible). This may justify some policy measures in order to influence the out-of equilibrium trajectories of the national economy toward the best (high level) equilibrium. Some of these cases are examined in the next section.

5 Some Numerical Examples

In this section, we explore numerically some examples using a linear specification of functions F,J,G and H. For the functions F, J and H, this leads to the following specifications:

$$F^{X^d+Y^d}\left(s^{TC}\right) = \beta\left(1-s^{TC}\right)+\beta'$$
$$J\left(\omega, s^{EC}\right) = \omega\left(1-s^{EC}\right)$$
$$H\left(s^{TS}, s^{ES}, \omega, q\right) = \alpha q\omega + (1-\alpha)\left[ks^{ES} + (1-k)\left(1-s^{TS}\right)\right]$$

To specify G, we focus on two different cases:

$G\left(s^{TS}, s^{ES}\right) = \gamma\left(1-s^{TS}\right)$ (Case *I*)
or $G\left(s^{TS}, s^{ES}\right) = \gamma s^{ES}$ (Case *II*)

In Case (*I*), the competitive effect is dominant inside the matching conditions on the traditional market for services. In Case (*II*), the electronic market for services has a strong spillover effect on the traditional market for services.

We will distinguish the two cases where there is or not coordination failures. In the case where only one *NRECS* equilibrium exits, we will consider examples able to examine the effect of macroeconomic measures or actions driven towards the sector of services to improve the exposition of national products on electronic markets and the quality of information concerning the supply of services.

5.1 Case *I* results

Let us assume first that $G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/3; \gamma = 1; q = 1/2;\ \alpha = 0{,}1;\ k = 0, 2$

From Table 1, we can deduce that improving the exposition of national products (ω) on electronic markets has primarily a positive impact on the electronic market for commodities. Services are not much impacted by (ω). Indeed, as one can see, the initial service sector is relatively large which limits its expansion. The expansion of the electronic market for commodities impacts negatively on the traditional segment of the commodity markets. Thus, transaction customs change in favor of electronic markets for commodities.

ω	s^{TC}	s^{EC}	s^{TS}	s^{ES}	Y
0,20	0,33	0	0,39	0,27	0,23
0,25	0,25	0,10	0,38	0,25	0,24
0,30	0,19	0,19	0,37	0,24	0,24
0,35	0,14	0,26	0,36	0,23	0,25
0,40	0,09	0,32	0,35	0,22	0,26
0,45	0,06	0,37	0,35	0,21	0,26

Table 1: Share of the 4 markets and revenue with $G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/3; \gamma = 1; q = 1/2;$ $\alpha = 0{,}1;\ k = 0, 2$

In *Table 2*, we use the same set of parameters, except γ which is now equal to $\gamma = 1/2$.

Parameter γ depicts the exogeneous efficiency of the traditional market for services. It can vary according to institutional (Government interventions, *etc*.) or sociological factors. In this situation, one can notice that the repartition between electronic and traditional markets is more balanced than the one prevailing when $\gamma = 1$. The natural consequence of this γ-decrease is to weaken the traditional market for services. In turn, some service firms swith to the electronic market to continue selling services.

ω	s^{TC}	s^{EC}	s^{TS}	s^{ES}	Y
0,20	0,37	0,05	0,12	0,44	0,23
0,25	0,30	0,16	0,10	0,42	0,23
0,30	0,24	0,24	0,09	0,41	0,24
0,35	0,20	0,31	0,07	0,40	0,24
0,40	0,16	0,37	0,06	0,39	0,25
0,45	0,13	0,42	0,05	0,39	0,25

Table 2: Share of the 4 markets and revenue with
$G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/3; \gamma = 1/2; q = 1/2$ $\alpha = 0,1$; $k = 0,2$

We then studied the impact of parameter β. This parameter depicts the demand level (foreign and domestic) on that market. As shown by *Table 3*, an increase in this parameter leads to improve the efficiency of the traditional market for commodities. This situation corresponds to cases where the structural and sociological components of internal demand are yet compatible with the prevalence of a large market of commodities in its traditional form. It is not surprising to verify that in this case, this market sustain a high level of activity after the development of electronic markets. It is also interesting to observe that an important increase of national income associated with the development of the e-market of commodities is compatible with the specialisation of the economy in the production of the less intrinsically rentable good.

ω	s^{TC}	s^{EC}	s^{TS}	s^{ES}	Y
0,20	0,52	0	0,23	0,23	0,18
0,25	0,52	0,06	0,20	0,20	0,19
0,30	0,48	0,14	0,18	0,20	0,21
0,35	0,44	0,20	0,15	0,19	0,22
0,40	0,41	0,26	0,12	0,19	0,24
0,45	0,38	0,31	0,11	0,19	0,25

Table 3: Share of the 4 markets and Revenue with $G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/2; \gamma = 1/2; q = 1/2$
$\alpha = 0.5$ and $k = 0.2$

Let us now turn to the effect of the firms' website quality when producing services. In Table 4, *q* varies from *0.20* to *0.90*. As it can be deduced, improving *q* favors primalarily the electronic market for services: this market expands while the *relative* size of the other three market decreases. All in all, the total revenue expands with this market. To some extent, this situation may be related to the Indian case: developing the internet has a major impact on services (software, *etc*), while traditional markets are still dominant for trading commodities.

q	s^{TC}	s^{EC}	s^{TS}	s^{ES}	Y
0,20	0,45	0,22	0,19	0,12	0,21
0,30	0,45	0,21	0,18	0,15	0,22
0,40	0,44	0,21	0,16	0,17	0,22
0,50	0,44	0,20	0,15	0,19	0,22
0,60	0,44	0,20	0,13	0,21	0,22
0,70	0,43	0,19	0,12	0,23	0,23
0,80	0,43	0,19	0,10	0,26	0,23
0,90	0,43	0,19	0,09	0,28	0,24

Table 4: Share of the 4 markets and revenue with $G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/3; \gamma = 0.5; \omega = 0.35$ $\alpha = 0,1;\ k = 0,2$

5.1 Case *II* results $\left(G\left(s^{TS}, s^{ES}\right) = \gamma s^{ES}\right)$

Let us now turn to another functional form of *G*. In Case II, we focus on the spillovers created by the electronic market for services. This leads to multiple equilibria and to coordination failures.

ω	s^{TC}		s^{EC}		s^{TS}		s^{ES}		Y	
	LE	HE	LE	HE	LE	HE	LE	HE	LE	HE
0,2	0,55	0,41	0,26	0,02	0	0,11	0,17	0,43	0,14	0,22
0,25	0,45	0,30	0,34	0,16	0	0,08	0,20	0,43	0,16	0,23
0,30	0,37	0,25	0,37	0,25	0	0,06	0,25	0,44	0,18	0,24
0,35	0,3	0,21	0,4	0,32	0	0,02	0,3	0,43	0,20	0,25
0,40	0,2		0,4		0		0,4		0,24	

Table 5: Share of the 4 markets and revenue with $G\left(s^{TS}, s^{ES}\right) = s^{ES}$

$G\left(s^{TS}, s^{ES}\right) = \gamma\left(1 - s^{TS}\right); \beta = 1/3; \gamma = 0.5; q = 0,5\ \alpha = 0,1;\ k = 0,2$

As one can see, two kinds of equilibria may emerge in this economy. In the first one (HE), the level of global income is higher than that prevailing in the second one (LE). The sizes of the two electronic markets vary in the two equilibria. In the HE, electronic markets for services are expanding and are "driving" the whole service sector. In turn, this generates a high income level. In the LE, the economy is still specialized in the production commodities. This situation is especially interesting as two countries initially endowed with the same set of characteristics may converge to two different income levels. As was previously stated, such coordination failures leave a room for policy measures.

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