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Doctor-Nurse Teams, Incentives and Behavior

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resumo

Ao longo dos últimos anos, os enfermeiros têm registado ganhos de conhecimentos e é habitual que enfermeiros e médicos trabalhem juntos em equipa. Usando um modelo baseado na teoria dos contratos, o objetivo deste artigo é analisar os efeitos de uma melhoria da produtividade dos enfermeiros nos incentivos pagos e no comportamento dos médicos e enfermeiros, em particular, quando o orçamento é limitado. Os resultados mostram que depois de uma melhoria da produtividade dos enfermeiros, estes passam a receber um incentivo de menor valor mas o orçamento global dos incentivos é mais elevado. Quando o orçamento dos cuidados de saúde é limitado, os resultados mostram que o tratamento dos doentes fica ao cargo dos enfermeiros, e não dos médicos, refletindo uma atitude de *free-riding* por estes. O contributo deste trabalho é particularmente relevante para os *policy makers* dos recursos humanos das unidades de cuidados primários.

JEL Classification: I19, D82.

abstract / résumé

Nurses have been gaining expertise over time and it is common that they work together in a team with doctors to treat patients. Using a model based on contract theory, the aim of this article is to analyze the effects of an improvement in nurses' productivity on the incentives paid and on the behavior of doctors and nurses, in particular when the budgets are limited. The results show that following an improvement in nurse productivity, nurses' incentives are lower but the overall budget of incentives is higher. Under a restricted health care budget, results show that the treatment of patients is mainly carried out by nurses, and not doctors, reflecting free-riding by doctors. The contribution of this work is particularly relevant for human resources policy makers in primary health-care units.

Au cours des dernières années, les infirmières ont enregistré des gains en matière de connaissances et il est habituel pour les infirmières et les médecins travaillent ensemble comme une équipe. Basé sur un modèle de la théorie des contrats, le but de cet article est analyser les effets de l'amélioration de la productivité des infirmières sur les incitations payeés et les comportements des médecins et des infirmières, en particulier, lorsque le budget est limité. Les résultats montrent que, après une amélioration de la productivité des infirmières, ils doivent recevoir un motivation de valeur inferieur, mais le budget global d'incitations est plus élevé. Lorsque le budget des soins de santé est limité, les résultats montrent que le traitement des patients est de la responsabilité des infirmières, et pas des médecins, ce qui reflète une attitude de free-riding par eux. La contribution de ce travail est particulièrement pertinent pour les décideurs politiques de ressources humaines des établissements de soins primaires.

1. Introduction

It is natural that doctors and nurses work in teams. The list of references to this type of team outside of Economics is long. These teams may be explicit (Firth-Cozens, 2001) or not (Anderson and Halley, 2008; Radcliffe, 2000), and may or may not be part of a hierarchy of authority.

The main feature of a doctor-nurse team is that it aims to improve a patient's health condition, but it is not possible to clearly identify the contribution of each individual to that goal. This idea of a team coincides with the definition of teams proposed by Alchian and Demsetz (1972)[1].

Doctor-nurse team work was initially described by Stein (1967). In this team, the doctor is more relevant than the nurse, in the sense that the nurse has a lower level of education, status and payment. The nurse is seen as the doctor's third arm with the nurse's productivity comparably lower.

More than twenty years later, Stein and two of his colleagues revisited doctor-nurse team work and conclude that nurses now have a different role (Stein et al., 1990). Nurses have become more autonomous health professionals, with well defined areas of expertise, and nursing has increasingly become an associated science to medicine.

The improvement in the level of expertise and productivity of nurses has been documented by Brown (1988). He concludes that physicians' offices would be more profitable if nurses substituted assistant physicians. Some research shows that nurses have increased their expertise so much that they can substitute doctors[2] . A review of this topic has been carried out by Richardson and Maynard (1995).

Our aims are: i) to model the doctor-nurse team game, where agents are heterogeneous in their productivities, ii) to analyze the effects of an improvement in nurse productivity on the incentives offered and how the choice of agents on their efforts impacts patients, in particular, under limited health budgets. It is not our purpose to study the relationship between doctors and nurses.

The proposed model is based on contract theory employing a comparative statics analysis for two different points in time. It considers a team of a doctor and a nurse, who exert effort to treat or improve the health status of patients. The improvement in the nurse's expertise is captured in the team production function. The principal is the contractor who pays the incentives to the team but he cannot observe their efforts; he only observes the outcome of the efforts.

The results show that with nurses having improved their expertise, the bud-get needed to provide incentives to both agents is higher than before. This happens because the increase in the nurse's productivity creates a free-riding possibility for the doctor. As a consequence, the doctor needs higher incentives to be diligent. If budgets are sticky and limited then it becomes impossible to provide high incentives for both agents. The contractor can adopt one of two possible attitudes: either the incentives are kept constant, or one agent is chosen to whom the necessary incentives will be provided to exert effort. In both situations, the effort to treat the patient is provided by the nurse, and not the doctor, because the nurse is highly productive and can substitute for the doctor's effort.

The scenario described here is more likely in non-surgical areas of health care, such as primary care and family health care units as well as rehabilitation units. The model described in this work does not apply to a hospital ward, where a set of patients are to be found, but it applies to primary health care units where the medical attention is fully given to each patient at a time. There is no trade-off between agents' effort and number of patients receiving attention. All patients looking for medical primary care, receive it. This care is provided either with high, or low, professional commitment to improve the patient condition.

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1 According to Achian and Demsetz's definition, health care team work is such that it is not possible to separate it into two different production functions, respectively dependent on the labor of doctor and nurse.

2 For instance, in some countries and under some conditions, nurses prescribe drugs (Lewis-Evans and Jester, 2004; While and Biggs, 2004).

This work provides new insights for policy makers and managers of health care units. Firstly, it provides some of the theoretical underpinnings for the possible and potential substitutability between doctors and nurses. Secondly, it describes how doctors and nurses choose their efforts when there are team performance incentives. These incentives may be monetary or non--monetary. An example of monetary team incentives can be found in Portuguese primary care (Fialho et al, 2011) or in the accountable care organizations in the USA (Frandsen and Rebitzer, 2014). Thirdly, the increasing concerns with efficiency and internal organization raise several challenges. The results in this paper show that the most common form of organization in health care ought to be handled carefully. This organization, based on teams, may raise several problems related to payments, professional conflicts and distrust, along with doubts about medical hierarchies and responsibilities, whenever nurses tend to take on more tasks to guarantee that patients get treatment or health improvement. Some of these issues relating to doctor-nurse relationships have been discussed by different researchers (e.g. Kenaszchuk et al., 2010 and Tang et al., 2013).

This paper is organized as follows. In the following section we describe the model. In Sections 3 and 4, we analyze the old and new team production technology. Then, in Section 5, we briefly extend the model. Finally, in the last section we present the conclusion. The proofs are presented in the appendix.

2. The model

2.1. The players

We assume a simplified and reduced hierarchy of two tiers: the top tier is the principal or the part contracting health professionals (it can be the Ministry of Health, a primary health care unit, an insurance company or a manager –here it is referred to as the contractor) and the bottom tier is the health care team, composed of one doctor and one nurse.

2.1.1. The health care team

The team in health care is composed of a doctor (*d*) and a nurse (*n*) and it is not possible to separate the contribution of each one of them to treat patients. Patients treatment in primary care require triage, examination, prescription, medicines dispensation, patients advise as well as emotional and physical sup-port and so on. Although it may be possible to identify tasks and who does them, it is not possible to quantify and analyse the importance of each in the success of treating a patient.

The agents are risk neutral and limited liability constrained.

We assume that both agents exert an effort for treating the patient: the doctor exerts effort *a* and nurse exerts effort *e*. These efforts, for simplicity, are of a high or low level: $a, e \in \{H, L\}$. We represent the probability that agents choose a high level of effort by p_i, $i = d,n$. We also represent the agent effort choices by the set (a, e), where $a, e \in \{H, L\}$. So the set of possible alternatives is (*HH*), (*HL*), (*LH*) and (*LL*).

The agents have a von-Neumann Morgenstern utility function which is additively separable in money (*w*) and in cost of effort (*v*): $U_i = w_i - v_i(j)$, $i = d, n$ and $j = a, e$. This component of the cost of effort captures any re-scaling of the cost of effort that one may wish to consider, such as that arising from on-the-job training or job features.

Assumption 1

The disutility of the agent's efforts is positive, if the effort is high. But if the effort is low, there is no cost of effort. Formally, we have $v_i(H) = v_i > 0$ and $v_i(L) = 0$, $i = d, n$.

For the sake of simplicity, we take it that $v_d = qv_n$, and $q > 1$.

We assume that doctors have a larger cost of effort ($q > 1$) due to the features of their training, continuing study and job characteristics.

For very similar costs of effort, it suffices to perform a local analysis such that q tends to 1 ($q \rightarrow 1$). If it is believed that the cost of efforts is very different because of the nature of the tasks performed by doctors and nurses, then q takes large values. So the parameter q allows capturing both any similarity and difference between the agents' costs of effort.

We assume for now that the reservation utility ($\bar{U}_i$, $i=d, n$) of both agents is sufficiently small, non negative, and it may differ between doctor and nurse.[3]

We assume for the sake of simplicity that the reservation utility does not change over time. Changing the reservation utility over time would just re-size results without changing the conclusions. On the other hand, we can assume that the outside option for agents in health care is either working in a least preferred position in the health care sector or working in the non-health care sector or even being unemployed, which would always be the least preferred option for these agents.

2.1.2. The contractor

We consider the contractor to be a perfect agent of a Ministry of Health or of shareholders such that limited budgets are available to pay incentives and pressure exists for cost constraint, either from the parliament or from the share-holders. We also consider the contractor to be a perfect agent for patients, looking for the best possible outcome for them.

The contractor aims to maximize the patient's benefit net of incentives paid to doctors and nurses, in expected terms. We assume that the expected benefit of patients is sufficiently large so that the most preferable situation is the one where both agents exert high effort that is (*HH*). All the other possible situations yield a lower patient benefit. These situations may occur where agents exert less than the high level of effort, such as in (*HL*), (*LH*) and (*LL*). We also assume that such patient benefit may be ranked in decreasing order as (*HH*), (*HL*), (*LH*) and (*LL*). The patient's benefit is represented by G_{ij}, $i, j = H; L$, and so the highest is G_{HH} and the lowest G_{LL}.

When no budget limitation exists and there is a sufficient budget to pay the incentives to doctors and nurses to have them exerting a high level of effort, then the most preferred agent choice of effort (*HH*) is implemented and patients get the highest possible benefit.

In the case where the budget is sticky and limited, such that there is not enough budget to pay the incentives that motivate the highest level of effort from doctors and nurses, then the contractor may be of two types: myopic or selective. If the contractor is myopic and so he just keeps paying the incentives offered previously under the full budget. If the contractor is selective, he is able to choose which equilibrium will be implemented. The equilibrium is chosen that yields the highest expected net benefit, that is, the patient's benefit G_{ij} less the incentives paid to the agents.

2.2. The contracts

The contracts cannot be based on the individual efforts, which are not observable, but are based on the team output (Y), which can be observed. We assume that this signal is either success, or failure, in the patient treatment or improvement of well-being, that is, $Y \in \{S, F\}$.

The incentives are offered according to the observed signal of health output $w_i \in \{h_i, l_i\}$, $i = d, n$. In particular, the high payment (h_i) is given if $Y = S$ and the low payment (l_i) is given if $Y = F$.

Agents are liability constrained, so that they cannot be paid less than a certain non-negative amount of money ($l_i \geq 0$), which raises a moral hazard problem.

3 In the extensions section, we show that this assumption for the reservation utility is not crucial for the results.

The most common methods for paying health care professionals are a salary, fee-for-service and capitation (Robinson, 2001; Maynard, 2005). However, recently there has been some discussion, with associated examples, of pay-per-performance and team based incentives (Burgess and Propper, 2000; Hehenkamp and Kaarboe, 2011; Frandsen and Rebitzer, 2014). Therefore, the payments we suggest for the contracts are incentives that depend on the observed performance. The incentives we consider in this work may be monetary (as the pay-per-performance incentive) or may be non-monetary, meaning incentives that implicitly reflect the trust of patients, providers and society in general, which are provided after the output has been observed, as suggested by Maynard (2005).

2.3. Health production technology before and after

The health production technology is given by the probability of obtaining success in the patient treatment given the efforts of doctor and nurse, which is p_{ae}, as shown in Table 1. A successful treatment is obtained when health care is provided to improve a patient situation and the patient experience that improvement. Otherwise, when there is no improvement, then there is a treatment failure.

Table 1 - Health Production Technology

(a, e)	probability of success
HH	p_{HH}
HL	p_{HL}
LH	p_{LH}
LL	p_{LL}

Assumption 2

We assume that $p_{HH} > p_{HL} > p_{LH} > p_{LL}$.

This assumption justifies three major aspects. The first aspect is that this production function allows factors to be complements and substitutes. On the one hand, doctor and nurse efforts are complements, because with the doctor and nurse simultaneously exerting a high level of effort, the probability of success increases, that is, $p_{HH} > p_{HL}$ and $p_{HH} > p_{LH}$. On the other hand, the efforts may be substitutes when only one agent supplies effort and success is obtained more often than when no agent supplies effort, that is why $p_{HL} > p_{LL}$ and $p_{LH} > p_{LL}$. This becomes clearer when p_{LH} is very close to p_{HL}, that is $p_{LH} \rightarrow p_{HL}$, because the same outcome can be achieved with different inputs.

The second aspect is that differences in doctor and nurse productivities are taken into account by considering $p_{HL} > p_{LH}$. That is, doctors are more productive than nurses when producing successful outputs using one unit of effort. But this difference can be minimized by having $p_{LH} \rightarrow p_{HL}$.

Finally, the third aspect is that health professionals are always considered to make a positive contribution, and so $p_{HL}>p_{LL}$ and $p_{LH} > p_{LL}$.

The marginal productivity of agents can be measured as a difference in probabilities of success (that is, the increase in the probability of success after the increase of one unit of effort). For the doctor, given nurse effort, the marginal productivity is measured by $MP_d^e = (p_{He} - p_{Le})_{e=L,H}$. And for the nurse, marginal productivity is given by $MP_n^a = (p_{aH} - p_{aL})_{a=L,H}$.

It should be noted that the marginal productivities depend on what the other member of team is doing.

To capture the effect of the improvement in nurse expertise, the model is analysed[4] before and after that improvement. We represent these two periods by a superscript $t = \{0, 1\}$, where $t = 0$ is before, and $t = 1$ is after improvement.

The improvement of the nurse expertise is captured by:

1) an increase in the probability of success, when the nurse is the only member of the team exerting a high effort (p_{LH}), and

2) an increase in the probability of success, when both doctor and nurse are exerting a high effort ($\uparrow p_{HH}$). We assume this increase because there is a natural spillover effect on the team work due to the improvement in the nurse's expertise.

Assumption 3

The probabilities of success p_{HH} and p_{LH} before and after are such that $p^1_{HH} = p^0_{HH} + \varepsilon$ and $p^1_{LH} = p^0_{LH} + \mu$, $\varepsilon > 0$, $0 < \mu < 1$, $\varepsilon < \mu$.

After the change in nurse productivity, the ranking of probabilities is maintained:

$p^t_{HH} > p_{HL} > p^t_{LH} > p_{LL}$, $t = 0,1$.

We assume that $\varepsilon < \mu$ because some skills and tasks performed by doctors and nurses overlap when both are exerting a high level of effort and because an increase in the productivity of nurses is such that the ranking of probabilities is kept.

Other possibilities that could capture the increase in the nurse's marginal productivity would involve a decrease in p_{HL} and/or p_{LL} which is neither consistent with our context of change in the team production, nor does it reflect the continuous improvement of health care technology.

2.4. Timing of the game

The timing of the game is as follows:

1st stage: the contractor offers the contract to the doctor and the nurse.

2nd stage: the team accepts or rejects (if one of the agents or both reject, the game ends),

3rd stage: each team member simultaneously exerts effort,

4th stage: output is observed and payments are made.

The game is solved by backward induction.

3. The old team production technology

3.1. The incentives

The incentives offered to the agents are such that they minimize the expected expenses that implement the most preferred efforts, that is (*HH*): So formally we have the following optimization problem:

4 We do not consider any improvement in the doctor productivity for the sake of simplicity. In this way we avoid cumbersome modelling which would not provide value added to the findings. We are not defending the idea that doctors have not improved their productivity over time.

$$Min_{h_i, l_i}[p_{HH}(h_d + h_n) + (1 - p_{HH})(l_d + l_n)$$

subject to the participation constraints, the incentive compatible constraints and the limited liability constraints of agents (as presented in the appendix).

Solving this optimization problem gives us the following payments and corresponding budgets.

Let the difference between high and low payments be given by

$$\Delta w_i^t = h_i^t - l_i^t, i = d, n.$$

Lemma 1 *- optimal incentives*

The set of incentives that minimizes the expected budget and implements (*HH*) as a Nash equilibrium, when both agents decide their efforts simultaneously, is given by the following $(l_d^t, l_n^t, h_d^t, h_n^t)$:

$$\begin{cases} l_d^t = l_n^t = 0, \text{if } Y = F, \forall \text{t} \\ h_d^t = \Delta w_d^t = \dfrac{v_d}{p_{HH}^t - p_{LH}^1} = \dfrac{v_d}{MP_d^{e=1}}, \forall t, \text{if } Y = S, \\ h_n^t = \Delta w_n^t = \dfrac{v_n}{p_{HH}^t - p_{HL}^1} = \dfrac{v_n}{MP_n^{a=1}}, \forall t, \text{if } Y = S \end{cases}$$

The corresponding success and failure budgets are given by

$B^t_S = h^t_d + h^t_n > 0$ and $B^t_F = l_d^t + l_n^t = 0$.

3.2. The Nash equilibrium

The defined incentives, for sure, implement the Nash equilibrium (*HH*). It may be possible to find other equilibria, given the offered incentives. Hence, a guarantee has to be made such that the agents do not have an incentive to deviate from the equilibrium (*HH*). Indeed the following two results can be shown.

Result 1

The equilibrium (*HH*) Pareto dominates any other possible equilibria.[5]

Result 2

No profitable coalition between doctor and nurse can be formed that would induce another outcome different from the (*HH*) Nash equilibrium.

Therefore, given the optimal incentives, the equilibrium chosen by the agents in the team is the Nash equilibrium (*HH*) and there is no incentive for agents to deviate from this equilibrium.

5 Dominance is strict except for the equilibrium (*LH*).

3.3. Strategic relationship between efforts

It is worth knowing how the agents' efforts behave strategically, given the choice of effort by the other agent.

The concept of strategic complements and strategic substitutes used here is close to that presented by Bulow et al (1985): the increase in the probability of exerting high effort by one agent results in the variation of the expected utility of the other agent (in the team), considering that agents are not exerting high effort initially. If agents have efforts which are strategic complements then the increase in the probability of exerting high effort by one agent implies the increase of that probability by the other agent. The increase in the probabilities of exerting a high effort by both agents, increases the probability of a successful outcome and so it increases the expected utility of agents.

For the case of efforts which are strategic substitutes, an increase in the probability of exerting high effort by one agent results in the decrease of the probability of exerting a high effort by the other agent which, at the end, reduces the expected utility of both agents.

To find the strategic relationship between efforts, after deriving the best response correspondence for each agent, we check how each agent responds to an increase in the probability of the other agent exerting a high level of effort. We find three possible results, which are the three possible cases of strategic relationship between doctor and nurse efforts. The cases represent strategic complements, substitutes or independence. However, the case of independence is not of interest for this work (Result 3 is derived in the appendix).

Result 3 - *The strategic relationship between efforts*[6] *(listed in three possible cases):*

Case 1) Efforts are strategic complements when $MP_n^{a=H} > MP_n^{t,a=L}$ or $MP_d^{t,e=H} > MP_d^{e=L}$:

Case 2) Efforts are strategic substitutes when $MP_n^{a=H} < MP_n^{t,\,a=L}$ or $MP_d^{t,e=H} < MP_d^{e=L}$.

Case 3) Efforts are independent when $MP_n^{a=H} = MP_n^{t,a=L}$ or $MP_d^{t,e=H} = MP_d^{e=L}$,

where *MP* means marginal productivity.

These strategic relationships are relevant later for describing the equilibrium that emerges under a restricted budget.

4. The team technology

4.1. The implications of the improvement in nurse expertise

4.1.1. In the members of the team

The improvement in nurse expertise, as described before, is captured by an increase in p_{LH} larger than the increase in p_{HH}: This results in two changes:

i) in doctor marginal productivities: $MP_d^{e=H}$ decreases and $MP_d^{e=L}$ remains unaltered,

ii) in nurse marginal productivities: both $MP_n^{a=H}$ and $MP_n^{a=L}$ increase.

Taking into account *Lemma 1*, which gives the optimal payments, these changes imply that the doctor requires a larger incentive to exert a high level of effort[7]. On the contrary, a relatively lower incentive is

6 The strategic relationship between efforts (strategic complements or substitutes) is different from the production relationship of efforts (complements or substitutes), even though them may be related.

7 Note that $\Delta w_d^1 > \Delta w_d^0 \Leftrightarrow \frac{v_d}{p_{HH} - p_{LH}^1} > \frac{v_d}{p_{HH} - p_{LH}^0}$, where $\Delta w_d^t = h_d^t - l_d^t, t = 0,1$.

needed for the nurse to exert a high level of effort[8]. In absolute value, the larger change of incentives is observed for the doctor and so the larger impact on the budget of incentives is originated by this change.

Firstly, the increase in the nurse productivity decreases the value of her incentive, because her marginal productivity increases, independent of the effort decision of the doctor, and so the likelihood of the team achieving successful outcomes is higher. Secondly, one would expect some compensation in the expenditures of the incentives in the budget resulting from the opposing increase and decrease in incentives paid to doctors and nurses, respectively.

However, this is not the case, as we show in what follows.

4.1.2. The budget of incentives

In comparing the success budgets before and after, we find that an increase has occurred. Since the patients' benefit is sufficiently high and the concerns for the public health exist, it is worth keep paying to doctors and nurses, even though the health public expenses are higher.

Recall that $q = \frac{v_d}{v_n}$ and let $\bar{q}$ be a threshold value such that

$$\bar{q} = \frac{\varepsilon}{\mu - \varepsilon} \frac{MP_d^{1,e=H}}{MP_n^{1,a=H}} \frac{MP_d^{0,e=H}}{MP_n^{1,a=H}}.$$

Comparing the budgets before and after the improvement of the productivity of the nurse it is found that the threshold value for the difference in budgets is given by $\bar{q}$. This result is presented in *Proposition 1* (the proof is in the appendix).

Proposition 1 - the success budget before and after

The success budget that implements the equilibrium (*HH*) in *t = 1* is larger than that in *t = 0,* that is, $B_S^1 > B_S^0, \forall q > q$.

When the budget of success becomes lower after the increase in nurse productivity (that is, when $q > \bar{q}$.), then, economically speaking, there would not be much to say as resources would not be limited. Moreover, it seems unrealistic that health care budgets are decreasing.[9] For this reason, we will concentrate on the case where the success budget needed to pay the incentives increases.

The increase in the budget arises due to the asymmetric change in the marginal productivities of the agents: doctor productivity decreases while nurse productivity increases. This asymmetric change yields a higher budget of incentives necessary to implement (*HH*) as a Nash equilibrium since the incentives offered to doctors are higher while those for nurses are lower.

The increase in the budget may be justified because it is on the patients' best interest that doctors and nurses exert a high level of effort and provide full attention to patients. Otherwise, there would not be enough improvements on the patients' health conditions.

If the contractor adjusts the budget for the new situation then the equilibrium (*HH*) continues to emerge, as expected. However, it may be difficult to adjust the budget, for bureaucratic reasons (either the public health budgets are limited, or these budgets are sluggish to adjust for political or strategic reasons). Thus, if the available budget is the same as the old incentive budget, at *t=0*, then Nash equilibrium (*HH*) cannot be implemented at *t=1*.

8 Note that $\Delta w_n^1 < \Delta w_n^0 \Leftrightarrow \frac{v_n}{p_{HH}^1 - p_{LH}^1} < \frac{v_n}{p_{HH}^0 - p_{LH}^0}$, where $\Delta w_n^t = h_n^t - l_n^t, t = 0,1$.

9 It is not our purpose to discuss this here. We do not present any evidence of increasing health care budgets but rather refer to anecdotal evidence from newspapers or statistical databases such as those provided by Eurostat or the OECD.

4.2. Sticky budgets

If the budget associated with success is sticky in its adjustment to new productivities, then the contractor is bound by the old incentives budget for use under the new team productivities.

We consider that the contractor can be either myopic or selective. A myopic contractor offers the same incentives at *t=0* and *t=1*.

A selective contractor changes the incentives offered at *t=1* and chooses the equilibrium to be implemented, given the restricted budget of incentives.

4.2.1. The myopic contractor

We shall consider that contractor does not change the optimal incentives and keeps those in place at *t=0*, that is, $(l_d = l_n = 0;\ h_d \text{ and } h_n > 0)_{t=0}$.

Under these incentives we find that the emerging Nash equilibrium is (*LH*) at *t=1*. This equilibrium arises when the doctor's marginal contribution to success is not very high and the productivity of the nurse is sufficiently high, so that the nurse finds it worthwhile to compensate and substitute for the lack of the doctor's effort. This is the case of free-riding in teams, which may happen because efforts may happen to be strategic substitutes at *t=1*. This was not the case at *t=0*, where the efforts of the team where strategic complements.

This is a relevant result since it makes it clear that the change in nurses' expertise allows for free riding by the most productive agent, the doctor. The result is presented in *Proposition 2* (the proof is in the appendix).

Proposition 2 - conditions for the equilibrium (LH)

At *t = 1* there is a Nash equilibrium (*LH*) when the old incentives of t = 0 are offered.

Moreover, there are additional conditions that hold the Nash equilibrium (*LH*): on top of the old incentives, when i) at *t=0* the efforts are strategic complements and ii) at *t=1* the efforts are either strategic substitutes or strategic complements.

So, according to *Proposition 2*, there are conditions that hold the Nash equilibrium (*LH*). There are also conditions under which this equilibrium holds when doctors and nurses efforts were strategic complements before and may even be strategic substitutes afterwards. These results, that show the possible emergency of the equilibrium (*LH*), provide a possible perspective on the historical relationship between doctors and nurses: from a "joint work perspective" to a "free-riding work perspective".

Given the incentives offered in *t=0* and considering other compatible conditions (as shown in the appendix), it is possible to find other Nash equilibria.[10] It is worth noticing that there are no conditions that sustain the Nash equilibrium (*HL*).

4.2.2. The contractor is selective

If the contractor is selective then he chooses which equilibrium is to be implemented, given the success budget from *t=0*.

The choice is determined by selecting that which provides the higher social benefit, net of incentives. Moreover, since in the emerging equilibrium only one of the agents is paid to exert a high level of effort, then we have the following lemma (proof can be found in the appendix):

10 All the other possible equilibria are not relevant for the purpose of this work and therefore are not referred to here.

Lemma 2 - optimal incentives that implement equilibria (LH) and (HL)

i) to implement (LH), the offer made is $\Delta w'_d = 0$ and $\Delta w'_n = \dfrac{v_n}{p^1_{LH} - p_{LL}}$;

ii) to implement (HL), the offer made is $\Delta w''_d = \dfrac{v_d}{p_{HL} - p_{LL}}$ and $\Delta w'_n = 0$.

Recall that $q = \frac{v_d}{v_n}$ and let q_1 be a threshold value such that

$$q_1 = \frac{p^1_{LH}}{p_{HL}} \frac{MP_d^{e=L}}{MP_n^{1,e=L}} + MP_d^{e=L} \left[\frac{G_{HL}}{v_n} -, \frac{p^1_{LH}}{p_{HL}} \frac{G_{LH}}{v_n} \right]$$

where G_{HL} and G_{LH} are the patient's benefits associated with each possible outcome. Comparing the expected net benefits of (*LH*) and (*HL*), it can be seen that the threshold point is given by q_1. This result is presented in *Proposition 3* (proof can be found in the appendix).

Proposition 3 - condition for the choice of (LH)

When $q > q_1$, the equilibrium (*LH*) is preferred to equilibrium (*HL*).

From the condition obtained in *Proposition 3*, even when the increase in the productivity of the nurse is very high, so that p^1_{LH} gets very close to p_{HL}, then the threshold value tends to 1, and so (*LH*) is preferred. This condition, $q>1$, is always true, in accordance with *Assumption 1*. Therefore, (*LH*) is chosen by the contractor because it provides higher net expected benefits.

5. Extensions

5.1. When the reservation utility is large

We have assumed that the reservation utility of both agents was sufficiently small. The formal translation of this assumption is to say that

$$\overline{U}_d < v_d \frac{p^t_{LH}}{p^t_{HH} - p^t_{LH}} \text{ and } \overline{U}_n < v_n \frac{p_{HL}}{p^t_{HH} - p_{HL}}$$

The question may then be raised as to what would happen if the utilities were larger than those values.

5.1.1. The incentives

When the reservation utility is large, we have the following incentives for the doctor.

Lemma 3 - optimal incentives for the doctor

When $\overline{U}_d > v_d \dfrac{p^t_{LH}}{p^t_{HH} - p^t_{LH}}$, the doctor's incentives are given by

$$h_d = \overline{U}_d + v_d \frac{(1 - p^t_{LH})}{p^t_{HH} - p^t_{LH}} \text{ and } l_d = \overline{U}_d - v_d \frac{p^t_{LH}}{p^t_{HH} - p^t_{LH}}.$$

These incentives yield the same payment spread as that in *Lemma 1*, that is, for the doctor $\Delta w_d^t = h_d^t - l_d = \frac{v_d}{p_{HH}^t - p_{LH}^t}$. For the nurse, the process of deduction is similar.

5.1.2. The budget

This budget for success increases with p^t_{LH}, meaning that the change of nurse expertise implies an increase in the budget to implement the equilibrium where both agents exert a high effort. Therefore, the analysis as developed in the previous sections continues to be applicable.

5.2. Different changes in probabilities

5.2.1. The increase in p_{LH} changes the ranking of probabilities

In an extreme case, it could be the true that the improvement in the nurse's expertise was such that the likelihood of success in the patient treatment, when the nurse exerts a high level of effort, would be higher than that of the doctor's, that is, $p^1_{LH} > p_{HL}$.

Suppose the ranking of probabilities is $p_{HH} > p^1_{LH} > p_{HL} > p_{LL}$. We need to separate the case where the agents' cost of effort is similar (q tends to 1) from that where it is different.

i) When the costs of effort are similar, then

$$\Delta w_d^1 = h_d^1 = \frac{v_d}{p_{HH}^1 - p_{LH}^1} \text{ and } \Delta w_n^1 = h_n^1 = \frac{v_n}{p_{HH}^1 - p_{HL}},$$

and so the doctor's payment is higher than the nurses'. It is clear that the preferred equilibrium (*LH*), not only is cheaper, but it also yields success more often.

ii) When the costs of effort are different (q is large), we take *Proposition 3* and conclude that it still holds. For a sufficiently large patient benefit G_{LH}, the equilibrium (*LH*) is always preferred to (*HL*).

If that benefit is not so large then it may still be possible that (*LH*) is preferred to (*HL*) for some cases such that $q > q_1$.

Therefore, if there is a change in the probability ranking such that $p^1_{LH} > p_{HL}$, it becomes even more evident that the contractor will pay nurses a lower incentive and choose the equilibrium (*LH*), which yields higher probability of successful outcome.

5.2.2. The increase ε is larger than the increase μ

It is shown in *Proposition 2* that the Nash equilibrium (*HH*) arises when $\varepsilon > \mu$. Therefore, if the change in nurse expertise results in increasing returns of scale, meaning a larger increase in p_{HH} than the increase in p_{LH}, then the incentive budget would be enough to pay for a high effort level of both agents.

5.3. Risk averse agents

We have assumed risk neutral agents with a limited liability constraint in order to induce the problem of moral hazard. The results of the model do not change if we instead assume risk averse agents.

Suppose the utility of the agents is given by $U_i = u(w_i) - v_i$, $i = d, n$, where $u'(w_i) > 0$ and $u''(w_i) \leq 0$, then Lemma 4 follows.

Lemma 4 - optimal incentives

The optimal incentives that implement the Nash equilibrium (*HH*) are such that

$$\Delta u_d^t = \frac{v_d}{p_{HH}^t - p_{LH}^1} \text{ and } \Delta u_n^t = \frac{v_n}{p_{HH}^t - p_{HL}}.$$

The optimal incentives are given by

$$h_d = u^{-1}(\overline{U}_d + v_d \frac{1 - p_{LH}^1}{p_{HH}^t - p_{LH}}); l_d = u^{-1}(\overline{U}_d - v_d \frac{p_{LH}^1}{p_{HH}^t - p_{LH}});$$

$$h_n = u^{-1}(\overline{U}_n + v_n \frac{1 - p_{HL}}{p_{HH}^t - p_{HL}}); l_n = u^{-1}(\overline{U}_n - v_n \frac{p_{HL}}{p_{HH}^t - p_{HL}}).$$

Therefore, with such payments the analysis previously presented for the case of risk neutral and limited liability agents continues to hold.

5.4. Larger Teams

Multiple nurse teams

If we consider the common health care team with one doctor and several nurses (no matter how many), the model can be extended easily.

We know that the optimal incentive of the doctor is an inverse function of his productivity measured when all the nurses are working:

$$\Delta w_d = \frac{v_d}{p_{HH(H)}^t - p_{LH(H)}^t},$$

where $p_{aH(H)}$ means the probability of success when all the nurses are exerting a high level of effort, for a given doctor's effort.

So if we consider an increase in the probability of success when all[11] the nurses are exerting a high level of effort but not the doctor (that is, $\uparrow p_{LH(H)}$) as a result of the change in the team production structure, it obviously implies an increase in the doctor's incentive due to an improvement in the productivity of nurses. Then again, the doctor is motivated to free-ride on the nurses' high level of effort and, since the budget is limited, nurses end up exerting a high level of effort with a lower incentive.

Multiple teams

If we assume that the health care unit is composed of *N* identical teams, then the budget of incentives when success is observed is

$$NB_S^t = N \frac{v_d}{p_{HH}^t - p_{LH}^t} + N \frac{v_n}{p_{HH}^t - p_{HL}}.$$

11 This is an oversimplification view of the way teams work and nurses decide to exert high effort. In reality it may happen that only some of the nurses choose to exert high effort which could result in a different outcome.

As previously, under the new scenario, the old budget of incentives is insufficient to make agents choose to exert a high level of effort. In the most extreme options available, the contractor either pays the optimal incentives to some teams and gives no incentives to the other teams, or one of the agents is paid, and where the conditions of *Proposition 3* hold, then nurses are paid a lower incentive.

6. Conclusion

Nursing has been changing over time and this work analyses some effects of the improvement in nurses' education and skills to treat patients. Considering the natural team between a doctor and a nurse, a model based on contracts is proposed to analyze the effects of such improvement on the incentives offered and on the agents' choice of effort to treat patients. The particular scenario of limited and sticky health budgets is carefully considered.

We show that after the improvement in nurses' expertise, the incentives for nurses are lower than before, but the overall incentives budget is higher. Doctors receive a higher incentive and they can now free-ride on nurses' effort because nurses are more productive. Moreover, when the budgets are rigid and cannot adjust to the new production conditions, the treatment of patients is mainly provided by nurses and not doctors. Because a nurse's effort substitutes a doctor's effort, doctors' free ride on nurses' effort, and the final outcome is similar.

The results of this work are of major importance for human resources policy makers in non--surgical health care units. Not only it is shown how substitutability between doctors and nurses in a team may emerge and be explored, but grounding is also provided for discussions at different levels relating to payments, conflicts and distrust, the correct implementation of medical hierarchies and responsibilities within the health care organization.

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Appendix:

Proof - Lemma 1

$$\underset{h_i,l_i}{Min}[p^t_{HH}(h_d+h_n)+(1-p_{HH})(l_d+l_n)]$$

$$\Leftrightarrow \underset{h_i,l_i}{Max}\left[-p^t_{HH}(h_d+h_n)-(1-p^t_{HH})(l_d+l_n))\right],\ i=d,n$$

$s.t.$

$PC_d : EU_d(H,H) \geq \overline{U}_d \Leftrightarrow p^t_{HH}h_d - p^t_{HH}l_d + l_d - v_d \geq \overline{U}_d$

$PC_n : EU_n(H,H) \geq \overline{U}_n \Leftrightarrow p^t_{HH}h_n - p^t_{HH}l_n + l_n - v_n \geq \overline{U}_n$

$ICC_d : EU_d(H,H) \geq EU_d(L,H) \Leftrightarrow p^t_{HH}h_d - p^t_{HH}l_d + l_d - v_d \geq p^t_{LH}h_d - p^t_{LH}l_d + l_d$

$ICC_n : EU_n(H,H) \geq EU_n(H,L) \Leftrightarrow p^t_{HH}h_n - p^t_{HH}l_n + l_n - v_n \geq p_{HL}h_n - p_{HL}l_n + l_n$

$LL_d : l_d \geq 0$

$LL_n : l_n \geq 0$

(PC_i- participation constraint; ICC_i- incentive compatibility constraint; LL_i - limited liability constraint)

Taking LL_i constraints binding, because it is the minimum that can be paid, then $l_d = 0$ and $l_n = 0$ and so

$PC_d : p^t_{HH}h_d - v_d \geq \overline{U}_d$

$PC_n : p^t_{HH}h_n - v_n \geq \overline{U}_n$

$ICC_d : p^t_{HH}h_d - v_d \geq p_{LH}h_d$

$ICC_n : p^t_{HH}h_n - v_n \geq p^t_{HL}h_n$

i) *It is not possible to have a PC binding and a ICC not binding because agents need incentives to exert high effort. Thus, this case is excluded.*

ii) *Taking the ICC binding but not the PC, one gets the following:*

$(p^t_{HH} - p_{LH})h_d - v_d = 0 \Leftrightarrow h_d = \dfrac{v_d}{p^t_{HH} - p_{LH}}$ and $\Delta w^t_d = h_d - l_d = \dfrac{v_d}{p^t_{HH} - p_{LH}}$, and

$(p^t_{HH} - p^t_{HL})h_n - v_n = 0 \Leftrightarrow h_n = \dfrac{v_n}{p^t_{HH} - p^t_{HL}}$ and $\Delta w^t_n = h_n - l_n = \dfrac{v_n}{p^t_{HH} - p^t_{HL}}$.

Moreover,

from $PC_d : p^t_{HH}h_d - v_d \geq \overline{U}_d \Leftrightarrow \overline{U}_d \leq p^t_{HH}h_d - v_d \Leftrightarrow \overline{U}_d \leq v_d \dfrac{p^t_{LH}}{p^t_{HH} - p_{LH}}$,

and

from $PC_n : \overline{U}_n \leq v_n \dfrac{p_{HL}}{p^t_{HH} - p_{HL}}$.

Proof - Results 1 and 2

Given the incentives offered by the contractor to doctors and nurses, such that, $\Delta w^t_d = h_d - l_d = \dfrac{v_d}{p^t_{HH} - p^t_{LH}}$ and $\Delta w^t_n = h_n - l_n = \dfrac{v_n}{p^t_{HH} - p_{HL}}$ and also $l_d = 0$ and $l_n = 0$, it can be shown that agents do not have incentives to deviate from the Nash Equilibrium (HH) nor to make a coalition to deviate from that equilibrium. These are shown in *result 1* and *2*.

Result 1

Equilibrium HH dominates any of the other possible equilibria

Given the payment $\Delta w^t_d = \dfrac{v_d}{p^t_{HH} - p^t_{LH}}$,

For the doctor:

$EU_d(HH) > EU_d(LL) \Leftrightarrow p^t_{HH}\Delta w^t_d - v_d > p_{LL}\Delta w^t_d \Leftrightarrow p^t_{HH} - p_{LL} > p^t_{HH} - p^t_{LH}$, is always found to be true.

$EU_d(HH) \geq EU_d(LH) \Leftrightarrow p^t_{HH}\Delta w^t_d - v_d \geq p^t_{LH}\Delta w^t_d$, is always found to be true.

$EU_d(HH) > EU_d(HL) \Leftrightarrow p^t_{HH}\Delta w^t_d - v_d > p_{HL}\Delta w^t_d - v_d$, is always found to be true.

Identical results can be shown for the nurse.

Result 2

No profitable coalition exists.

The proof comes directly from the Pareto dominance of the equilibrium (HH).

Thus, it is not possible to find a condition such that

$\sum_i EU_i(HH) < \sum_i EU_i(HL)$,

$\sum_i EU_i(HH) < \sum_i EU_i(LH)$ and

$\sum_i EU_i(HH) < \sum_i EU_i(LL), i = d, n.$

Proof - Result 3: Cases of strategic relationship between efforts

Each agent is maximizing his/her expected utility which is given by

$\underset{p_i}{Max}\left\{EU_i(w_i, p_i) = h_i \Pr(Y = S) + l_i \Pr(Y = F) - p_i v_i\right\}, i = d, n$,where

$\Pr(Y = S) = p_d.p_n.p^t_{HH} + p_d.(1 - p_n).p_{HL} + (1 - p_d).p_n.p^t_{LH} + (1 - p_d)(1 - p_n).p_{LL}$,

$\Pr(Y = F) = 1 - \Pr(Y = S)$.

By computing the first order condition relative to p_i, we derive the best response correpondance (BRC) of both agents.

We denote $h_i - l_i$ as Δw_i , $i = d, n$.

$$\text{Nurse BRC: } p_n = \begin{cases} 0, \text{ if } \Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right] - v_n < 0. \\ ]0,1[\,, \text{if } \Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right] - v_n = 0. \\ 1, \text{if } \Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right] - v_n > 0. \end{cases}$$

$$\text{Doctor BRC: } p_d = \begin{cases} 0, \text{ if } \Delta w_d \left[p_n(p^t_{HH} - p^t_{LH}) + (1-p_n)(p_{HL} - p_{LL})\right] - v_d < 0. \\ ]0,1[\,, \text{if } \Delta w_d \left[p_n(p^t_{HH} - p^t_{LH}) + (1-p_n)(p_{HL} - p_{LL})\right] - v_d = 0. \\ 1, \text{if } \Delta w_d \left[p_n(p^t_{HH} - p^t_{LH}) + (1-p_n)(p_{HL} - p_{LL})\right] - v_d > 0. \end{cases}$$

After differentiating the defining condition of the BRC, we get the following strategic relationship between efforts:

For the nurse: $\dfrac{\partial(\Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right])}{\partial p_d} =$

$= \Delta w_n \left[(p^t_{HH} - p_{HL}) - (p^t_{LH} - p_{LL})\right].$

For the doctor: $\dfrac{\partial(w_d \left[p_n(p^t_{HH} - p^t_{LH}) + (1-p_n)(p_{HL} - p_{LL})\right])}{\partial p_n} =$

$= \Delta w_d \left[(p^t_{HH} - p^t_{LH}) - (p_{HL} - p_{LL})\right].$

Efforts are strategic complements for the nurse:

take the derivative obtained for the nurse $\dfrac{\partial(\cdot)}{\partial p_d}$ and suppose that $\dfrac{\partial(\cdot)}{\partial p_d} > 0$, that is,

$p^t_{HH} - p_{HL} > p^t_{LH} - p_{LL} \Leftrightarrow MP^{t,a=H}_n > MP^{t,a=L}_n.$

If $\dfrac{\partial(\cdot)}{\partial p_d} > 0$ then an increase of p_d causes an increase in the condition

$\Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right] - v_n.$

i) Suppose that initially the condition

$\Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1-p_d)(p^t_{LH} - p_{LL})\right] - v_n \leq 0 \Leftrightarrow$

$\Leftrightarrow \Delta w_n \left[p_d MP^{t,a=H}_n + (1-p_d) MP^{t,a=L}_n\right] - v_n \leq 0$

then after an increase in p_d, this condition becomes larger than 0 and so the nurse increases her probability of exerting high effort to 1. Thus, an increase in p_d, increases the likelihood that nurses choose a higher level of effort.

ii) Suppose that initially the condition

$$\Delta w_n \left[p_d(p^t_{HH} - p_{HL}) + (1 - p_d)(p^t_{LH} - p_{LL})\right] - v_n > 0,$$

then there is no effect on the nurse's effort because it is already at the highest level.

The other cases are deduced in a similar way. Thus, we have

Case 1) Efforts are strategic complements when $MP_n^{t,a=H} > MP_n^{t,a=L}$ or $MP_d^{t,e=H} > MP_d^{e=L}$.

Case 2) Efforts are strategic substitutes when $MP_n^{t,a=H} < MP_n^{t,a=L}$ or $MP_d^{t,e=H} < MP_d^{e=L}$.

Proof - Proposition 1

Comparing the success budgets for $t = 0$ and $t = 1$.

$$B_0^S = \frac{v_d}{p^0_{HH} - p^0_{LH}} + \frac{v_n}{p^0_{HH} - p_{HL}}$$
$$B_1^S = \frac{v_d}{p^1_{HH} - p^1_{LH}} + \frac{v_n}{p^1_{HH} - p_{HL}}$$

where by assumption $v_d = qv_n$.

$$B_1^S > B_0^S \Rightarrow$$

$$\Rightarrow \frac{qv_n}{p^1_{HH} - p^1_{LH}} + \frac{v_n}{p^1_{HH} - p_{HL}} > \frac{qv_n}{p^0_{HH} - p^0_{LH}} + \frac{v_n}{p^0_{HH} - p_{HL}} \Leftrightarrow q > \overline{q},$$

where $\overline{q} = \dfrac{\varepsilon\ (p^1_{HH} - p^1_{01})(p^0_{HH} - p^0_{LH})}{(\mu - \varepsilon)(p^0_{HH} - p_{HL})(p^1_{HH} - p_{HL})}$.

In case $q = 1$ then $B_1^S > B_0^S \Rightarrow$

$$\Rightarrow v_n > \left[\frac{1}{p_{HH}^1 - p_{LH}^1} + \frac{1}{p_{HH}^1 - p_{HL}} - \frac{1}{p_{HH}^0 - p_{LH}^0} - \frac{1}{p_{HH}^0 - p_{HL}}\right]^{-1}$$,which is a positive number, as expected for v_n.

Proof - Proposition 2

Given the payments $\Delta w_d^0 = \dfrac{v_d}{p_{HH}^0 - p_{LH}^0}$ and $\Delta w_n^0 = \dfrac{v_n}{p_{HH}^0 - p_{HL}}$ and the BRC of *result 3*, we have the following Nash strategies and Nash equilibria.

There are 4 possible Nash equilibria as shown in the next table:

	p_n=1	p_n=0
p_d=1	HH	HL
p_d=0	LH	LL

We now proceed by checking the possible existence of each Nash equilibrium and corresponding conditions.

1) The pair of strategies (LL)

i) Given $p_n = 0$,

from the doctor's BRC we obtain

$$\frac{v_d}{p_{HH}^0 - p_{LH}^0}(p_{HL} - p_{LL}) - v_d < 0$$

because $p_{HL} - p_{LL} < p_{HH}^0 - p_{LH}^0$.

Then $p_d = 0$.

ii) Given $p_d = 0$,

from the nurse's BRC we obtain

$$\frac{v_n}{p^0_{HH} - p_{HL}}(p^1_{LH} - p_{LL}) - v_n \gtrless 0.$$

a) If the condition $p^1_{LH} - p_{LL} > p^0_{HH} - p_{HL}$ holds,

then $p_n = 1$, and so (LL) cannot be a Nash Equilibrium.

b) If the condition $p^1_{LH} - p_{LL} > p^0_{HH} - p_{HL}$ does not hold,

then $p_n = 0$.

Thus, (LL) is a Nash Equilibrium.

2) The pair of strategies (HH)

i) Given $p_d = 1$, then

from the nurse's BRC we obtain

$$\frac{v_n}{p^0_{HH} - p_{HL}}(p^1_{HH} - p_{HL}) - v_n > 0$$

because $p^1_{HH} > p^0_{HH}$ by assumption.

Then $p_n = 1$.

ii) Given $p_n = 1$, then

from the doctor's BRC we obtain

$$\frac{v_d}{p^0_{HH} - p^0_{LH}}(p^1_{HH} - p^1_{LH}) - v_d < 0$$

because $p^1_{HH} - p^1_{LH} < p^0_{HH} - p^0_{LH} \Leftrightarrow \varepsilon - \mu < 0$,

which is a true condition by assumption.

Then $p_d = 0$.

Thus, the pair (HH) cannot be a Nash equilibrium.

3) The pair of strategies (LH)

i) Given $p_d = 0$,

from the nurse's BRC we obtain

$$\frac{v_n}{p^0_{HH} - p_{HL}}(p^1_{LH} - p_{LL}) - v_n \gtreqless 0.$$

If the condition $p^1_{LH} - p_{LL} > p^0_{HH} - p_{HL}$ holds $[Condition\ A]$,

then $p_n = 1$.

ii) Given $p_n = 1$, then

from the doctor's BRC we obtain

$$\frac{v_d}{p^0_{HH} - p^0_{LH}}(p^1_{HH} - p^1_{LH}) - v_d < 0$$

because $p^1_{HH} - p^1_{LH} < p^0_{HH} - p^0_{LH} \Leftrightarrow \varepsilon - \mu < 0$,

which is a true condition by assumption.

Then $p_d = 0$.

Thus, (LH) is a Nash Equilibrium.

Next, in order to obtain more information, Condition A, deduced above, is re-written as follows:

a.1) Re-writing *condition A* with reference to $t = 0$ and we get

$p^0_{LH} + \mu - p_{LL} > p^0_{HH} - p_{HL} > 0 \Leftrightarrow \mu > p^0_{HH} - p_{HL} - (p^0_{LH} - p_{LL}) > 0 \Leftrightarrow$

$\Leftrightarrow \mu > MP^{0,a=L}_n - MP^{0,a=L}_n > 0$ or $\mu > p^0_{HH} - p^0_{LH} - (p_{HL} - p_{LL}) >$

$0 \Leftrightarrow \mu > MP^{0,e=H}_d - MP^{e=L}_d > 0$

meaning that efforts are strategic complements at $t = 0$, as shown in *result 3*.

a.2) Re-writing *condition A* with reference to $t = 1$ and we get

$$p^1_{LH} - p_{LL} > p^1_{HH} - \varepsilon - p_{HL} > 0 \Leftrightarrow p_{HL} - p_{LL} > p^1_{HH} - p^1_{LH} - \varepsilon > 0 \Leftrightarrow$$

$$\Leftrightarrow \frac{p_{HL} - p_{LL}}{p^1_{HH} - p^1_{LH}} > 1 - \frac{\varepsilon}{p^1_{HH} - p^1_{LH}} \ .$$

Consider this condition true so it follows.

The right hand side of the condition is always $1 - \dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}} < 1$ because $0 < \dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}} \gtrless 1$.

The left hand side of the condition may be either i) $\dfrac{p_{HL} - p_{LL}}{p^1_{HH} - p^1_{LH}} > 1$, when $\dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}} < 1$

or ii) $\left[1 - \dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}}\right] < \dfrac{p_{HL} - p_{LL}}{p^1_{HH} - p^1_{LH}} < 1$, when $\dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}} > 1$.

Re-writing these expressions one gets either i) $\dfrac{MP_d^{e=L}}{MP_d^{1,e=H}} > 1$

or ii) $\left[1 - \dfrac{\varepsilon}{p^1_{HH} - p^1_{LH}}\right] < \dfrac{MP_d^{e=L}}{MP_d^{1,e=H}} < 1$,

that is, in first expression i) the efforts are strategic substitutes, while in the second expression ii) the efforts are strategic complements at $t = 1$, as shown in *result* 3.

4) The pair of strategies (HL)

Given $p_d = 1$, then

from the nurse's BRC we obtain

$$\frac{v_n}{p^0_{HH} - p_{HL}}(p^1_{HH} - p_{HL}) - v_n > 0$$

because $p^1_{HH} > p^0_{HH}$ by assumption.

Then $p_n = 1$ and so (HL) cannot be a Nash Equilibrium.

Proof - Lemma 2

$\underset{h_i,l_i}{Min}(p^t_{HH}(h_d+h_n)+(1-p^t_{HH})(l_d+l_n)) \Leftrightarrow \underset{h_i,l_i}{Max}\,[-p^t_{HH}(h_d+h_n)-(1-p^t_{HH})(l_d+l_n)]$

$s.t.$

$PC_d : EU_d(LH) \geq 0 \Leftrightarrow p^t_{LH}h_d - p^t_{LH}l_d + l_d \geq 0$

$PC_n : EU_n(LH) \geq 0 \Leftrightarrow p^t_{LH}h_n - p^t_{LH}l_n + l_n - v_n \geq 0$

$ICC_n : EU_n(LH) \geq EU_n(LL) \Leftrightarrow p^t_{LH}h_n - p^t_{LH}l_n + l_n - v_n \geq p_{LL}h_n - p_{LL}l_n + l_n$

$LL_d : l_d \geq \overline{w}_d \geq 0$

$LL_n : l_n \geq \overline{w}_n \geq 0$

Since we are looking for the minimum bonus, we take the low incentive $\overline{w}_d = \overline{w}_n = 0$.

There is no need to satisfy the doctor's ICC because he is exerting a low level of effort. By looking at the PC_d, we deduce that doctor's incentive is null:

$EU_d(LH) \geq 0 \Leftrightarrow p^t_{LH}h_d - p^t_{LH}l_d + l_d \geq 0 \Leftrightarrow p^t_{LH}h_d \geq 0.$

Then we just need to look for the optimal bonus of the nurse:

$\underset{h_n}{Max}\,[-p^t_{HH}h_n]$ st PC_n , ICC_n and LL_n.

The PC not binding and the ICC binding and so:

$$\begin{cases} p^t_{LH}h_n - v_n \geq 0 \Leftrightarrow p^t_{LH}.\dfrac{v_n}{p^1_{LH} - p_{LL}} - v_n \geq 0 \\ p^t_{LH}h_n - v_n - p_{LL}h_n = 0 \Leftrightarrow h_n = \dfrac{v_n}{p^t_{LH} - p_{LL}} \end{cases},$$

thus, $\Delta w_n^{'} = \dfrac{v_n}{p^t_{LH} - p_{LL}}$.

Proof - Proposition 3

Under the new team production structure $LH \succ HL$ means that the expected net benefit of LH is larger than the expected net benefit of HL:

$$p^1_{LH}(G_{LH} - \frac{v_n}{p^1_{LH} - p_{LL}}) > p_{HL}(G_{HL} - \frac{v_d}{p_{HL} - p_{LL}}) \Leftrightarrow$$
$$\Leftrightarrow p^1_{LH}G_{LH} - p^1_{LH}\frac{v_n}{p^1_{01} - p_{LL}} - p_{HL}G_{HL} + p_{HL}\frac{qv_n}{p_{HL} - p_{LL}} > 0 \Leftrightarrow$$
$$\Leftrightarrow q > \frac{p^1_{LH}}{p_{HL}}\frac{p_{HL} - p_{LL}}{p^1_{LH} - p_{LL}} + \left[\frac{G_{HL}}{v_n} - \frac{p^1_{LH}}{p_{HL}}\frac{G_{Lh}}{v_n}\right](p_{HL} - p_{LL}) \Leftrightarrow$$

$$\Leftrightarrow q > q_1.$$

When $p^1_{LH} \to p_{HL}$ then $q > \lim_{p^1_{LH} \to p_{HL}} \{q_1\} = 1 + [G_{HL} - G_{LH}]\,\frac{(p_{HL} - p_{LL})}{v_n}$.

If $(G_{HL} - G_{LH}) \to 0$ then $q > 1$.

Proof - Lemma 3

See proof of *Lemma* 1-3rd case: *PC* and *ICC* are binding

Proof - Lemma 4

The optimization problem is

$$\underset{h_i,l_i}{Min}[p^t_{HH}(h_d+h_n)+(1-p^t_{HH})(l_d+l_n)] \Leftrightarrow \underset{h_i,l_i}{Max}\,[-p^t_{HH}(h_d + h_n) - (1 - p^t_{HH})(l_d + l_n))]$$

$s.t.$

$$PC_d : EU_d(H, H) \geq \overline{U}_d \Leftrightarrow p^t_{HH}u(h_d) + (1 - p^t_{HH})u(l_d) - v_d \geq \overline{U}_d$$

$$PC_n : EU_n(H, H) \geq \overline{U}_n \Leftrightarrow p^t_{HH}u(h_n) + (1 - p^t_{HH})u(l_n) - v_n \geq \overline{U}_n$$

$$ICC_d : EU_d(H, H) \geq EU_d(L, H)$$

$$\Leftrightarrow p^t_{HH}u(h_d) + (1 - p^t_{HH})u(l_d) - v_d \geq p^t_{LH}u(h_d) + -(1 - p^t_{LH})u(l_d)$$

$$ICC_n : EU_n(H, H) \geq EU_n(H, L)$$

$$\Leftrightarrow p^t_{HH}u(h_n) + (1 - p^t_{HH})u(l_n) - v_n \geq p_{HL}u(h_n) + (1 - p_{HL})u(l_n)$$

(PC_i- participation constraint and ICC_i- incentive compatibility constraint)

Assumption: $u'(\cdot) > 0$ and $u''(\cdot) < 0$.

We need to implement the following change of variables:

$$u(h_i) = \overline{u}_i \ , \ \Rightarrow \ h_i = \vartheta_i(\overline{u}_i), \ \ i = d, n$$

$$u(l_i) = \underline{u}_i \ , \ \Rightarrow \ l_i = \vartheta_i(\underline{u}_i), \ \ i = d, n$$

By solving the optimization problem and taking the PC and ICC to be binding, we find the optimal payments and the optimal utility spread:

$$u(h_d) = \overline{u}_d = \overline{U}_d + \frac{1 - p_{LH}}{p^t_{HH} - p_{LH}} v_d \Rightarrow h_d = u^{-1}(\overline{U}_d + \frac{1 - p_{LH}}{p^t_{HH} - p_{LH}} v_d)$$

$$u(l_d) = \underline{u}_d = \overline{U}_d - \frac{p_{LH}}{p^t_{HH} - p_{LH}} v_d \Rightarrow l_d = u^{-1}(\overline{U}_d - \frac{p_{LH}}{p^t_{HH} - p_{LH}} v_d)$$

So we get

$$\Delta u_d = u(h_d) - u(l_d) = \frac{v_d}{p^t_{HH} - p_{LH}}.$$

The analogous calculus can be resolved for the nurse which results in

$$\Delta u_n = u(h_n) - u(l_n) = \frac{v_n}{p^t_{HH} - p_{HL}}.$$

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The Silence at the Stands: Agony in the Portuguese Market for Taxis

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resumo

Os táxis não podem ser baratos. Decorre de ser conduzido por um profissional com toda a flexibilidade dos carros, menos vários inconvenientes. E, no entanto, ... por que não? Os Taxistas reclamam sobre o preço proibitivo do gasóleo, que não cobre tarifas medíocres. A raiz e a verdade da questão encontram-se no serviço: clientes, quilómetros ... e na falta deles.

O mercado pode ser descrito como um cartel de entrada livre – gerido por associações do setor, toleradas pelo regulador – capturado, onde nem a entrada nem a saída fazem mover o preço. Para os consumidores, é péssimo. Enquanto isso, lucros de monopólio são desperdiçados entre o máximo de remediados, que mal conseguem sobreviver.

Melhor seria se a regulação evoluísse da captura por organizações dos motoristas para um conjunto de licenças e preços definidos de acordo com os níveis de tráfego, após um choque de preço negativo, que apressaria a eliminação do excesso de oferta.

Será que isso importa? Os táxis podem ser preciosos para fazer a ponte entre os transportes públicos e o ambientalmente frágil e caro transporte de carro.

JEL Classification: L13; L44; L59; L91

résumé / abstract

Les Taxis ne peuvent pas être bon marché. On est conduit par un professionnel avec toute la souplesse des voitures, sans leurs plusieurs inconvénients. Et pourtant ... pourquoi ne sont-ils pas? Les chauffeurs de taxi se plaignent sur les prix prohibitifs du gazole, qui ne couvrent pas les tarifs médiocres. L'essentiel de la question réside dans le service: les clients, les kilomètres ... et la manque d'eux.

Le marché correspond à une description d'un cartel de libre entrée géré par les associations, toléré par an régulateur capturé, où ni l'entrée ni la sortie bouge les prix. Pour les consommateurs, ça craint. Cependant, les profits monopolistiques sont gaspillés entre le maximum de misérables, qui survivent à peine.

Le meilleur serait l'évolution de la régulation, de la capture par les organisations de chauffeurs, pour un ensemble de prix et licences fixées en fonction des niveaux de trafic – positivement après un choc négatif sur les prix, qui hâterait l'élimination de l'excès de l'offre.

Est-ce que ceci est important? Les taxis peuvent être précieux pour combler le fossé entre les transports publics efficaces et l'écologiquement malsain et cher automobile.

Taxis cannot come cheap. You are driven by a professional with all the flexibility of cars minus several inconveniences. And yet … why aren't they? Drivers will grumble about prohibitive gas prices not covering lousy fares. The root, and truth, of the matter lies in service: clients, miles… and the dearth of them.

The market fits a description of a free-entry cartel, run by associations, tolerated by a captured regulator, where neither entry nor exit budge price. For consumers, it is a raw deal. Meanwhile, monopoly profits are squandered among the maximum of deadbeats, who barely get by.

Better if regulation evolved from the capture by the drivers' organizations, towards price and licenses set according to traffic levels, after a clearing negative price shock.

Does it matter? Taxis can be precious in bridging the gap between the shunned efficient public transports and environmentally unsound and pricey motoring.

Daniel Murta

1. Introduction

Taxi is a unique transport medium, overshadowed in land transportation by both the car leadership and the mass public transportations bus/coach and metro/train. Nonetheless, it can play a pivotal role in an efficient transportation system, bridging gaps between various modes, including the aerial and maritime, mostly as a complement but also, at times, as a substitute or, again, as a complement to walking.

Taxis naturally form a market, in terms of distance to related services, geographically dominated by the urban component with a residual, dwindling regional element. And yet, their market identity notwithstanding, the demand ought to be sensitive to the quality of other public transportations – such as the metro or dedicated lane express buses – their reach, working hours, frequency, comfort, and … cost. Clients should bear in mind the costs of motoring which, even if most drivers narrowly define as the everyday operating costs, still encompass fuel – a hot commodity, nowadays – and parking. Also, being a somewhat premium solution to most urban transport needs, business surely varies with general living conditions, in terms of real wages and unemployment.

Historically, and to a great extent to the present day, bar a few deregulation experiences scattered around the world, it has been a business of rents. Naturally, protected, regulated rents. They have generally stood on two pillars: a fixed, limited supply of licenses – often a tradable valuable rent, on occasion a source of auctioning income for municipalities; and a regulated level of fares. These usually comprise a fixed part that allows for the first x meters to be covered, and a variable part, charging *y* for each additional *z* meters. Extras for luggage or special cases are common[1]. Nightly duty can have either a higher parallel fare structure, as it has in Portugal, or involve a fixed extra. Henceforth, the fare structure will be referred, in spite of the simplification involved, simply as the price.

How the source of the rents is divided between the two restrictions – price and quantity – depends on the individual markets around the world: New York is (also) famous for having less permits now than in the 1930s, suggesting busy drivers earning their companies dollars essentially by quantity control[2], whereas in other cities/countries, like Portugal the rides are expensive, relative to both purchasing power and alternatives, and the rent rests more on the price than quantity.

Literature and experience on deregulation address these two restrictions: the first by freeing entry, (the lack of) which hurts consumers and excluded professionals, the second by deregulating – freeing – price, intending to benefit consumers. Before mixed results stemming from these actions are presented, a summary of the issues involved. The first one (entry) poses problems in being set and the second one (price) creates costs/distortions of its own. Essentially, freeing entry removes the rent from its owners, which should give way to compensation. There is usually no appetite for that, both by the scarcity of public funds and for using today's or tomorrow's taxpayers' money to giveaways to renters. Freeing price, although financially positive to the consumer in terms of tumbling prices, can cause problems in loss of clarity and transparency, giving way to bargaining. In a market well loaded with casual and uninformed customers[3], the end user can often be the loser. Absent of social consent for "shopping around" practices for the best rate, a collapse in an arranged and well publicized fare structure can be bad for the consumer.

Any one of those two deregulations, hurting profits and attracting new players can also endanger safety, comfort and quality of service, further downgrading the pool of drivers modest enough to put up with less pay, but these concerns can be dealt with by direct regulation of standards.

1 Airport service, transporting disabled people, luggage or pets.
2 The same holds for Boston or London, Paris, Milan and other big or rich western cities.
3 Visitors or tourists, for example.

Several factors, some more unique to the country than others, contrive to put the Portuguese market for Taxis in a terrible situation. Explaining it, and placing it within the context of other developments elsewhere in the World, as well as examining possible clues for improvement, will form the core of this paper. First, a brief revision on literature beckons.

2. Revision of literature

Notwithstanding major references in Industrial Organization, which will help formalize some of the subsequent description of the Portuguese situation, three surveys of different focus and date will be referred and discussed, as they will provide a framework and arguments on the performance and regulation of the Taxi Industry.

Starting with the most recent, Aquilina (2011) covers ten case studies in England, following the Office for Fair Trading's (OFT) 2003 recommendation to Licensing Authorities that they should lift quantity restrictions on Taxi licenses. The studies cover cities were the restrictions were lifted and others where they were not. In all cases there were two periods of observation[4]; data were collected on waiting times, both of customers and drivers; fares, number of vehicles and a survey of customers' perception of service quality. Crucially, in both periods of observation fares were always regulated[5], and were generally raised during the time of the study. Furthermore, the biggest city where de-regulation of licenses took place was affected by major construction work. These mishaps dampen the conclusions. They amount to the finding that the cities which de-regulated were the ones where waiting times were longer, and thus where those were cut the most; there, too, was where the fleets increased in biggest numbers.

A much feared loss of quality in service, in association with license de-regulation, was not reported by the relevant survey in either of the sub-group towns. The author downplays such fear, noting that standards of quality can be imposed by a regulator, instead of letting high fares deliver such an outcome. Anyway, in this study fares remained regulated and rose.

The similar performance by the cities that did not de-regulate led to the conclusion that such a move is not necessary to achieve a good performance by the industry, but can, nonetheless, act as a substitute, when the regulator cannot find the adequate balance in terms of licenses.

The background for Taxi regulation consists of the prerogative of Licensing Authorities to refuse new licenses if they are satisfied about the absence of unmet demand (1985), and the widespread power of Licensing Authorities to set maximum fares, which they generally use. In a typically British succinct fashion, vehicle and driver quality are those that assure they are 'fit for purpose'. The above mentioned Office_of_Fair_Trading 2003 report, besides endorsing license reform, linking reduced availability to reduced quality, stresses the importance of quality and safety regulations and, critically, sanctions fare regulation (in a market where maximum fares are always adopted by drivers) since they protect vulnerable customers, or those found in vulnerable situations, from overcharging. Vulnerability is detailed to encompass lack of price competition stemming from inability (or costliness) to shop around for prices, both on the street – hailing – or at Taxi stands (if, as often is the case, it is not socially established); also, tourists lacking skills and/or information to negotiate a fare, or disabled people lacking alternatives.

Aquilina (2011) focuses on the street and rank hiring segment[6] to state that people hire randomly, either hailing or through the 'first in, first out' custom. So hiring is done in absence of competition, with consumers forming their expectations on the basis of the market as a whole. This provides drivers with monopoly power, which may lead to monopoly pricing, in spite of multiple suppliers – a very important point in the subsequent description of the Portuguese market. Drivers, goes the author on to say, would not gain from lowering fares or investing in improving quality, since the

4 In one case there were three.
5 Whether there was quantity de-regulation or not.
6 As opposed to the smaller, and rather different, phone or internet hired segment.

customer considers the market as a whole, and the driver would not capture either market share or loyalty, through any of those actions. The observed reality of Taxi markets, including the adherence to maximum fares, seems to bear these statements out.

The work by Liston-Heyes and Heyes (2005), also cited by Aquilina (2011), seeks to provide economic background to the debate and momentum around de-regulating the Taxi industry. They trace the foundations and rationale for regulation on market failure, agreeing with established consensus of the optimal performance [in economic Welfare] of competitive markets.

This market's failures, from textbook perfectly competitive ideals, start with the inherently interdependent supply and demand schedules – a parametric increase in supply decreases waiting times thereby increasing demand in a price quantity framework – a feature Beesly and Glaister (1983) note, citing Harold Demsetz: " […] effective regulation depends on […] suitable information. In markets in which demand cannot be kept analytically separate from supply, this is not easy."

Then there is the above mentioned lack of price competition. Diamond (1971) has established that monopoly pricing can prevail even with numerous suppliers, due to search costs. Here, these costs comprise lost time, the gamble in turning a sure offer down and the lack of information/ability from infrequent/non local customers, aggravated in cases of disability, heavy luggage, odd hours or odd destinations. Often, there is also the strong social convention of taking the first car of the rank, or shyness towards price comparisons – Liston-Heyes and Heyes (2005). The prevalence of frequent customers, and of booking rides can curtail these information asymmetries, but predicting the market outcome, and its performance on Welfare, is very difficult.

The authors proceed with describing waiting times and excess capacity [to keep them acceptably low] as public goods, going back to the interdependency of supply/demand, and noting a competitive environment [in the classic assumptions] will under-provide such a [public] service. Important models, like that of Chamberlin (1933), while anticipating excess capacity, fail to appraise its value to customers.

Liston-Heyes and Heyes (2005) mention economies of scale and the prospect of excess entry due to replication of fixed costs, but argue they are low. This is a point of central importance in the present predicaments of the Portuguese market, which will be discussed later. Anyhow, nobody suggests fixed costs are absent from this market. Some, like Fingleton et al. (1997), accept the evidence of their small size to recommend free entry.

Regarding quality of service[7] beyond waiting times, Liston-Heyes and Heyes (2005) find, again in agreement with Aquilina (2011), that direct regulation is the way to go.

In cataloging regulatory instruments, they start with price controls, usually under a fare formula based on distance and time, plus some fixed cost, calculated by meters[8]. Then, there is entry regulation, with evidence of low fixed costs and the interdependency of service quality and demand (through waiting times) both arguing for de-regulation. That same oddity is referred by Arnott (1996), to push for subsidizing Taxi travel – to correct under-supply of vacant capacity. Such an instrument – subsidy – is also plausible if outcomes in related markets, for instance, congestion reduction in personal transportation, by car, are to be sought.

In a further insight to the Portuguese market, Liston-Heyes and Heyes (2005) say the Taxi market is prone to regulatory capture[9]. Taxi consumers – visitors, businessmen on paid accounts, low income people without car, or your regular person in an unusual situation – typically will not be the ones lobbying for lower fares to the municipalities that set them. Taxi associations, on the other hand, generally will engage in canny lobbying, both for higher fares and stagnant licensing. Optimal independent regulation would be difficult and require much more information than the regulator will normally have.

7 Safety and cleanness of taxis, road competence and geographical knowledge of drivers.
8 Such as the above mentioned for Portugal.
9 Defined as occurring when a regulator prioritises the interests of the regulated industry [those on the 'supply' side] over general Welfare.

The authors conclude arguing for transparency in policy objectives, accepting there is low risk of excess entry, and some instances of the contrary; they find the case for fare regulation ambiguous, its balance depending on characteristics of the [individual] local market[10].

Finally, in terms of main foreign references centered on the Taxi market, the work by Cairns and Liston-Heyes (1996), somewhat older, ploughs away against deregulation of fares and entry.

It starts with the demonstration that the very existence of equilibrium depends on the regulation of fares. The (by now, oft cited) interdependence of supply/demand is presented here as a negative externality – one man's ride, increases another's wait. Under their assumptions, a socially optimal price – equal to the cost of adding capacity – will yield negative profits. Attaining zero profits will result in a zero value for the license. The price that achieves them, if waiting is very costly for intra-marginal consumers, can be higher than the [freely optimized] monopoly price.

With high search costs, examples of which have been mentioned before, and risk averse customers, they themselves may prefer a somewhat higher price to bargaining. On a full stand, a choosing, and choosy, customer may have the advantage, and drive the price down, in a Bertrand-like fashion. In such a case, drivers would prefer a fixed fare to bargaining with a 'bad hand'. In periods of high demand, a regulated fare will protect the client; in the opposite times, both he and the driver may have high search costs for another Taxi/customer, and bargaining will be difficult – an established fare is also better.

Once price is regulated, according to the authors, the market will become like an open-access resource – a commons – where too much entry can take place, hence where constraining it can increase Welfare. Optimum Welfare is, thus, compatible with positive profits and resulting valuable medallions[11]. Such a valuable – as opposed to worthless – license can also be seen as a bond of its holder, driver or Taxi owner, towards the (municipal) authority, the stripping of which can prevent morally hazardous behavior, such as deliberate choice of longer/congested routes, or fare-gouging.

The paper concludes restating price regulation is necessary for equilibrium to occur. Since the intensity of use may be difficult to monitor, a regulator can improve Welfare by limiting the number of Taxis as well. Humbly, they stress that regulatory capture can clearly take place, that no system of regulation is universally superior, and that their effectiveness is a matter for empirical judgment.

3. The Portuguese market for Taxis: An overview

Portugal is now commemorating 40 years of democracy. Remnants from both the long lasting preceding political system of Fascist inspired authoritarian rule (1920s to 1974), and the turbulent short communist leaning revolutionary period (1974-1976) linger to this day in the economy. However, it is the first corporatist, pre-democratic economic environment that helps characterize the market for Taxis, up until the late eighties. Government competition policies were designed to hinder competition, instead requiring for each new establishment a permit – which could be refused – as well as for any expansion of economic activity on the part of existing firms. Although watered down amidst a liberalization phase of the regime, this law and environment produced a culture of coziness that fitted perfectly with the classical way of functioning and regulating the Taxi industry – regulated fares and entry.

This long, idyllic phase, delivered what is expected and observed in most markets for Taxis thus regulated: modest profits, which attract enough people and capital; stable, transparent and dependable prices – published and metered; enough quality of service, absence of price competition, biding and other pressures or risks to the consumer. Quantity, in this quiet, almost secretive industry, and with so much time gone by, is for no-one to measure. Price, from which quantity can be qualitatively inferred – for the sake of comment – real relative price, would have

10 More necessary with more infrequent, foreign customers, less booking, less scope for reputation.
11 license; literally, it refers to the 'stamp' exhibited on the vehicle.

to take into account a very poor peasant-turning-urban society, where walking and cycling were mass transportation 'systems' and the public ones were limited, in scope and performance, and otherwise privilege only of the biggest cities. Taxis were there for the few – few richer civil servants, few tourists and very few occasions.

Next, is the second phase, and its cutoff point from the one just described. To place it a quarter of a century ago, in the late eighties, has nothing to do with a concrete shock. Following the entrance in the European Union (E.U.), Portugal experienced rapid growth in per capita income, in itself a good thing for Taxis, but even quicker, steeper growth in car ownership. The general access to a car – your own, a close relative's, your neighbour's – forever altered the prospects for Taxis.

Table 1 – Car Ownership (per 1,000 inhabitants)

	1991	1993	1995	1997	1999	2001	2002	…	2011	2012
E.U.	334	360	375	388	412	437	444			
Portugal	183	225	261	300	342	540	560		447	406

Source: Eurostat and INE (National Bureau of Statistics).

Of course, this is nothing new to the rich industrialized world, but decisively changed the landscape for professional drivers. The car, which in Portugal as elsewhere in Europe or America is credited with a 90% share of personal land based transportation, hurts the alternative transport mediums. All public transportation – urban, regional and long range which, in Portugal, is typically under 500 kilometers or just over 300 miles – struggled to cope with the ascent of the car on Portuguese choices. (For a description of the Portuguese transport system, see Murta, 2010.)

Other negative shocks for the Taxi industry have since occurred:

- The capital's underground system, has undergone continuous development, with new lines, connection to the main national railway line (1998) and, most recently, much more interconnectedness between lines, improving accessibility; less than two years ago, a long awaited connection to the (very central) airport was opened; to convey a sense of the importance of Lisbon, the Metro and the airport, it is enough to say greater Lisbon houses 4 million people out of 10 million Portuguese; the airport, besides being the country's biggest, is the capital's only such structure for civil flights;

- The second city – Oporto – has, since 2003, a brand new mixed light rail/underground system, fully connected to its only, rather busy, airport;

- A stagnant economy, with stagnant personal disposable incomes and high personal indebtedness, with real growth this century zero or negative in five of thirteen years, and at or over 2% only twice (Table 2);

Table 2 – Real GDP Growth Rate

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2.0	0.8	-0.9	1.6	0.8	1.4	2.4	0.0	-2.9	1.9	-1.3^{po}	-3.2^{pe}	-1.4^{pe}

Notes: Chain linked volume data; reference year: 2006. Po (Pe) denotes provisional (preliminary) data.
Source: INE.

- In 2012, under pressure from the Troika[12], the Health Ministry clamped down very hard on transport of sick people or people attending exams [specially from outside major cities], most

12 The three institutions overseeing and accompanying the 2011 financial assistance program: the I.M.F., the E.C.B. and the European Commission.

severely on those it contracted with Taxis[13]; industry sources assuredly say that prices contracted in bulk, of €0,30 per Km or less, in some cases, were considerably lower than those practiced by Fire Department related firms which, although also hit by cuts in transportation, were not as drastically affected; this development has brought demonstrations of Taxi drivers to the streets and, sources say, has caused hundreds of professionals to leave the industry.

In light of the two described phases – a steady one, before the late eighties, and a declining one, until the present – how did the market use to work, and how does it now?

The sector produces very little data, and is dominated by individually owned one Taxi firms. It has a strong, but incomplete membership of two drivers' associations – Antral and FPT[14]. Small firms employing drivers are to be found in the two major cities, in the Algarve tourist hub, and marginally in Coimbra. Five years ago, both claimed there were around 30.000 drivers, between their associates and the rest.

Price is regulated by conventions, which are signed between the biggest association, or the two main associations, and the relevant Ministry. The last one, which is in place, was signed in December of 2012, to run until the end of 2014, between the two associations and a branch from the Ministry for the Economy and Employment[15], now only consisting of Ministry for the Economy. Portugal, in this respect, follows many countries and cities and what many authors (e.g. Cairns and Liston-Heyes, 1996) recommend in having a regulated price, to which drivers fully commit.

However, if one analyses the various conventions and the projected length of their being in effect, one notices several gaps, in different years. Asked about these aspects, sources in the Associations say when drivers fail to see the point in raising fares, they do not press for a new convention, leaving the last one to stand in force. This candid truth, thus exposed, allows two major aspects of the market to be ascertained:

- There is regulatory capture, as all cited authors say the sector is prone to have, whereby prices are set in accordance to the drivers' interests;

- The economics of the sector, namely, its contracting demand relative to its existing supply, contrive to make nominal price hikes unattractive to the drivers, with them settling for real price decline instead.

This practice of keeping prices still, at times, is rather recent, and could not happen in the inflation plagued decades of the seventies and eighties. Before, either because of inflation or also in view of less dire conditions on the demand side, the associations complained about the need to raise prices. One can interpret this as evidence that the regulatory capture was less complete in those days – it is true that government, while fighting inflation, tried to delay price hikes in which it had a say. Or, it can be noted that complaints are not as strong as actions, and the whole scheme of signing conventions with the government, thereby splitting the blame for higher prices, is very nice for the industry.

Anyhow, whereas formerly drivers could be heard complaining about prices and perhaps taxes, the last decade has seen a consensual claim emerge: slow business, bankrupting, nerve racking and slow business; and anecdotic evidence of drivers over four hours into their shift without a single customer.

The number of licenses for Taxis has always been regulated, in as much as Municipalities are responsible for them, and auction new ones, which drivers then validate with the IMT institute[16], from the Ministry for the Economy. Lately, there have not been any new licenses distributed[17].

13 It also contracted with firms related to Fire Departments.

14 Antral is the acronym for 'Associação Nacional dos Transportadores Rodoviários em Automóveis Ligeiros'. It is bigger and much older than FPT, that stands for 'Federação Portuguesa do Taxi', created in 2003. They are reckoned to split a 90% and 10% share of the associated drivers' numbers.

15 Direção Geral das Atividades Económicas, Ministério da Economia e Emprego.

16 IMT stands for Instituto da Mobilidade e dos Transportes Terrestres, I.P., and regulates transportation.

17 Confirmed by the responsible from Coimbra Municipality.

Industry sources are certain that there are too many Taxis everywhere, including in Lisbon, and have evidence of licenses being dropped, given away or sold for symbolic amounts.

This fact – it will be taken as such, since it makes sense, is reported by entities whose interest is contrary to it, and there is no evidence against it – has huge implications for the market – in effect, it turns regulated entry, with positively valued medallions, into free entry, in terms of ceasing to be an active/costly constraint.

To grasp the consequences on equilibrium of free entry, with monopoly prices, a curious example is evoked. Lipsey et al. (1990), in their economics textbook, tell a story about price fixing and profits[18]. If barbers in a town, unhappy with their miserly earnings, teamed up and set a price, whilst allowing for free entry, such a price would indeed be higher, and revenues would go up, for a time. Afterwards, either they would raise costs to try and gain market share (plusher service) and/or entry would take place until profits were wiped out. Even in the presence of monopoly pricing.

As noted above, Aquilina (2011) states that monopoly pricing is compatible with multiple suppliers, since one driver would be unable to gain meaningful market share from a unilateral cut on price.

4. The Portuguese market for Taxis: Modelling equilibrium

To present the market equilibria as they seem to be developing, the classical framework found, for example in (Martin 2002), will be followed.

$$P = a - bQ \tag{1}$$

is the standard linear demand. Linear costs with small, but non zero, fixed costs are given by

$$C(q) = cq + F, \tag{2}$$

yielding the benchmark competitive total quantity

$$S = \frac{a-c}{b} \tag{3}$$

and the freely optimized monopoly price, in which optimal quantity is half of the competitive one:

$$P_{mon} = \frac{a+c}{2} \quad ; \quad Q_{mon} = \frac{a-c}{2b} = \frac{S}{2} \tag{4}$$

The number of firms, which stop entering or leaving when variable profits equal fixed costs is given by

$$\pi_i^{var} = (P-c)q_i = (P-c)\frac{Q}{n} = \frac{a-c}{2}\frac{S}{2\,n} = \frac{bS^2}{4\,n} = F \tag{5}$$

$$N_{Pmon}^{free\ E} = \frac{(a-c)^2}{4\,bF} = \frac{bS^2}{4F} \tag{6}$$

18 Box 13-2, Chapter 13, Part 4, pp. 256-257.

Finally, welfare from this zero profit equilibrium:

$$W_{Pmon}^{free\ E} = CS + 0 = \frac{(a-P)}{2}Q = \frac{1}{2}\frac{(a-c)}{2}\frac{S}{2} = \frac{bS^2}{8} \quad (7)$$

This is, naturally, a far cry from an ideal omnipresent sole Taxi, incurring in F losses, and charging P = c:

$$W_{1;P=c}^{*} = CS + \pi = \frac{1}{2}(a-P)Q - F = \frac{1}{2}(a-c)S - F = \frac{bS^2}{2} - F \quad (8)$$

Notice that, apart from the value of one fixed cost, a stylized market of a firm charging the competitive price would yield four times more Welfare; the largest part of the difference – fully two thirds of it – lies not on the smaller quantity – half – that the (regulatory captured) monopoly pricing envisions, but on the squandering of monopoly profits on the replication of fixed costs, by a large, excessively large, number of firms, as shown by the following expression:

$$W_{1;P_{mon}}^{*} = CS + \pi_{mon} = \frac{bS^2}{8} + \frac{bS^2}{4} - F = \frac{3}{8}bS^2 - F \quad (9)$$

The market arrives to this clearly underperforming equilibrium through a doubly convoluted path:

- It is the experience of exit, and worthlessness of licenses that demonstrates there is non-constrained free entry, for practical purposes;

- It is not raising prices – letting price conventions 'expire', or be left to outlast their set period – that points to prices being already 'captured' at a level drivers don't want to raise, the hallmark of 'monopoly' pricing.

A glance at other developments abroad, before turning attention to possible improvements on this sorry state of affairs. Europe has seen a fair share of Taxi drivers' demonstrations, from the most recent in France, against unregulated entry by allegedly less qualified competitors (February, 2014), to others in Athens (September, 2011); Rome (July, 2006) and Milan (January, 2003) all contrary to licensing reforms. In Portugal, they cannot demonstrate against themselves, or against a number that bad economic fundamentals, rather than a reform minded government, has turned excessive.

New York, is a case apart. A city of millions, a Mecca for tourism[19], is notorious for its tight grip on drivers' licenses, especially its meager number, and has just auctioned several more for prices that exceeded $1 M USD, per Taxi (November, 2013)! In New York, there are no demonstrations to be seen. The drivers are employees of investors who have the capital to spend on such a 'license to rent', and they are mostly quiet foreigners[20]. Customers of a possibly steeply fared service are not organized, and come a lot from out of town.

Does it matter? Is there a better way to run a city Taxi market? Well, going back to the beginning, Taxis can play a pivotal role in an efficient transportation system, and if they stray too much from a competitive solution, efficiency is bound to suffer. Such a high value for a license highlights the nature of rent seeking market even Cairns and Liston-Heyes (1996), acknowledge. Any change on this equilibrium is bound to affect the economic value of those rents, implied in the values they

19 Ranked 5th by MasterCard in international overnight visitors.
20 According to the New York City Taxi and Limousine Commission, 82% of the drivers are foreign born. Source: http://www.statisticbrain.com/taxi-cab-statistics.

fetch at the auctions. If New York collects that money, it stands in an awkward position to 'take it away'. That is a reason for not rushing into issuing many licenses, as it is also for not pressing for fare reductions.

5. The Portuguese market for Taxis: Moving forward

From a regulator's perspective, it is humble to start thinking about improvements on *status quo*, by recalling the Hippocrates oath's first commandment: 'first do no harm'. It is common to mistake this for doing nothing, but that's surely a good way to start.

If nothing is done, the market will continue to bleed some drivers, with the remaining struggling to get by on the lowest revenues that cover their expenses; consumers will not flock to the stands, as the price is rather heavy on their lean wallets.

A word on price sensitivity. Given the high prevalence of casual/rare travel, aggravated with the demise of Health related contracted transportation, demand is not elastic. From most of the studies covered above, one infers there is some price sensitivity, not so much as it would tempt drivers into a price war. A thorough study on demand, out of the scope of this text, would be most welcome, and the author would be glad to participate.

Acting on the number of licenses, when they are worthless is pointless or tricky – expanding is pointless; reducing enough for them to become valuable is tricky, because it would create random winners, giving a plausible claim for compensation on the part of the numerous losers, who saw their license 'confiscated'. With high public debt, who would accept the State spending money on people who, to some extent, overcharge customers?

That leaves price as the instrument of change. It seems a one-off sizable reduction on prices, say a third on global fares, keeping the way they are calculated and transparently shown to the customers, would achieve a lot on the short run, and could have a proper follow-up later on. It would speed up the (already existing) exit from the market by drivers who wouldn't be able to earn enough to cover costs.

Fixed costs are not high, but they do exist:

- there is the opportunity cost on the vehicle;

- insurance;

- the renewal of the Taxi's license;

- some aspects of its maintenance[21];

- safety inspections;

- social charges for the driver;

- a fixed tax take on revenues, which can be later partially recovered, if there aren't enough profits;

- the renewal of the driver's license;

- etc.

Therefore, a cut on price, when variable profits barely cover fixed cost – zero profits, negative for those who leave – would force the departure of more drivers. It would also favor every consumer, and bring a few extra ones, dampening the exodus of motorists. The remaining Taxis would be busier, charging less, which is tantamount to a better deal on efficiency, or Welfare, in microeconomic sense.

This is the static result. The dynamic implications depend on whether this one-off gesture was the 'single bullet'. If it was, it would 'scar' the market, deterring investment for fear of another round of

21 Part of maintenance service is pure consumables, which would rank as variable costs, like oil and tyres.

price cuts and, in general, a perception of utter lack of sympathy for drivers and obsession with the consumer.

A more coherent and balanced approach, inspired on the, much commended and practiced, forward guidance by central bankers, would be to offer a path to future regulation, both in terms of fares and licenses. The price cut would have to be put into a context of returning the market to growth, and adding value for the economic activity of Taxi driving. Bringing extra customers, and getting drivers busier. During the painful process to get there, some pledges should be made:

- Once licensed driver or Taxi numbers stabilized to a given degree, for example a variation in number under 5%, a 5 year stay on new licenses would ensue;

- Some agreed measure(s) of traffic, like 'average number of trips per shift', that the Nevada Taxi Cab Authority collects for Las Vegas, or 'average number of miles driven per shift', that the New York City Taxi and Limousine Commission collects[22], would be good proxies to base a discussion either on fare increases, along with data on inflation, of course, or (new) license issuance.

The balance to be found would keep the transparency on prices, as de-regulation throws actors into opportunistic prone biding. It would seek to return to regulated entry – now, it is in effect free. Keep an eye on prices on behalf of the consumer, but gladly welcome profits for Taxi drivers, who cannot remember having them.

6. Conclusion

Taxis have never been cheap, nor can they be. High petrol prices, and a protracted economic crisis in Portugal, have left them as expensive as ever. Further, public transport has improved, a lot in the two major cities. Taxis have lost their piggy-bank, in the form of Health related transportation, paid by taxpayers.

Fares and entry have always been regulated, and pricing does conform to drivers' wishes. But the permanent sharp contraction of demand has left them too many, dividing among themselves just enough trips to cover cost, many of them not making it and leaving.

This free entry, monopoly priced market delivers a poor result in Welfare, both for consumers and drivers.

In the short run, a big price cut, demanded by the regulator, would deliver speedier exit, more work for those staying, growth, and better prices for customers.

In the long run, it should be placed within a framework measuring traffic, freezing license issuance and prices until demand and growth allowed, evenly, both to rise. Profits and inherent positive value for licenses would be welcomed. Consumers would remain protected stakeholders, but not more.

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A Quantile Regression Analysis of Growth and Convergence in the EU: Potential Implications for Portugal

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abstract

This paper applies a quantile regression approach to examine the growth and convergence process of fourteen EU member states over the period 1986-2009. From the results of the estimation of an accounting growth regression we conclude that an increase in the weight of the non-tradables sector and a loss of (price) competitiveness are especially harmful for growth for under-performing countries, while these benefit the most from physical capital accumulation and are less negatively affected by an increase in government consumption. Additionally, technological convergence is felt less strongly by low-growth member states. The variables retained are robustly related to growth at all quantiles, but the quantitative importance of the respective coefficients differs across quantiles in some cases. Given the changes in growth rhythms that Portugal recorded throughout the period under analysis, we derive some potential implications from these results for a better understanding of the Portuguese growth and convergence process after European integration. Our findings suggest that, given the growth deceleration that the Portuguese economy has been experiencing since the late 1990s, policies to enhance growth should pay more attention to promoting competitiveness and changing the specialization pattern away from the non-tradables sectors, as well as to increasing investment.

JEL Classification: C23; O47; O52

1. Introduction

In 1986, Portugal (and Spain) joined the European Economic Community (EEC) that later became the European Union (EU). During the 25 years that ensued, European integration proceeded at a fast pace with the signature of the Single European Act in 1986 and the Treaty of the European Union in 1992, the single market was established in 1993, and the euro was introduced in 11 countries in 1999, Portugal included. Accession by Portugal to the EU was accompanied by a growth acceleration of the Portuguese economy relative to the previous decade, 1974-1985. Over this period, following political and economic turmoil, the Portuguese economy became almost stagnant, undergoing two IMF interventions in 1978-79 and 1983-85. From 1986 to 1998, the Portuguese economy enjoyed a phase of sustained economic growth in which real convergence with the core European economies took place. This convergence process was accompanied by the implementation of better macroeconomic policies (associated with the process of nominal convergence on the way to the euro in the 1990s), structural reforms, especially in the financial, labour and product markets, but also investments in physical and human capital, and technology enhancing factors (e.g. Barros and Garoupa, 1996; Duarte and Simões, 2002; Vamvakidis, 2002; Lains, 2003; Freitas, 2006; Mateus, 2006; Santos Pereira and Lains, 2010). Yet this expansionary phase did not last, and since 1999 Portugal has been experiencing a stagnation/divergence period highlighting the need for further structural reforms to recover the ground lost during the last almost 15 years (see Alexandre *et al.*, 2014).

This paper applies quantile regression analysis to estimate an empirical growth model for a sample of fourteen EU member states over the period 1986-2009 in order to get a better understanding of the changes in the Portuguese convergence process and in its growth rhythm. Our main aim is to identify the relevant growth determinants for Portugal, as a member of the EU, adding to the literature by applying an estimation methodology we believe more suitable for the period and countries under analysis, the quantile regression technique. This estimation approach allows for the identification of different impacts of the explanatory variables across the growth rate distribution. Given the changes in growth rhythms registered over the period under analysis in the EU, and particularly in Portugal, this seems a suitable approach. According to Mello and Perelli (2003), quantile regression is a suitable estimation methodology in a growth context as it allows to capture countries' heterogeneity and assess how policy variables affect countries according to their position on the conditional growth distribution. In fact, the quantile regression estimator gives, potentially, one solution to each quantile. In terms of policy implications, as suggested by Barreto and Hughes (2004), it may the case that, due to the presence of other (un-modelled) factors countries grow slower (or faster) relative to the conditions suggested by the variables that are included in the model. This happens because the factors that are not included in the estimated model create an unfavourable (more favourable) environment for the impact of the included growth determinants. Quantile regression analysis allows us to identify those growth determinants that do not have the expected notable effect on growth and hence determine the policy implications specifically for under-performing versus over achieving countries in terms of output growth. We also depart from the previous literature on growth and convergence in the EU by focusing on a more recent period (1986-2009) that is usually missing from older analysis or is included in a longer time frame in more recent studies (e.g. Soukiazis and Castro, 2005; Castro, 2011).

We first review the recent growth and convergence process of the Portuguese economy focusing on the period 1986-2009, the 25 years since Portugal joined the EEC, now EU, and comparing it with the average EU14 economy[1]. We start by presenting some descriptive data on convergence

1 Together with Portugal this group, composed of the member countries in the European Union prior to the accession of the ten candidate countries on 1 May 2004, is usually known as EU15. The EU15 includes the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom. The EU14 includes all the previous countries except Luxembourg.

and growth for Portugal relative to the aggregate of reference, the EU14. This comparison highlights the two different phases in terms of growth and convergence that Portugal experienced after European integration. We next apply quantile regression analysis to estimate an empirical growth model for the EU14 sample. The empirical model includes the factors driving convergence and growth highlighted by the theoretical predictions and empirical evidence developed in the economic growth literature over recent decades (e.g. Doppelhofer, Miller, and Sala-i-Martin, 2004; Durlauf, Johnson, and Temple, 2005; Sala-i-Martin, 1997). Finally, we derive some potential implications of our results for a better understanding of the Portuguese growth and convergence process after European integration.

The results from the estimation of our preferred models indicate that slow growers are negatively affected in a quantitatively more important way by a loss in price competitiveness and an increase in the share of the non-tradables sector, while fast-growing countries suffer more from an increase in government consumption. As for expected positive growth effects, these are confirmed for physical capital accumulation and are higher for under-performing countries. Finally, technological catch-up/convergence seems to be a generalized phenomenon across the conditional growth distribution, as long as countries possess the necessary absorptive capacity in the form of educational human capital. However, for the first of our two preferred models there is an indication that this effect is weaker for under-performing economies. On a normative level and as far as the Portuguese economy is concerned, given its uneven growth performance in the recent past and in particular the growth slowdown it has been experiencing since the turn of the century, our results suggest that more attention should be paid to policies aimed at restoring competitiveness and changing the specialization pattern, as well as increasing investment.

The remainder of this paper is organized as follows. Section 2 describes the developments in terms of output and productivity indicators for Portugal over the last 25 years relative to the EU14 and the USA. Section 3 attempts to assess which factors are the most relevant to explain the growth performance of the fourteen EU member states over the period 1986-2009 by estimating an appropriate growth regression specification using quantile regression techniques. Some potential implications of the results obtained for the specific case of Portugal are next derived. Finally, Section 4 offers some conclusions.

2. The different phases of Portuguese growth and convergence following EU accession

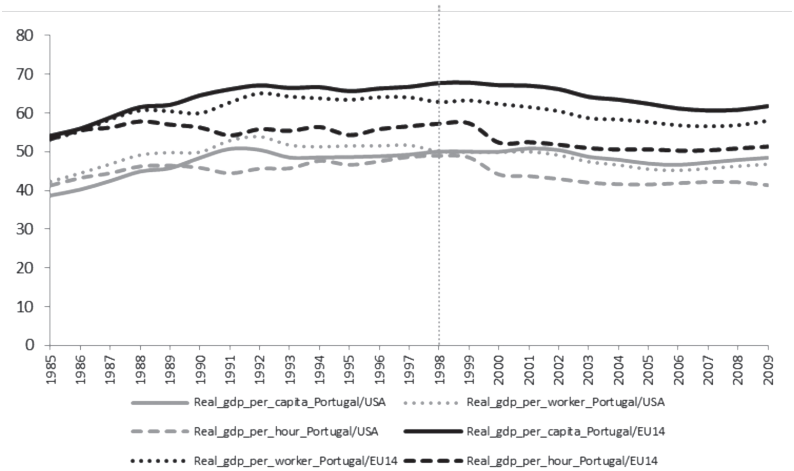
In an initial approach to the growth and convergence performance of the Portuguese economy after EU accession, Figure 1 shows the variation over time of real GDP *per capita*, per worker and per hour worked relative to either the aggregate of reference, the EU14 (black lines), or the USA (grey lines), the usual benchmark in terms of productivity and technological development comparisons, from 1985 until 2009. All variables are measured in purchasing power parities. The figure suggests that the period we are analysing can be broken down into two sub-periods according to the behaviour of Portuguese per capita income. As can be seen, Portugal joined the EC in 1986 with a low relative real GDP per capita standing at a little less than 55% of the EU14 average. From 1986 up until 1992 the situation improved with Portugal standing at 65% of the EU average in 1992. The 1992-93 crisis brought progress to a temporary halt, but in 1998-99 relative real GDP per capita was 66%. From 1999 onwards, however, Portugal embarked in a period of stagnation during which its GDP per capita remained largely unchanged relative to the EU average, and in 2009 it stood only at 62%.

As far as productivity growth and convergence is concerned, a driving force of output growth and convergence (e.g. Hall and Jones (1999); Jones (2002); Jones and Fernald (2014)), Figure 1 presents the evolution of two measures of labour productivity relative to the EU14 and the USA, real GDP per worker and real GDP per hour worked. In both cases it is evident the low relative productivity levels of the Portuguese economy, and the almost absence of convergence over the period under analysis. Relative real GDP per worker increased from 52.2% in 1985 to 58.7% in 2009, reaching a maximum of 63.2% in 1992 but decreasing in almost every year from then

onwards. Relative real GDP per hour worked stood at 52.8% in 1985 and decreased to 51.5% in 2009, reaching a maximum of 57.2% in 1988.

The trends relative to the USA in terms of the three macroeconomic performance measures under analysis are practically the same as those registered relative to the EU14. At the end of the period under analysis Portugal was still 38 percentage points below the EU14 average, and 52 points below the United States in terms of real GDP *per capita*, and even further away in terms of labour productivity.

Figure 1: Relative Real GDP per capita, Per Worker and Per Hour Worked (EU14 or USA =100) 1985 -2009



Source: Authors' computations based on data from the PWT 7.0

Table 1 contains information on real GDP *per capita*, per worker, per hour worked, and Total Factor Productivity (TFP) annual average growth rates for the period 1986-2009, detailing the previous information from Figure 1. For the whole period, Portugal grew faster than the EU14 average and the USA in terms of all the measures considered, except for real GDP per hour worked. However, the Portuguese growth and convergence process in terms of real GDP *per capita* after EU membership was not uniform. In fact it can be divided into two periods: 1986-1998, a convergence period during which growth in the Portuguese economy accelerated and Portugal grew faster than the EU14 average (and the USA), 3.87% and 2.21%, respectively; and a stagnation/divergence period from 1999 onwards when its growth rate slowed down to figures lower than the reference group average, 0.17% and 1.15 %, respectively. The differences across the two sub-periods are even more striking in terms of the labour productivity and TFP measures.

Although the real GDP measures and TFP growth rates declined from one period to the next in Portugal, the EU14 and the USA (except real GDP per hour worked in this case), the change in growth rhythms in Portugal additionally reversed the positive growth differential with the EU14 and the United States it had registered before 1999. The TFP (and real GDP per hour worked) growth gap between the United States and the EU14 in the second period was also considerable. This comparison highlights the well-known dichotomy between the productivity performance of the US economy and that of the EU before and after 1999. Before 1999 US TFP and real GDP per hour worked were growing less than in the EU but the situation reversed in the following decade. As a result, the EU almost ceased to converge with the United States in terms of

productivity levels (see Figure 2). Portugal's case is even more striking than that of the EU14 since productivity fell dramatically after 1999, even registering negative growth values in the cases of real GDP per worker and TFP.

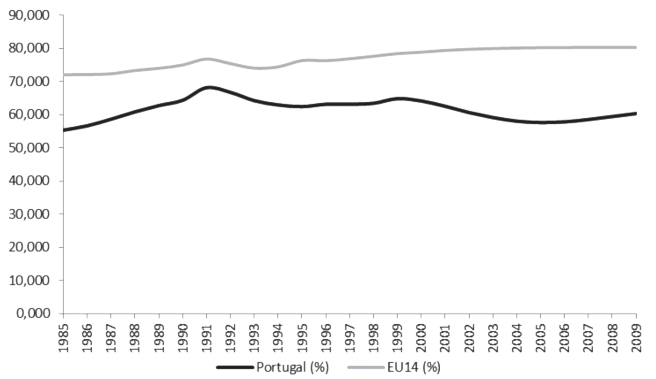
Table 1: Real GDP per capita, Per Worker and Per Hour Worked and TFP Average Growth Rates (%) 1986-2009

	Real GDP *per capita*			Real GDP per worker			Real GDP per hour worked			TFP		
	1986-98	1999-09	1986-09	1986-98	1999-09	1986-09	1986-98	1999-09	1986-09	1986-98	1999-09	1986-09
Portugal	3.87	0.17	2.26	2.95	-0.22	1.59	2.48	0.06	1.41	1.93	-0.20	0.98
EU14	2.21	1.15	1.81	1.84	0.69	1.37	2.22	1.22	1.76	1.13	0.12	0.68
USA	2.05	0.49	1.45	1.96	0.43	1.37	1.45	1.66	1.60	1.06	0.60	0.91

Note: TFP growth rates are relative to the EU15.
Source: Authors' computations based on data from the PWT 7.0 and AMECO.

Figure 2 contains TFP levels relative to the USA, the world technological leader, over the period 1985-2009, for Portugal and the EU14. In 1985, Portugal was almost 45 percentage points less productive than the USA, while the EU14 registered a relative TFP of around 72%. The situation in Portugal improved at a fast pace until 1992, when it reached a value of almost 67%. Since then however the situation deteriorated, and in 2010 relative TFP stood at 61.2%. The EU14 increased its situation only slightly over the whole period, standing still almost 20 percentage points below the USA in 2009. The potential for technological catch-up both for Portugal but also for the average EU14 country therefore does seem to exist.

Figure 2: TFP Relative to the USA (%) 1985-2009



Note: EU14 does not include Germany.
Source: Authors' computations based on data from the World Productivity Database, UNIDO

In summary, average growth in Portugal slowed down considerably in the second sub-period under analysis so that the expansionary phase enjoyed in the first years following EU accession seems to have made further reforms less pressing and thus productivity remained weak. There are a number of potential important factors that may explain the slowdown in

output and productivity. First, factor accumulation might not have been adequate concentrating on less productive investments (infrastructures; residential investment) and the educational attainment levels of the labour force might not have registered the necessary upgrade. Second, the dimensions shaping the dynamics of technology did not show the necessary improvements. Third, and directly related to the availability of low skilled workers, there might have been an excessive specialization towards relatively unskilled labour-intensive activities. This might also have prompted firms to use less advanced technologies. Finally, the regime of macroeconomic stability achieved in preparation to joining the European Monetary Union (EMU) was put into question by the lack of fiscal consolidation in the years following EMU membership. In the next section we take into account some of these issues when we estimate a growth accounting regression for the sample of fourteen EU member states with some potentially important growth and convergence determinants selected according to the relevant literature. Based on our findings for the whole sample we then derive some potential implications for the specific case of Portugal.

3. Empirical model, methodology and results

We replicate here estimations of empirical growth models that have been carried out in a large number of empirical growth studies in order to better identify the relevant growth determinants for our sample of fourteen EU member states taking into account parameter heterogeneity. We accomplish this by applying a quantile regression approach. The factors driving growth and convergence included in our empirical model are those highlighted by the theoretical and empirical literature on growth and convergence that developed over recent decades (e.g. Doppelhofer, Miller, and Sala-i-Martin, 2004; Durlauf, Johnson, and Temple, 2005; Sala-i-Martin, 1997; Barreto and Hughes, 2004; Crespo-Cuaresma, Foster, and Stehrer, 2011). Our ultimate goal is to derive potential implications of the results obtained for a better understanding of the growth and convergence process of Portugal as a member of the EU.

3.1. Growth accounting regression specification

We estimate what is known in the literature as a growth accounting regression (e.g. Benhabib and Spiegel (1994)) that encompasses the neoclassical, technological diffusion, and endogenous growth models explanations. As Crespo-Cuaresma, Foster, and Stehrer (2011) point out this implies that it is not possible to establish a single clear link between the selected variables and a unique growth theory since the same variable can have an important role in different growth theories[2].

The estimated growth accounting regression is given by equation (1):

$$\Delta ly_{it} = \beta_0 + \beta_1 \left(hcap_{it} \times dist.frontier_{it} \right) + \beta_2 inov_{it} + X'_{it} \beta_x + \varepsilon_{it} \qquad (1)$$

where the real GDP per capita annual growth rate (Δly_{it}) depends on technological catch-up/convergence (*dist.frontier*) that is facilitated by human capital (*hcap*), taken as the main determinant of absorption capacity; the activity of the R&D/innovation sector (*inov*); and a vector *X* that includes a set of control variables found to be relevant growth determinants in previous theoretical and empirical growth models through factor accumulation and productivity/efficiency gains; α_0 is the constant term and ε the error term.

2 For example, exogenous growth models emphasize the importance of human capital for growth through factor accumulation to be used in final goods production (see Mankiw, Romer, and Weil, 1992), while more recent endogenous growth models emphasize its importance for productivity growth (Lucas, 1988; Romer, 1990b; Nelson and Phelps, 1966).

The choice of the explanatory variables was determined by theoretical predictions and previous empirical evidence, the convenience of a parsimonious specification and the availability of annual data for the EU14 countries, a necessary condition for the estimation with quantile regression techniques (see Table 2). The expectations concerning growth and real convergence of the Portuguese economy after EU membership are supported by exogenous and technological diffusion growth models predictions (e.g. Solow, 1956; Mankiw, Romer, and Weil, 1992; Nelson and Phelps, 1966; Barro and Sala-i-Martin, 1997). According to exogenous growth models, poorer countries grow faster than initially richer countries through faster factor accumulation since marginal productivities are higher in the former. However, catch-up only occurs if the countries possess the same structural characteristics. In technology diffusion models, real convergence occurs through technological catch-up of the followers, where imitation is less costly than innovation. This assumption implies that the growth rate of technology will be higher in the countries further away from the technological frontier, as long as they show adequate absorptive capacity, namely in what concerns educational attainment. An economy must possess a certain number of characteristics, known as social or absorptive capacity, in order to catch-up to the richer/leader countries and fully exploit the advantages of its technological backwardness (e.g. Nelson and Phelps, 1966; Abramovitz, 1986) and to be able to innovate. The convergence and growth benefits from the absorption of technology from abroad are bound to be exhausted as countries close the technological gap and so the focus must be on growth through innovation, as predicted by endogenous growth models (e.g. Romer, 1990a; Romer, 1994; Jones, 1995; Jones, 2005).

Particular attention will be paid to absorptive capacity, in the form of the skill level of the workforce, and innovation efforts. The estimation of a growth accounting regression allows us to identify the innovation and technological diffusion growth effects in the EU sample of countries. This methodological strategy seems adequate for a sample of developed countries that nonetheless exhibit differences in their productivity paths, pointing to different intensities of innovation and imitation activities among EU countries. We consider the USA as the technological leader in order to emphasize the technological convergence mechanism for the sample. Additionally, the increase in international trade and the specialization pattern associated with the integration process, as well as macroeconomic stability achieved mainly in preparation for the euro, might also help to explain the output dynamics of the Portuguese economy relative to its European counterparts (e.g. Kormendi and Meguire, 1985; Frankel and Romer, 1999; Bassanini and Hemmings, 2001; Bassanini and Scarpetta, 2001; Alcalá and Ciccone, 2004). The concerns with the relationship between the size of government and economic growth will also be addressed (e.g. Barro, 1990; Karras, 1997).

Recent studies on growth and convergence in the EU include, for instance, Soukiazis and Castro (2005) and Castro (2011). The main concern of these studies is to assess whether the rules associated with EMU membership undermined economic growth in Europe, in particular the Maastricht criteria budgetary rules and those associated with the Stability and Growth Pact. They conclude however that it is not possible to detect any significant influence of the change occurred in policy settings on growth, namely a negative one as predicted by some authors (e.g. Thirlwall, 2000; Hein and Truger, 2005). In this particular study we depart from these earlier studies by adopting a growth accounting specification and considering a larger number of potential explanatory variables, although we use some common regressors such as initial output, investment in physical capital, human capital, trade openness, inflation, or government consumption. In any case, within the framework we consider not all are found to be relevant growth determinants. Our time coverage and estimation methodology also differ from the ones considered in these previous studies.

Table 2: Proxies Used for Growth and Convergence Determinants in the Estimations

Determinant	Proxy	Source
Convergence (*dist.front*)	Total factor productivity ratio of the follower relative to the leader, the USA (both in index numbers).	World Productivity Database AMECO
Absorption capacity (*hcap*)	Average years of secondary schooling of the population aged 25 and over; Average years of total schooling of the population aged 25 and over.	Barro and Lee (2010)
Innovation (*inov*)	Total R&D spending (% GDP);	OECD
	Scientific journals articles (number per thousand people);	World Bank
	Patents (number per thousand people);	OECD
	Average years of tertiary schooling of the population aged 25 and over.	Barro and Lee (2010)
Control variables:	Investment share (% GDP);	PWT 7.0
(*X*)**:**	Non-tradables sector share (% GDP)	OECD
- factor accumulation;	Openness ratio;	PWT 7.0
- structural change;	Real exchange rate;	PWT 7.0
- macroeconomic stability	Public Consumption (% GDP);	PWT 7.0
	Public debt (% GDP);	Eurostat
	Public expenditures (% GDP);	Eurostat
	Tax burden (% GDP).	Eurostat

3.2. Empirical Methodology

We use a quantile regression approach, originally proposed by Koenker and Bassett (1978), in order to assess the influence of growth covariates on economic growth, conditioned by the location of the dependent variable at different parts of its distribution. Applying this methodology to growth regressions has several advantages. We can test for differentiated effects of the covariates at different parts of the growth rate distribution that otherwise would be collapsed on the mean estimates obtained through, for example, OLS estimators. Galton's fallacy (see Friedman, 1992), a major critique to the technique of regression to the mean, and consequently to standard convergence equations estimations, can also be addressed through the quantile regression methodology. Furthermore, it allows for deeper investigation of the reasons for different patterns of growth and convergence (divergence) experienced by EU economies over the period 1986-2009. Traditional econometric methods such as OLS are based on mean estimates of the parameters ignoring the distribution characteristics of the variable representing the phenomena under analysis. They thus give a synthetic picture of the effects of covariates that might be very misleading. The quantile regression approach proposed by Roger Koenker (see Koenker and Bassett, 1978; Koenker and Hallock, 2001; Koenker, 2005) tries to overcome this problem by estimating the effects of covariates over the whole distribution of the variable to be explained. Quantile regression methods allow heterogeneous marginal effects of the covariates on the conditional outcome distribution. They thus provide one method of capturing parameter heterogeneity across countries by allowing for the presence of heterogeneous effects across different quantiles of the conditional growth distribution.

Denoting the vector of *k* regressors in equation (1) by *Z*, the quantile regression model can be written as:

$$\Delta ly_{it} = Z'_{it}\beta_{\tau} + \varepsilon_{\tau it} \tag{2}$$

where Z_{it} is a $k\times 1$ vector containing the independent variables, β_{τ} is an unknown $k\times 1$ parameter vector associated with the τth quantile and $\varepsilon_{\tau it}$ is an unknown error term. It is assumed that $\varepsilon_{\tau it}$ satisfies the constraint $Quant_{\tau}(\varepsilon_{\tau it} \mid Z_{it})=0$, such that the errors have zero conditional mean, though no other distributional assumptions are required. The coefficient for a regressor *k*, $\beta_{\tau k}$, can be interpreted as the marginal change in the τth conditional quantile of Δly_{it} due to a marginal change in *k*.

The τth quantile regression, $0<\tau<1$, solves the following minimization problem:

$$\min_{\beta_{\tau}} \frac{1}{n}\left(\sum_{it:\Delta ly_{it} \geq Z'_{it}\beta_{\tau}} \tau\left|\Delta ly_{it} - Z'_{it}\beta_{\tau}\right| + \sum_{it:\Delta ly_{it} < Z'_{it}\beta_{\tau}} (1-\tau)\left|\Delta ly_{it} - Z'_{it}\beta_{\tau}\right| \right) \tag{3}$$

Quantile regression thus allows us to trace the entire distribution of the growth rate of real output per capita, conditional on the regressors included. In our study of growth dynamics, the influence of the different growth determinants is thus investigated by running a set of τ quantile regressions. In other words, we estimate τ growth accounting regressions, each of which measures the influence of each explanatory variable at a different quantile of the growth distribution.

The growth empirics literature has benefitted from the quantile regression methodology for several reasons: its estimators are robust to outliers in terms of growth and it gives information on the (degree of) importance of policy and state variables according to the conditional growth distribution. In terms of policy implications, as suggested by Barreto and Hughes (2004), it may be the case that, due to the presence of other (un-modelled) factors countries grow slower (or faster) relative to the conditions suggested by the variables that are included in the model. This happens because the factors that are not included in the estimated model create an unfavourable (more favourable) environment for the impact of traditional growth determinants. Quantile regression analysis allows us to identify those growth determinants that do not have the expected notable effect on growth and hence determine the policy implications specifically for under-performing versus over achieving countries, in terms of output growth. Additionally, these estimators are robust to the presence of outliers as far as the dependent variable is concerned, a characteristic of output growth rates across countries. In fact, Mello and Perelli (2003) point out that the distribution of average GDP growth rates is skewed to the right. This literature has by now many contributions, some of the most representative are (see Table 3): Mello and Novo, 2002; Mello and Perelli, 2003; Barreto and Hughes, 2004, Canarella and Pollard, 2004, Miles, 2004, Osborne, 2006, Laurini, 2007, Foster, 2008, Dufrénot, Mignon, and Tsangarides, 2010, and Crespo-Cuaresma, Foster, and Stehrer, 2011). A general conclusion from Table 3 is that the results concerning the influence of many growth determinants vary across quantiles and, even when a variable is found to be robust across quantiles, the estimated impact on growth of that variable is often found to differ (quantitatively) across the quantiles. This applies irrespective of the number and type of countries considered, time period of the analysis, and the set of growth determinants included.

We use in this paper a variant of Koenker's method proposed by Canay (2011), which proved that when fixed effects are location shift variables, influencing all quantiles in the same way, a two-step estimator is consistent and asymptotically normal when the number of individuals and time periods goes to infinity. As a first step, the fixed effects are obtained in accordance with the model to be estimated. As they are constant across the distribution of the variable to be explained, we can simply retain the parameters obtained in the estimation of its conditional mean. The difference to the mean of these coefficients' values is subtracted to the dependent variable and we are thus able to apply the quantile regression methodology to our model with only one intercept[3].

3 We use Koenker (2012b). See also Koenker (2012a).

Table 3: Summary of Selected Empirical Growth Studies Applying Quantile Regression Analysis

Authors	Sample	Methodology	Dependent Variable	Explanatory variables	Main results
Mello and Novo (2002)	98 countries in the Barro-Lee data set. 1960-1985.	Quantile regression.	Growth rate of real GDP per capita.	Initial income. Investment share. Human capital. Population growth. Real government consumption. Number of revolutions and coups. Number of assassinations.	Only the top 35% quantiles exhibit a negative relationship between growth and initial income. Changes in human capital have a stronger impact on the GDP growth rate for fast-growing countries than for slow-growing countries.
Mello and Perrelli (2003)	100 countries. 1960-1985	Quantile regression.	Growth rate of real GDP per capita.	Initial GDP per capita. Proxies for human capital. Ratio of real government consumption expenditure to real GDP. Proxies for political instability. Measure of market distortions. Average share of investment to real GDP. Average growth rate of the total population.	Concavity pattern of the regression quantile process on the initial income coefficient. The quantile processes for the secondary school enrolment, proxies for political instability, and market distortions are relatively stable around the OLS estimate. The quantile regression process for the investment variable is positive for all the quantiles but it decreases from τ = 30% to τ = 70%, and then it increases again. The quantile regression for the coefficient on population growth increases non-linearly across the quantiles.
Barreto and Hughes (2004)	119 countries. 1960-1990	Quantile and OLS regression of 7770 different models to select the robust growth determinants.	Growth rate of real GDP per capita.	50 different variables from Levine and Renelt (1992) and Barro and Lee (1994).	For over achieving countries, the determinants of growth are trade, social infrastructure, government expenditure share, investment share and investment prices as well as a few demographic variables. For under-performing countries, the most significant determinants of growth are latitude, social infrastructure, civil liberties and liquid liabilities.
Canarella and Pollard (2004)	86 countries. 1960-2000	Quantile regression applied to the MRW model.	Growth rate of real GDP per person of working age.	Initial income. Investment share. Average fraction of working age population in secondary school. Rate of growth of the working age population. Regional dummies.	Convergence does not apply to countries in the lower quantiles. Countries whose growth rates are in the higher quantiles respond differently to investment in human and physical capital than do countries whose growth rates are in the lower quantiles.
Miles (2004)	77 countries. 1970-1998	Quantile regression.	Growth rate of real GDP per capita.	Initial real GDP per capita. Average years of secondary schooling. Interaction term between human capital and initial per capita GDP. Investment share. Population growth. Regional dummies.	Human capital has a larger marginal benefit for countries that have experienced fast growth, but little significant impact on slow growing nations. Varying size and statistical significance of coefficients for the other explanatory variables.

Table 3: Summary of Selected Empirical Growth Studies Applying Quantile Regression Analysis (cont.)

Authors	Sample	Methodology	Dependent Variable	Explanatory variables	Main results
Osborne (2006)	Barro-Lee dataset. 1960-1995	Quantile regression applied to the level of output not the growth rate.	Real GDP per capita.	Real non-residential capital per worker. Country's population's average schooling. Average annual rate of inflation. Government consumption less education and defense spending as a percentage of GDP. Political instability. Measure of democracy. Black market premium. Export to import relative prices. Openness of the economy. Proxy for financial sophistication. Measure of inequality.	Physical and human capital have a positive impact across quantiles but the dimension of the effect of human capital is higher for higher quantiles. The significance of the other variables differs across quantiles. For the statistically significant variables, the differences in the magnitude of the estimated coefficients is most compelling with respect to education, openness, and financial development.
Laurini (2007)	Brazilian municipalities. 1970-1996	Nonparametric quantile smoothing splines.	Per capita income growth.	Initial income per capita.	Convergent lower and higher incomes and divergent intermediary incomes.
Foster (2008)	75 trade liberalising countries. 1960-2003	Quantile regression.	Real per capita GDP growth.	Initial GDP per capita. Investment share. Average years of secondary schooling in the population over 15. Population growth. Dummy variable capturing trade liberalisation episode.	Countries experiencing the lowest rates of per capita GDP growth benefited the most from trade liberalisation. The coefficient estimates for investment tend to be fairly similar across the quantiles. For population growth the coefficient is positive at low quantiles, but tends to become negative and significant at higher quantiles.
Dufrénot, Mignon, and Tsangarides (2010)	75 developing countries. 1980-2006	Quantile regression.	Real per capita GDP growth.	Initial GDP per capita. Indicator of trade openness. Investment share. Population growth. Government's balance as share of GDP. Terms of trade growth. Inflation rate.	Openness has a higher impact on growth among low-growth countries relative to high-growth countries, with significantly larger short-run and long-run effects.
Crespo-Cuaresma, Foster, and Stehrer (2011)	255 NUTS2 European regions 1995-2005	Quantile regression with Bayesian Model Averaging (BMA)	Growth rate of real GDP per capita.	35 potential determinants of growth (e.g. initial GDP per capita; skill endowment; GFCF; infrastructures; geography; technology)	The set of robust variables differs across quantiles. The size of the parameters on a specific set of variables varies across quantiles.

3.3. Results

Our empirical strategy consisted in first regressing two groups of equations of type (1) depending on the interaction term representing the absorption capacity of the follower country: either average years of secondary schooling of the population aged 25 and over (*lhcs*) or average years of total schooling of the population aged 25 and over (*lhct*). Additionally, we estimated equation (1) considering different proxies for innovation and different control variables. All the proxies for innovation (see Table 2) revealed not to be statistically significant or the signs were not the right ones according to theoretical predictions. Also, the results did not show any improvement when we included different control variables. The tax burden was not statistically significant or it presented a positive sign that might reflect a pro-cyclical budget policy. The same applies to the openness ratio, but in this case the sign was negative. On the contrary, the real exchange rate was always significant with the predicted theoretical sign, negative[4].

We ended up with a small number of growth equations (A1 and A2) all of them without the innovation component. In these two models the convergence coefficient (interacted with *lhcs* or *lhct*) was always statistically significant with the expected sign, negative, and robust to the consideration of different sets of explanatory variables. The control variables that proved to be statistically significant are: public consumption (% GDP), *lkg*; the investment share (% GDP), *lki*; the real exchange rate, *lp*; and the non-tradables sector share (% GDP), *lnt*. Public consumption always presented a negative estimated coefficient.

Our two preferred growth regressions thus result from the estimation of models of type A1 and A2. In both cases we consider as the proxy for absorptive capacity to interact with technological catch up, *lhcs*. This result is in accordance with previous studies that find that to fully exploit the growth benefits from technological backwardness countries need a sufficient level of education at the secondary level (e.g. Simões (2009)). Model A1 includes as control variables (all in logs): public consumption (*lkg*), the investment share (*lki*), and the real exchange rate (*lp*). Model A2 includes one more regressor from the control variables set: the non-tradables sector share, *lnt*. Table 4 contains some descriptive statistics for these variables, for the whole sample and for Portugal alone.

Table 4: Summary Statistics for the Variables Included in Models A1 and A2

	EU14				Portugal			
	Min.	Average	Max.	Coef. Var.	Min.	Average	Max.	Coef.Var.
Δly (%)	-10.8	1.9	9.4	1.377	-3.7	2.5	8.4	1.123
hcs (years)	1.486	3.525	8.263	0.296	1.486	1.941	2.445	0.147
tfpr (index)	71.18	99.08	111.5	0.054	91.26	97.97	103	0.039
kg (% GDP)	5.67	9.99	17.27	0.239	5.67	5.93	6.36	0.028
ki (% GDP)	13.81	21.59	32.47	0.166	19.22	27.26	32.47	0.11
p (index)	52.63	101.7	155.8	0.199	52.63	78.04	99.8	0.165
nt (% GDP)	40.58	50.89	65.07	0.081	47.94	53.66	58.02	0.063

Notes: *Δly* - real GDP per capita annual growth rate; *tfpr* - distance to frontier; *hcs* - average years of secondary schooling; *kg* - public consumption share; *ki* - investment share; *p* - real exchange rate; *nt* - non-tradables sector share.

In what follows, we interpret the main results derived from models A1 and A2 through the inspection of the tables of results and the plots of the covariates estimates for different quantiles of the distribution of the dependent variable, the growth rate of real GDP *per capita*. In Tables 5 and 6 OLS results are displayed first. Subsequently, Tables 5 and 6 report the estimated vector β_τ

4 We also tested for the influence of some financial proxies, such as the interest rate banking spread, but the results were never statistically significant.

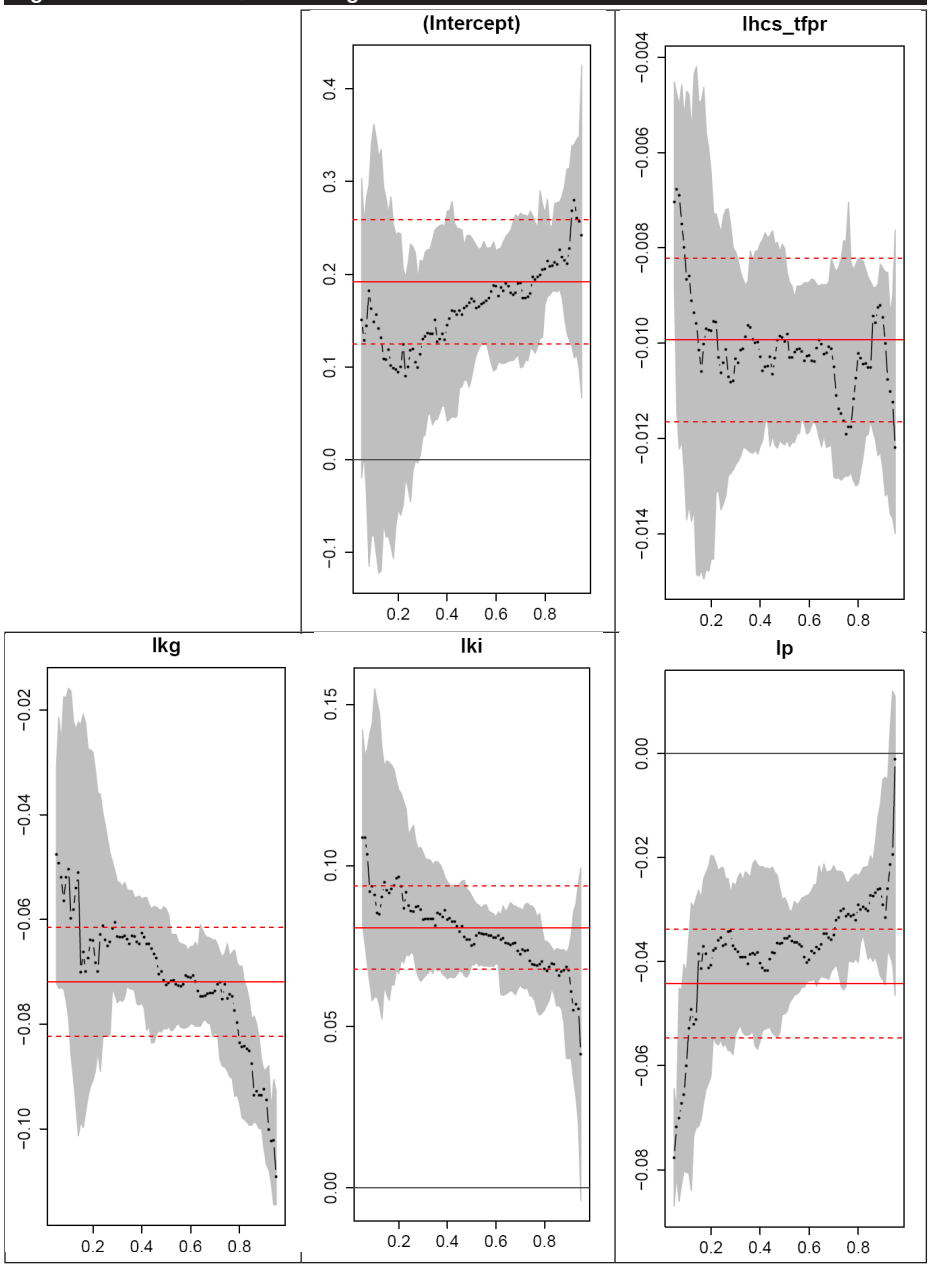
corresponding to the 10th, 25th, 50th, 75th and 90th quantiles of the conditional growth distribution for the preferred specifications of the estimated A1 and A2 models, respectively.

Table 5: Quantile Regression Estimates - Model A1

	Mean regression (OLS)	Quantiles				
		τ=0.1	τ=0.25	τ=0.5	τ=0.75	τ=0.9
Intercept	0.1918	0.1483	0.1181	0.1734	0.1968	0.2280
	(0.0409)	(0.1160)	(0.055)	(0.0401)	(0.0435)	(0.0700)
lhcs_tfpr	-0.0099	-0.0087	-0.0104	-0.01	-0.0119	-0.0095
	(0.0010)	(0.0025)	(0.0015)	(0.001)	(0.0011)	(0.0016)
lkg	-0.0719	-0.0504	-0.0639	-0.0726	-0.0751	-0.0924
	(0.0063)	(0.0142)	(0.0090)	(0.0058)	(0.0060)	(0.0094)
lki	0.0807	0.0909	0.0859	0.0752	0.0695	0.0676
	(0.0079)	(0.0225)	(0.0110)	(0.008)	(0.0087)	(0.0143)
lp	-0.0442	-0.0600	-0.0369	-0.0355	-0.0312	-0.0290
	(0.0063)	(0.0138)	(0.0084)	(0.0058)	(0.006)	(0.0076)
Adjusted R^2	0.759					

Notes: *Δly* - real GDP per capita annual growth rate; *tfpr* - distance to frontier; *hcs* - average years of secondary schooling; *kg* - public consumption share; *ki* - investment share; *p* - real exchange rate. Variables are in logs. Standard errors in parenthesis.

Figure 3: Plots of the Quantile Regression Results - Model A1



Notes: *Δly* - real GDP per capita annual growth rate; *tfpr* - distance to frontier; *hcs* - average years of secondary schooling; *kg* - public consumption share; *ki* - investment share; *p* - real exchange rate. Variables are in logs.

According to the results presented in Table 5 and Figure 3, the signs of the estimated coefficients of the different regressors considered in model A1 do not change across quantiles. But the results also show that the quantitative importance of the β-coefficients differ across the growth rate distribution. The estimated coefficient of the technological gap interacted with human capital (*lhcs_tfpr*) is always negative as expected, implying that the countries that are further away from the technological frontier (the USA) grow faster, provided they have the necessary absorptive capacity in the form of average years of secondary schooling. However, the magnitude of this effect is not the same across quantiles with the under-performing countries in terms of growth benefitting less from the technological diffusion mechanism, while the other growth quantiles exhibit a technological catch-up coefficient similar to that estimated for the mean (at a 90% confidence interval for the mean coefficient). The regressions referring to the lower quantiles of the conditional growth distribution analyse the technological convergence hypothesis for the low-performing countries in the sample, i.e. for the economies whose growth performance has been more sluggish than it could have been expected based on the conditions suggested by the variables that are included in the model. The results presented in Table 5 and Figure 3 thus indicate that when we focus on the lower quantiles of the distribution, low-performing countries register slower rates of technological convergence than over-performing economies.

As for public consumption, the coefficient is negative for all the growth quantiles, implying that for our sample of fourteen European countries an increase in the size of government will reduce growth. This is in line with the theoretical predictions of Barro (1990), according to whom when a government increases 'utility-enhancing' public consumption while reducing 'production-enhancing' public spending, growth rates fall, and is also in line with the results from a recent study by Acosta-Ormaechea and Morozumi (2013). Additionally, a stronger negative effect is found for over-achieving countries, or equivalently for the economies that experienced the highest growth rates. In this case, the interpretation of this finding is the following. The regressions that refer to the upper quantiles of the conditional growth distribution focus on the countries that have been particularly dynamic in the period, corresponding to those economies whose growth rate has been faster than it could have been expected based on the variables included in the model. From the results presented in Table 5 it is possible to see that the fast-growing economies have been more severely hampered in their growth performance by an increase in government consumption.

The estimated coefficient for the investment share is always positive, confirming the predictions of exogenous growth models that higher physical capital accumulation leads to faster growth (e.g. Solow, 1956; Mankiw, Romer, and Weil, 1992). The values of the estimated coefficient are higher for the under-performing countries. In fact, the results reported in Table 5 and Figure 3 indicate that the coefficient observed in the OLS regression is driven by the observations around or above the median of the conditional growth distribution. For the lower tails (τ = 0.1; 0.25), we find a higher growth influence of the investment rate.

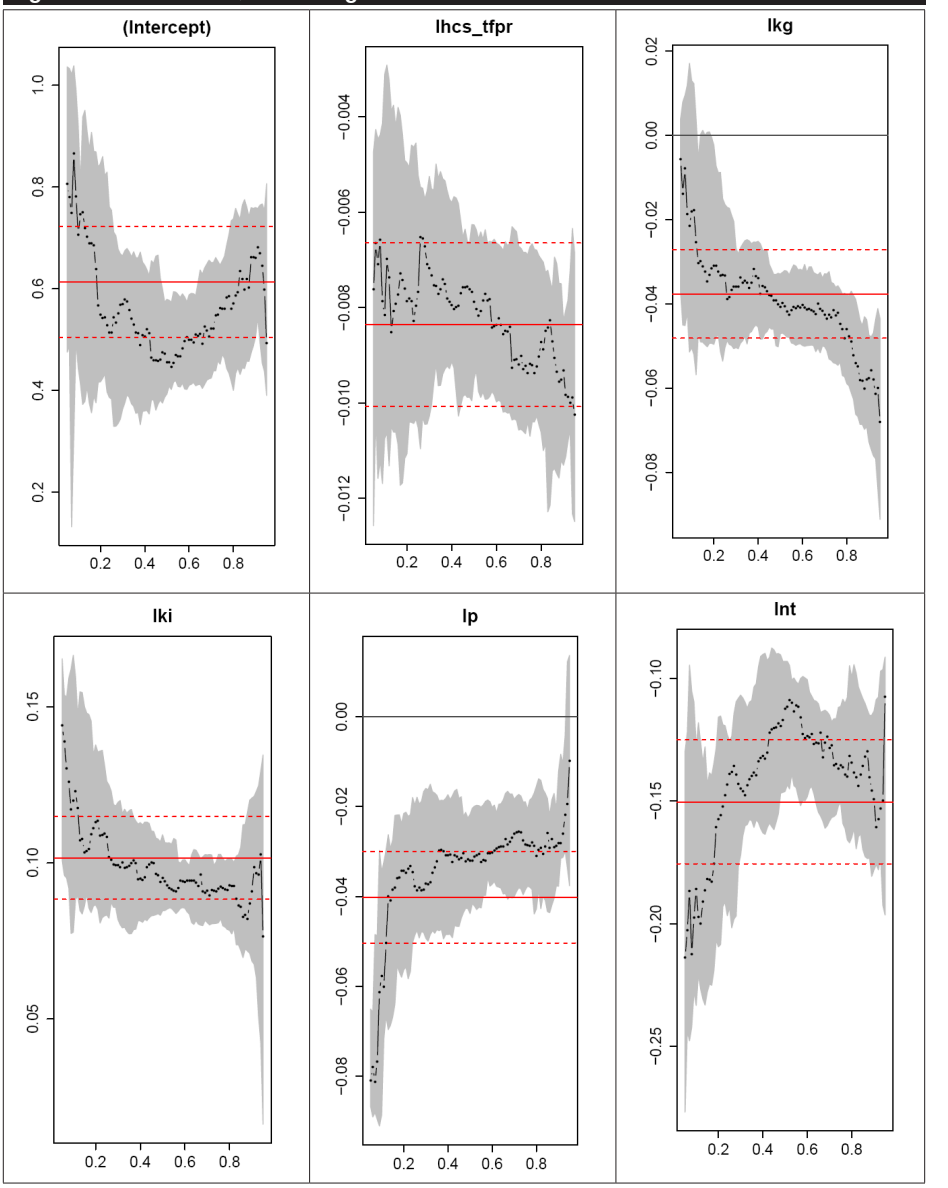
Finally, the estimated coefficient for the real exchange rate is negative as expected confirming the prediction that a decrease in price competitiveness is detrimental for growth. According to Rodrik (2008), an overvaluation of a currency is, among other things, usually associated with large current account deficits and balance of payments crisis, which are both damaging to growth. For the highest growth quantiles we find that the effect of a real exchange rate appreciation is felt less strongly (the estimated coefficient is close to zero) indicating that in these cases (price) competitiveness has a smaller growth influence, while the opposite applies at the left tail of the growth distribution. In the case of the real exchange rate, the coefficient observed in the OLS regression seems thus to be driven by the observations around the median of the conditional growth distribution.

Table 6: Quantile Regression Estimates - Model A2

	Mean regression (OLS)	Quantiles				
		τ=0.1	τ=0.25	τ=0.5	τ=0.75	τ=0.9
Intercept	0.6132	0.7056	0.5135	0.4548	0.5597	0.6597
	(0.0662)	(0.1533)	(0.093)	(0.0654)	(0.069)	(0.0957)
lhcs_tfpr	-0.0084	-0.0082	-0.0077	-0.0079	-0.0092	-0.0093
	(0.0010)	(0.0025)	(0.0015)	(0.0009)	(0.0010)	(0.0013)
lkg	-0.03763	-0.0182	-0.0334	-0.0408	-0.0429	-0.0578
	(0.0064)	(0.0152)	(0.0086)	(0.0058)	(0.0058)	(0.0077)
lki	0.1016	0.1198	0.1083	0.0951	0.0916	0.0907
	(0.0081)	(0.0200)	(0.0117)	(0.0081)	(0.0083)	(0.0122)
lp	-0.0402	-0.0577	-0.0378	-0.0321	-0.0284	-0.0281
	(0.0062)	(0.014)	(0.01)	(0.0061)	(0.0055)	(0.0079)
lnt	-0.1503	-0.186	-0.1390	-0.1124	-0.1355	-0.1493
	(0.0154)	(0.03)	(0.0209)	(0.0146)	(0.0151)	(0.0204)
Adjusted R^2	0.693					

Notes: *Δly* - real GDP per capita annual growth rate; *tfpr* - distance to frontier; *hcs* - average years of secondary schooling; *kg* - public consumption share; *ki* - investment share; *p* - real exchange rate; *nt* - non-tradables sector share. Variables are in logs. Standard errors in parenthesis.

Figure 4: Plots of the Quantile Regression Results - Model A2



Notes: *Δly* - real GDP per capita annual growth rate; *tfpr* - distance to frontier; *hcs* - average years of secondary schooling; *kg* - public consumption share; *ki* - investment share; *p* - real exchange rate; *nt* - non-tradables sector share. Variables are in logs.

Contrary to the previous model, the estimates for model A2 (Table 6 and Figure 4) indicate that the technological convergence coefficients for the different quantiles are not significantly different from the mean coefficient. The absolute value of the estimated coefficient is also smaller when

compared to the value obtained with model A1. As for the remaining coefficients, they exhibit paths and signs that are similar to those obtained with model A1. Finally, the coefficient of the non-tradables sectors share is significant and negative as expected across all quantiles since these sectors are protected from international competition, which makes them less efficient and productive. For instance, a competitive business environment fosters innovation aimed at reducing production costs and creating new products, and in this way enhances economic growth. Comparing the estimated coefficients across quantiles the resulting pattern points to a kind of an inverted-U shape. The coefficient is at its minimum for the median, while for the lower tail ($\tau = 0.1$) we find the highest negative growth influence of the real exchange rate. This variable shows again a strong negative influence upon the economies that are the best performers in terms of economic growth, although not as detrimental as the one for the under-performers.

In summary, we found evidence of parameter heterogeneity across quantiles in the sense that the size of the parameters on the set of variables found to be robust across quantiles with the expected sign, the interaction term between technological catch-up and absorptive capacity, investment, government consumption, the real exchange rate, and the share of the non-tradables sector, varies across quantiles. These results lead to different policy implications for over achieving versus under-performing countries, which is the case of Portugal since the turn of the century.

3.4. Potential implications for the Portuguese economy

As we have seen, the growth path of the Portuguese economy has not been uniform after EC accession, experiencing high growth rates between 1986 and 1998, but from 1999 onwards registering sluggish growth, that has deteriorated further with the financial and the global economic crisis. According to the growth regressions results, it is possible to argue that the high growth rates recorded by the economies located at the top of the growth distribution (as was the case of the Portuguese economy over the period 1986-1998) enabled by other factors not accounted for by the empirical model facilitated the development in the Portuguese economy of the non-tradables sector[5]. Although its influence is found to be detrimental to economic growth it is not felt as strongly in the higher growth quantiles relative to the lower tails of the distribution. At the same time, the lack of (price) competitiveness[6], which we also found to be growth detrimental, is again felt less strongly by over achieving countries in terms of output growth. There thus seems to have been a lack of concern by public decision makers with these features of the Portuguese economy throughout the first phase of European integration as the factors that are not included in the estimated model created an environment conducive to high growth relative to the conditions suggested by the variables that are included in the model (see Barreto and Hughes (2004) and Crespo-Cuaresma, Foster, and Stehrer (2011)).

As far as government consumption is concerned, although the negative impact is quantitatively more important at higher quantiles, a high growth context makes it easier for over achieving countries to accommodate an increase in the size of the respective governments without hampering in a sharp way their growth performance. However, if growth slows down, as has been the case for Portugal, the negative growth impact of an increase in government consumption, although lower in under-performing countries, will be more obvious. Thus, these countries will face greater growth difficulties in using stabilization policies to accommodate negative shocks such as the ones emanating from the recent financial and economic crisis. Additionally, the widely accepted/reliable technological convergence mechanism also seems to produce smaller effects during growth slowdowns. Furthermore, Portugal still presents low relative educational attainment levels (see Simões, Andrade, and Duarte, 2014; Carneiro, 2014; Teixeira *et al.*, 2014), a feature that undermines further its ability to benefit from its technological backwardness.

5 This is well documented in Alexandre and Bação, 2014, and Simões, Andrade, and Duarte, 2014.

6 Usually associated with the former specialization pattern and also a result of joining the EMU from the start with the associated real appreciation of the Portuguese Escudo (Bação and Duarte, 2014).

These relationships, combined with other un-modelled factors, created the conditions for the growth slowdown Portugal experienced over the last decade and make it more difficult to recover from stagnation. Given this context and the results found that indicate that the size of the impact of the variables considered vary across quantiles, the immediate policy implications that follow for the Portuguese economy are that more attention should be paid to incentives that allow for a change in the specialization pattern away from the non-tradables sector along with measures that induce a real exchange rate depreciation. Additionally, an increase in investment might also stimulate growth and allow for faster recovery since our results point to a quantitatively more important impact of this growth determinant for under-performing countries.

4. Conclusion

This paper applied a quantile regression approach to examine the growth and convergence process of fourteen EU member states over the period 1986-2009. The empirical growth models retained allowed us to identify a set of growth determinants with the expected influence, an interaction term between technological catch-up and absorptive capacity, investment, government consumption, the real exchange rate, and the share of the non-tradables sector. The quantitative importance of their influences was also found to vary across the growth rate distribution, confirming the importance of accommodating parameter heterogeneity in the empirical analysis of growth. The main findings can be summarized as follows: technological catch-up (interacted with absorptive capacity), government consumption, the real exchange rate and the share of non-tradables all have a negative growth impact, quantitatively higher for under-performing countries in the last two cases, but lower in the case of technological catch up. Government consumption is especially growth detrimental for over achieving countries. As for investment, it presents the expected positive growth influence, higher for slow growing countries.

We then derived some potential implications of the above described results for understanding the particular situation of the Portuguese economy. Portugal's accession to the EU was accompanied by important achievements in what concerns basic growth determinants performance (see Simões, Andrade, and Duarte, 2014). However, in terms of relative income per capita within the group of most advanced member states, the Portuguese economy is more or less in the same position it was immediately before European integration. After the initial expansionary phase that it enjoyed between 1986 and 1998, stagnation followed and the immediate future continues not to look good. Our findings suggest that the first phase of European integration (corresponding to the period 1986-1998), when Portuguese growth rates were located at the top of the distribution, allowed for the development of the non-tradables sector since although its influence is detrimental to economic growth it is not felt as strongly at the higher quantiles. At the same time, not enough attention seems to have been paid to the lack of (price) competitiveness (usually associated with the former specialization pattern), also found to be detrimental to economic growth, since again it is less important for fast growing economies. Additionally, when countries are growing fast they can accommodate in an easier way an increase in the size of government, even if its negative impact is higher. However, if growth slows down, as was the case for Portugal, they will face greater difficulties in using stabilization policies to accommodate negative shocks. All these relationships can therefore have contributed to the growth slowdown Portugal experienced during the second phase of European integration and make it more difficult to recover from stagnation and restore long-run growth, especially in a markedly adverse setting due to the current crisis. The technological convergence mechanism also seems to produce smaller effects during growth slowdowns, and absorption capacity, proxied by educational attainment, remains relatively low in Portugal. The most pressing policy measures that follow from our results thus involve incentives that allow for a change in the specialization pattern, associated with measures that increase competitiveness and promote investment.

While we have shown that there is evidence of parameter heterogeneity in the growth and convergence process of our fourteen EU member states over the period under analysis, further

research is needed to understand why such parameter heterogeneity exists, namely which un-modelled factors create an environment that is conducive to high or low growth relative to the conditions suggested by the variables we included in the estimated model. Although quantile regressions identify differences between the behaviour of successful vs. less successful countries, they do not address the question of why some have been more successful than others. This question can only be addressed by including more potentially relevant variables in the empirical model. This calls also for the use of more sophisticated statistical methods to identify the set of robust growth determinants.

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Linkages and Performance Comparison among Eastern Europe Stock Markets

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abstract

This article studies the linkages among the stock markets of Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Russia, Serbia, Slovenia and Ukraine. The empirical analysis begins with the estimation of a regional market model, whose beta parameters depend on predetermined information variables. Those parameters support the calculation of time-varying Treynor ratios used on a comparative performance analysis. A Vector Auto Regressive Model (VAR) is used to estimate the performance causality within this group of markets. The VAR model results provide evidence that there is reciprocal performance across the majority of the selected stock markets.

JEL Classification: F36, G15

1. Introduction

The empirical analysis of the present article evaluates the linkages between the Eastern Europe stock markets of Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Russia, Serbia, Slovenia and Ukraine. All the markets belong to former socialist economies, whose stock market activity is relatively recent, and which are classified as emerging markets (Czech Republic, Hungary, Poland, Russia) and frontier markets (Bulgaria, Estonia, Romania, Serbia, Slovenia, and Ukraine), by the Morgan Stanley Capital International (MSCI) classification. The differences between those economies during the period under analysis is an additional challenge to study the linkages between their stock markets. In fact this group includes Estonia and Slovenia, which are both members of the European Union and of the Euro area, Bulgaria, Czech Republic, Hungary, Poland and Romania, which are members of the European Union but not of Euro area, and Russia, Serbia and Ukraine, which are not members of the European Union.

The procedure used to evaluate the linkages between these markets begins with the estimation of regional market models. The parameters of the regional market models support the calculation of time-varying Treynor ratios, which are performance measures, and also can provide information on the market prices of risk, if their values are in close proximity, according to the arguments presented by Adcock (2007). The market model approach to financial integration analysis is strongly supported by financial integration theory, since the seminal article of Solnik (1973) who proposed the first asset pricing model in a perfectly integrated financial market. Further developments were made by Harvey (1991), who analysed the dependence of the world price of risk on macroeconomic and financial variables, and by Bekaert and Harvey (1995), who extended Harvey's study, to include the possibility of regime shifts which cause changes on the models parameters.

The market model estimations in the present article use a time-varying betas approach, to take into consideration the possibility of regime shifts. The major part of the articles on the market model, published during the sixties and the seventies, were based on constant betas. However, the issue of betas variability is present in literature since the market-timing procedure proposed by Treynor and Mazuy (1966) to evaluate the betas response to changes in the market conditions. The limits of the explanatory power of constant betas were subject to further analysis by Fama and French (1992), which showed that they depend on firms and macroeconomic variables, and later by Jagannathan and Wang (1996), who showed that are unable to explain satisfactorily the average return across different assets. Emerging and frontier stock markets are subject to permanent changes in their assets liquidity, and market capitalization. These changing conditions are natural sources of beta variability, which will be taken into consideration in the present article.

The time-varying betas approach used here is based on a recent contribution to this problem, given by Adcock *et al*. (2012), who proposed the inclusion of predetermined information variables to capture beta variability. This procedure is based on the assumption that assets returns are unconditionally distributed as an extended quadratic form of the predetermined information variables. An additional advantage of this method is that it can include the most traditional answer to the beta variability problem, the *market-timing* procedure, as one of its particular cases. The estimation of the market model with time-varying betas supports the calculation of Treynor ratios, which are both performance measures and essential information on the integration between these markets. The linkages between the Treynor ratios of these markets are estimated by a Vector Auto Regressive Model.

This article is organized as follows. Section 2 presents the theoretical background of the regional market model estimated, and of the comparative performance analysis based on Treynor ratios. Section 3 presents the database and the results of the market models estimation. Section 4 presents the Treynor ratios calculation and the estimation of the Vector Auto Regressive Model, together with Granger and Sims causality tests. The conclusion finishes the article.

2. The theoretical background for the use of a market model to study the linkages between Eastern Europe stock markets

The stock market model is a relation between the excess expected return of an individual asset or portfolio, and the excess return of a market portfolio. Similarly, an international, or regional, market model is the relation between a domestic market portfolio and an international (worldwide or regional) portfolio, and takes the following representation:

$$E_t\left(R_i\right)-r_{f,t}=\alpha_i+\beta_{i,t}\left(E_t\left(R_W\right)-r_{f,t}\right) \tag{1}$$

where $E_t(R_i)$ is the expected return of the domestic portfolio on period t, $E_t(R_W)$ is the expected return of the international portfolio, during the same period, $r_{f,t}$ is the international risk free short-term interest rate, α_i is the autonomous return component of the domestic market (not dependent on the international factor), and $\beta_{i,t}$ is the sensitivity of the domestic market expected excess return of the international stock market.

The estimation of the international market model in the present article uses two predetermined information variables to explain the beta coefficients variability: the international market current excess return (which is the market-timing variable), and the lagged excess return of the domestic market. The time-varying beta parameters are defined as follows, according to this predetermined information variable approach:

$$\beta_{i,t}=\beta_{i,0}+\beta_{i,1}\left(R_{W,t}-r_{f,t}\right)+\beta_{i,2}\left(R_{i,t-1}-r_{f,t-1}\right) \tag{2}$$

where $\beta_{i,0}$ is the beta constant term, $\beta_{i,1}$ is the beta term related to market timing effect, *i.e.*, the beta change caused by the international index excess return, and $\beta_{i,2}$ is the beta term related to the lagged dependent variable, $R_{i,t-1}$-$r_{f,t}$.

The Treynor ratios, proposed by Treynor (1965) to evaluate funds performance, are given by the following relation between excess return and beta parameters:

$$T_{i,t}=\frac{E\left(R_{i,t}\right)-r_{f,t}}{\beta_{i,t}} \tag{3}$$

The original Treynor ratios were proposed to be calculated with constant betas. In the present article, by the contrary, they are calculated using time-varying betas, dependent on the predetermined information variables. The Treynor ratios differences between a group of countries are caused by their autonomous return, represented by the constant α in the market model. By consequence, if all the countries in the group are perfectly integrated in the international market their autonomous return components are zero, and thus, their Treynor ratios are equal. According to Adcock (2007), the market price of risk is a performance measure whose value is common to all the assets in a market. This argument can be extended to the international level, when performance measures, here represented by the Treynor ratios have the same value across different markets. In that case, the Treynor ratio value is equal to the international market price of risk, and those markets are perfectly integrated.

3. Estimation of time-varying beta market models

The empirical research of the present article uses MSCI (Morgan Stanley Capital International) Indexes of the stock markets under study, expressed in Euros. The database consists of daily

data, covering the period between the 1st January 2009 and the 31st December 2012, and comprising 1043 observations of each national index. The original series were transformed into new series whose values were 100, at 1st January 2009, for all the indexes. The European Overnight Interest Average (EONIA) was used as a proxy of the short-term interest rate. There are two main reasons to choose this proxy of the risk-free asset. The first reason is the absence of a money market common to this group of countries. The second reason is that EONIA is a variable suitable to represent the short-term opportunity cost of investing in these Eastern Europe countries, from the point of view of an international investor. An equally weighted portfolio, composed by the domestic indexes of the database, was created to serve as regional index in this empirical analysis. The equally weighted portfolio offers several advantages over other international indexes, such as the Emerging Markets Index and the Frontier Markets Index, supplied by MSCI. In fact, none of the two MSCI indexes covers the entire group of stock markets under analysis. Furthermore, the equally weighted index constructed in the present article precludes the estimation bias caused by differences of market capitalization.

The testable version of the model estimated in this empirical analysis is the following:

$$R_{i,t} - r_{f,t} = \alpha_i + \beta_{i,t}\left(R_{W,t} - r_{f,t}\right) + \varepsilon_{i,t} \tag{4}$$

where $R_{i,t}$-$r_{f,t}$ is the *ex post* excess current return of the country i stock index, $R_{W,t}$-$r_{f,t}$ is the excess return of the regional index, and $\varepsilon_{i,t}$ is the error term.

The market model was estimated under the assumption that the residual series, $\varepsilon_{i,t}$, follow GARCH(p,q) models, according to which their conditional volatility, h_t^2, takes the following general representation:

$$h_t^2 = \phi_0 + \sum_{i=1}^{q} \phi_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \theta_j h_{t-j}^2 \tag{5}$$

This procedure corrects the autoregressive heteroskedasticity put in evidence by preliminary estimations.

Table I, Panel A, presents the results of the estimations of the beta coefficients of the Euro area market model and the GARCH processes. The standardized residuals (*i.e.* the residuals divided by the squared root of the conditional variance) were tested for autocorrelation, by a Ljung-Box test, and for ARCH (Autoregressive Conditional Heteroskedasticity) by an F test on the coefficients of the following auto regressive model:

$$\varepsilon_{i,t}^{*2} = a + \sum_{j=1}^{l} b_j \varepsilon_{i,t-j}^{*2} + \mu_{i,t} \tag{6}$$

where $\varepsilon_{i,t}^{*} = \varepsilon_{i,t} / \sqrt{h_{i,t}}$ is the standardized residual of the estimation of the market model. Both the Ljung-Box test and the ARCH test were carried out for a maximum of 24 lags, with a span of 4 lags. The results of the tests for residual autocorrelation, represented in Table I, Panel B, show that the residuals of the estimations are not auto correlated. Table I, Panel C, shows the results of the tests of ARCH effects on the squared standardized residuals. According to these results, the GARCH models estimated entirely eliminate the ARCH effects from the regressions residuals. The estimations results show that GARCH(1,1) is suitable to explain the residual volatility in the estimations of the market model of almost all these domestic indexes, the only exception being Romania, which required a GARCH(2,1).

Table I - Market Model Estimations

Panel A) Beta and GARCH Parameters Estimators

	Bulgaria			Czech Rep.			Estonia			Hungary			Poland		
Market Model															
Constant	-0.31310	(0.10786)	***	0.19552	(0.10216)	*	-0.03486	(0.12671)		0.24148	(0.15139)		-0.01514	(0.12454)	
$\beta_{i,0}$	3.75061	(0.76825)	***	-0.18389	(0.72249)		1.53928	(0.89960)	*	-1.36396	(1.06366)		0.75460	(0.87740)	
$\beta_{i,1}$	-5.44853	(1.36139)	***	1.97409	(1.27152)		-1.28627	(1.57500)		5.56330	(1.84949)	***	1.34318	(1.54014)	
$\beta_{i,2}$	-0.35773	(0.10973)	***	-0.23164	(0.08331)	**	-0.16862	(0.10492)		-0.25060	(0.07479)	***	-0.29323	(0.06924)	***
Residuals GARCH															
Constant	0.00001	(0.41×10^{-5})	***	0.16×10^{-5}	(0.75×10^{-6})	***	0.00001	(0.38×10^{-5})	***	0.66×10^{-5}	(0.34×10^{-5})	***	0.37×10^{-5}	(0.14×10^{-5})	***
Coef. of ε_{t-1}^2	0.17846	(0.03382)	***	0.03625	(0.01198)	***	0.17765	(0.04956)	***	0.08728	(0.02151)	***	0.09335	(0.02198)	***
Coef. of ε_{t-2}^2															
Coef. of h_{t-1}^2	0.77453	(0.04704)	***	0.94704	(0.01674)	***	0.79577	(0.04679)	***	0.88609	(0.02991)	***	0.88214	(0..02569)	***

	Romania			Russia			Serbia			Slovenia			Ukraine		
Market Model															
Constant	-0.19441	(0.11803)	*	-0.40935	(0.00241)	***	-0.06811	(0.16683)		0.40299	(0.07068	***	-0.25717	(0.17635)	
$\beta_{i,0}$	2.12614	(0.84003)	**	3.58531	(0.00016)	***	1.81617	(1.18278)		-1.18400	(0.50019	**	2.88124	(1.24613)	**
$\beta_{i,1}$	-1.45835	(1.47776)		-3.94642	(0.01680)	**	-2.52247	(2.08209)		2.31860	(0.88044	***	-3.78139	(2.19264)	*
$\beta_{i,2}$	-0.09552	(0.08133)		-0.08071	(0.28909)		0.49863	(0.10230)	***	0.37835	(0.11060	***	0.34278	(0.09692)	***
Residuals GARCH															
Constant	0.42×10^{-5}	(0.13×10^{-5})	***	0.29×10^{-5}	(0.11×10^{-5})	**	(0.85×10^{-5})	(0.25×10^{-5})	***	0.53×10^{-5}	(0.34×10^{-5})	***	0.12×10^{-4}	(0.39×10^{-5})	***
Coef. of ε_{t-1}^2	0.06399	(0.01527)	***	0.07645	(0.01962)	***	0.15699	(0.02724)	***	0.15473	(0.02820)	***	0.11698	(0.02208)	***
Coef. of ε_{t-2}^2	0.09665	(0.07230)													
Coef. of h_{t-1}^2	0.80744	(0.07072)	***	0.90659	(0.02174)	***	0.81943	(0.02827)	***	0.79632	(0.03586)	***	0.85220	(0.02583)	***

Notes: Standard errors are given in parenthesis; ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels.

Table I - Market Model Estimations (cont.)

Panel B) Ljung-Box Statistics on Standardized Residuals of the Market Model

Number of lags	Bulgaria	Czech Rep.	Estonia	Hungary	Poland
LB(4)	6.461	5.722	0.430	7.535	7.262
LB(8)	8.579	8.950	4.779	11.454	15.426
LB(12)	9.785	12.666	7.059	14.246	18.627
LB(16)	12.649	16.885	9.220	21.556	21.897
LB(20)	24.525	19.461	11.782	23.000	28.167
LB(24)	29.566	28.367	13.811	25.506	36.232

Number of lags	Romania	Russia	Serbia	Slovenia	Ukraine
LB(4)	4.334	2.316	3.503	6.656	1.874
LB(8)	8.339	13.071	5.237	13.138	8.611
LB(12)	11.931	14.780	7.837	15.602	16.874
LB(16)	20.320	22.740	8.920	22.318	18.079
LB(20)	21.861	27.121	15.128	26.676	22.768
LB(24)	25.477	29.634	25.882	31.390	26.348

Panel C) ARCH Tests Statistics on Standardized Residuals of the Market Model

Number of lags	Bulgaria	Czech Rep.	Estonia	Hungary	Poland
ARCH(4)	0.542	1.669	0.277	1.233	1.579
ARCH(8)	0.527	0.939	0.777	0.856	1.144
ARCH(12)	0.509	1.092	1.634	1.144	1.152
ARCH(16)	0.492	0.842	1.418	1.042	0.949
ARCH(20)	0.762	0.994	1.196	0.880	1.124
ARCH(24)	0.884	1.152	1.055	0.882	1.169

Number of lags	Romania	Russia	Serbia	Slovenia	Ukraine
ARCH(4)	1.144	1.960	0.142	1.889	0.883
ARCH(8)	1.828	1.192	0.609	1.230	0.867
ARCH(12)	1.425	0.894	0.575	0.978	0.562
ARCH(16)	1.405	0.974	0.565	1.111	0.560
ARCH(20)	1.244	0.925	0.582	0.941	0.577
ARCH(24)	1.167	0.817	0.545	0.909	0.581

Table II shows the statistics of the time-varying betas, which include the mean, standard-deviation, minimum and maximum. The average of the betas mean is 1.1579. The domestic markets whose mean betas are closer to the average are Estonia, Serbia and Poland. The domestic markets with the mean betas more distant from the average are Hungary and Slovenia, which indicates a weak linkage between these two markets and the others. Additionally, several cases of negative betas calculated for Hungary and Slovenia, preclude the calculation of Treynor ratios for these two markets. Thus the stock indexes of Hungary and Slovenia are excluded from the Treynor ratios linkage analysis, presented in the following section.

Table II - Basic Statistics on Time-Varying Betas

	Mean	Std. Error	Min	Max
Bulgaria	2.0928	0.0606	1.8233	2.4094
Czech R.	0.3137	0.0217	0.2058	0.4121
Estonia	1.1237	0.0146	1.0585	1.2017
Hungary	0.1531	0.0607	-0.1565	0.4423
Poland	1.0544	0.0148	0.9824	1.1308
Romania	1.6824	0.0164	1.6058	1.7682
Russia	2.4352	0.0438	2.2310	2.6607
Serbia	1.2381	0.0283	1.0960	1.3649
Slovenia	-0.4140	0.0260	-0.5476	-0.2935
Ukraine	1.8991	0.0422	1.7026	2.0977
Average	1.1579			

4. A Vector Autoregressive model on performance transmission between the different domestic indexes

Some *ex post* excess returns have negative values, which produce negative *ex post* Treynor ratios. As shown by Fonseca (2013), *ex post* excess returns must be scaled to be non-negative, by adding a constant, to all of them, when Treynor ratios are used for the purpose of portfolio construction. This procedure was also used in the present article, by adding a constant term, c, to the *ex post* excess returns, before the calculation of ex post Treynor ratios. The value given to the constant is c= $-min(R_{i,t}-r_{f,}t)$, which, taking into consideration that $min(R_{i,t}-r_{f,}t)<0$, ensures that positive values are calculated for the Treynor ratios. Thus, the final formula for the modified Treynor ratios, whose basic statistics are presented in Table III, becomes:

$$T_{i,t} = \frac{R_{i,t} - r_{f,t} + c}{\beta_{i,t}} \tag{7}$$

The basic statistics of the Treynor ratios show that the stock markets whose Treynor ratios mean is closer to the sample average are Estonia, Poland and Serbia.

Table III - Basic Statistics on the Modified Treynor Ratios

	Mean	Std. Error	Min	Max
Bulgaria	0.1363	0.0093	0.0682	0.1776
Czech R.	0.9119	0.0477	0.7444	1.1763
Estonia	0.2548	0.0178	0.1705	0.3883
Poland	0.2710	0.0166	0.1880	0.3491
Romania	0.1699	0.0142	0.0000	0.2421
Russia	0.1177	0.0101	0.0747	0.1660
Serbia	0.2308	0.0184	0.1457	0.3509
Ukraine	0.1503	0.0130	0.0931	0.2182
Average	0.2803			

The performance transmission between these eight markets was estimated by a VAR model, modified to include leads. The lags influence on the variables current values, designated in literature by Granger *causality*, depends on observed past data. By the contrary, the leads influence on the variables current values, designated in literature by Sims *causality*, depends on the forecast capability of the markets participants, which is more limited than their ability to follow past information. Thus, the estimated VAR has the following general representation:

$$\left[TR_t\right] = A_0 + \sum_{i=1}^{I} A_i\left[TR_{t+i}\right] + \sum_{j=1}^{J} A_j\left[TR_{t-j}\right] + \left[\varepsilon_t\right] \tag{8}$$

where $[TR_t]$ is a vector of current values of the Treynor ratios (each value refers to one domestic stock market), A_0 is the constant terms vector, A_i and A_j are parameters matrices, $[TR_{t+i}]$ is a vector of lead values of the Treynor ratios, *I* is the VAR lead-length, $[TR_{t-i}]$ is a vector of lag values of the Treynor ratios, *J* is the VAR lag-length model, and $[\varepsilon_t]$ is the vector of error terms. The determination of the VAR lag-length, and the VAR lead-length was based on the calculation of the Akaike Information Criteria (AIC) and the Schwarz Bayesian Criteria (SBC), which are defined, respectively, as follows:

$$\begin{aligned} AIC &= T\,log\left|\Sigma\right| + 2N \\ SBC &= T\,log\left|\Sigma\right| + N\,log\left(T\right) \end{aligned} \tag{9}$$

where T is the number of usable observations, $|\Sigma|$ is the determinant of the variance/ covariance matrix of the residuals, and N is the total number of parameters estimated in all equations. The determination of the VAR lead and lags lengths was done in two separate steps. In the first step, the number of leads was fixed to be equal to one, and the AIC and SBC statistics were calculated for five different lags, i=1,...,5. The lag-length was chosen according to statistics results in the first step, and it was used as a fixed value in the second step, in which the AIC and SBC statistics were calculated for five different leads, j=1,...,5. The results of the calculation of the AIC and SBC statistics are shown in the Table IV.

Table IV - AIC and SBC Statistics on the Treynor Ratios VAR Model

Panel A) Lag-length determination (lag-length =1)

Lag	AIC	SBC
1	-72310.5046	-71637.8467
2	-72215.3788	-71226.3686
3	-72341.5280	-71036.2889
4	-72222.7958	-70601.4517
5	-72136.1021	-70198.7767

Panel B) Lead-length determination (lead-length =3)

Lead	AIC	SBC
1	-72341.5280	-71036.2889
2	-72229.6907	-70608.3466
3	-72116.2777	-71036.2889
4	-71980.0822	-69726.8996
5	-71867.1011	-69298.1854

According to the results shown in Table IV- Panel A) the AIC statistic indicates that the VAR lag-length is of 3 lags, while the SBC statistic indicates a VAR lag-length of 1 lag. The 3 lag-length was chosen to be included in the lead-length calculations. The results of these calculations, reported in Panel B, show that AIC and SBC statistics converge to a 1 lead-length. Taking into consideration the AIC and SBC results, the Treynor ratios VAR model used in the causality tests includes 3 lags and 1 lead. The results of causality tests, given by the F statistics of the VAR model estimations, are shown in Table V – Panel A) for Granger causality and in Table V – Panel B) for Sims causality. According to the statistics significant at the 1%, 5% and 10% levels, the dominant market, in Granger causality, is the Polish stock market, whose lagged Treynor ratios influence the performance of five other markets. This stock market is followed by the Czech, Romanian and Serbian stock markets which have Granger causality on three other stock markets. No significant Granger causality is put in evidence from the stock markets of Bulgaria, Estonia, Russia and Ukraine. The results on Sims causality, presented in Panel B, which are significant at the 1%, 5% and 10% levels, provide evidence that the influence of the forward performance of each market on the other is of five cases, from Czech Republic and Ukraine, four cases from Serbia, three cases from Bulgaria and Estonia, two cases from Romania and one case from Poland and Russia.

Table V - VAR Model Causality Tests

Panel A - F Statistics on Granger causality

	Dependent variables															
	Bulgaria		Czech R.		Estonia		Poland		Romania		Russia		Serbia		Ukraine	
Bulgaria	1.2464		1.3065		1.0470		0.0687		0.8187		0.5794		0.2447		1.2464	
Czech R.	4.9931	***	9.2083	***	1.6031		0.2798		0.8825		2.7250		0.7387		4.9931	***
Estonia	0.1900		1.6604		0.1033		1.7570		0.4148		0.1350		0.7978		0.1900	
Poland	2.9533	**	0.4957		4.0290	***	10.9190	***	9.0334	***	5.7783	***	1.2837		2.9533	**
Romania	0.1588		3.0347	**	0.8303		4.3595	***	2.0453		0.3857		0.5673		0.1588	
Russia	3.3592		1.5830		3.2794		0.6700		0.4584		0.1090		2.0830	*	3.3592	**
Serbia	1.6477		2.8985	**	2.4243	*	2.0610		1.4716		2.3744	*	0.9109		1.6477	
Ukraine	0.6143		0.2919		0.9716		1.9148		0.1853		0.6478		0.6197		0.6143	

Panel B - F Statistics on Sims causality

	Dependent variables															
	Bulgaria		Czech R.		Estonia		Poland		Romania		Russia		Serbia		Ukraine	
Bulgaria	2.1994		0.1923		2.4297		1.9358		3.1932	*	6.9192	***	0.0146		3.1181	*
Czech R.	8.5869	***	1.7776		8.0059	***	45.1077	***	25.8730	***	16.2785	***	0.2126		0.1992	
Estonia	0.4706		0.0271		0.6766		18.7624	***	8.1687	***	16.8842	***	0.0552		0.4208	
Poland	0.1737		2.0880		1.0788		1.2569		0.3976		0.7661		0.5224		5.4500	**
Romania	0.2701		3.8462	**	0.3883		6.4196	**	0.0750		0.0083		0.0836		0.3332	
Russia	0.3856		7.6537	***	1.0239		0.2955		0.0519		0.2286		0.8287		0.3176	
Serbia	4.7212	**	2.3266		1.2789		9.5651	***	4.5118	**	7.8669	***	0.7706		0.08656	
Ukraine	22.2778	***	1.389		12.5548	***	11.6973	***	13.4436	***	25.7097	***	1.5979		0.85046	

Note: ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels.

5. Conclusion

The present article studies the linkages between the Eastern Europe stock markets of Bulgaria, Czech Republic, Estonia, Hungary, Poland, Romania, Russia, Serbia, Slovenia and Ukraine. A regional index was constructed to estimate market models, using an approach with beta parameters depending on predetermined information variables. The markets whose beta values are closer to the whole sample average are Serbia, Estonia and Poland. On the opposite situation are Hungary and Slovenia, with beta values distant from the whole sample average, which indicates a weak linkage between these two markets and the others. Additionally, the market model estimation for Hungary and Slovenia produced several cases of negative betas which preclude their inclusion in the comparative performance analysis. The estimation of the market models was followed by the analysis of the performance causality between these stock markets, through the estimation of a VAR model on their Treynor ratios. The causality tests, supported by the VAR estimation, provided a clear evidence of the reciprocal performance influence across the majority of these markets, both in terms of Granger causality and Sims causality.

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Teses de Doutoramento

Doutoramento em Pós-Colonialismos e Cidadania Global

De Criaturas a Criadores: Dinâmicas de Tradução entre o Artesanato e o Design

Karine Gomes Queiroz

A proposta de trabalho desta tese consiste em explorar as possibilidades da produção material enquanto exercício de aperfeiçoamento do sujeito e da sociedade. O entendimento aqui presente é o de que o estatuto do criador lhe permite entrever as possibilidades de um mundo melhor. A presente tese recorre às categorias de Boaventura de Sousa Santos para articular uma epistemologia alternativa da poiésis, testando os conceitos deste autor e inscrevendo-os na leitura crítica do design e do artesanato. No âmbito desta leitura, o conceito das cinco ecologias e a articulação com as representações inacabadas da modernidade configuram-se como metodologia crítica para demonstrar as potencialidades das experiências e saberes-fazer na atualidade. Os casos estudados distinguem-se pelas diferentes dimensões e modos que deram corpo à investigação. No primeiro caso, a Oficina Namban, realizada na Serra de Montemuro em Portugal, organizada pelo CEARTE - Centro de Formação Profissional Artesanal - Portugal, foi possível a observação participante de uma experiência de trabalho conjunto entre artesãos e designers, o que permitiu compreender como as relações são estabelecidas, e os processos criativos concebidos. No segundo caso, o Ñandeva - Programa Trinacional de Artesanato, localizado na tríplice fronteira entre Argentina, Brasil e Paraguai, foi possível conhecer um programa de integração regional assente na criatividade e produção de artefatos. Nos dois casos, embora de modos diferentes, a produção de materialidade tinha como pano de fundo a experiência colonial. No caso da

Oficina Namban, o processo criativo tratou de colocar em cena o Estilo Namban, produzido no Japão do século XVI e XVII, que forneceu uma narrativa visual da chegada dos "namban ji" - os portugueses enquanto bárbaros do Sul - aos portos do Japão. No caso do Programa Ñandeva, o pano de fundo consistiu nas Missões Guarani-Jesuíticas, em que a "pedagogia da forma" e a produção de materialidade representaram simultaneamente a "utopia real" da Contrareforma jesuítica, e o processo de resistência cultural por parte dos Guaranis. Os instrumentos metodológicos para a análise de cada caso incluíram observação participante, entrevistas semi-estruturadas e pesquisa documental, facultando o enquadramento necessário para se entender os lugares-comuns presentes no processo de tradução entre artesanato e design. Por fim, a presente tese procedeu à sistematização de topoi para a tradução na poiésis, mediante as experiências de campo, o que permitiu articular o ato de "imaginar o próprio conhecimento" como dinâmica imprescindível para a relação entre artesanato e design.

Universidade de Coimbra, 19 de Julho de 2013

Doutoramento em Gestão – Ciência Aplicada à Decisão

Avaliação de Projetos de Investigação e Desenvolvimento na Área das Telecomunicações

Joana Rita Silva Fialho

Uma correta avaliação de projetos de investigação e desenvolvimento (I&D) permite que as empresas possam selecionar e/ou priorizar os projetos que melhor satisfaçam os seus objetivos. Para além disso, muitas empresas deparam-se com limitações de recursos, especialmente os humanos. Uma ferramenta que ajude os gestores a encontrarem a melhor estratégia para alocar os recursos é muito importante para a conclusão dos projetos de forma eficiente e sem desperdícios.

Este trabalho apresenta duas ferramentas que ajudam a avaliar projetos de I&D, tendo como base a estrutura e política de uma empresa específica: a PT Inovação.
A avaliação deste tipo de projetos (e outros) depende, também, dessa estrutura e política, pois os pressupostos admitidos por umas empresas podem não o ser noutras. De acordo, então, com a empresa, construiu-se uma primeira abordagem de avaliação baseada em múltiplos critérios, dispostos numa estrutura hierárquica: abordagem hierárquica. Seguidamente, outra abordagem foi construída, tendo em conta apenas o critério financeiro e baseada na teoria das opções reais: abordagem estocástica. Note-se que a informação necessária para a utilização da abordagem hierárquica é mais fácil de obter do que a requerida pela abordagem estocástica.

Os projetos de I&D da PT Inovação podem ser muito diferentes entre si e, em geral, são desagregados em ações, cuja estrutura e objetivos podem ser muito específicos. Devido a esta variedade, os projetos e ações são diferenciados por tipos. Esta diferenciação leva a que, na abordagem hierárquica, os critérios tenham diferentes pesos, mediante o tipo de projeto ou o tipo de ação que se está a considerar. O processo de avaliação desta abordagem baseia-se no AHP (*analytic hierarchy process*), sendo que

algumas das suas limitações tiveram que ser ultrapassadas, nomeadamente a dificuldade em estabelecer algumas comparações, o grande número de comparações que podem ser requeridas pelo método, e o tratamento de critérios que utilizem valores financeiros. O resultado da abordagem hierárquica permite priorizar e/ou selecionar projetos ou ações. São ainda sugeridas formas de, perante o resultado dessa avaliação, afetar os recursos disponíveis pelas diferentes ações consideradas no processo de avaliação.

A abordagem estocástica parte do pressuposto inicial que as ações são compostas por um conjunto de tarefas (parcelas) homogéneas. Essas tarefas são avaliadas, ao mesmo tempo que é definida a melhor estratégia para a sua execução: mediante os níveis de recursos disponíveis, são definidas regras que ajudam a decidir sobre o nível de recursos a utilizar em cada instante, de acordo com a maximização de um valor financeiro que caracteriza a tarefa. Considera-se que o tempo de execução de uma tarefa e os *cash flows* esperados têm comportamento estocástico. Os custos são fixos, por unidade de tempo e, tal como o tempo de execução, dependem do nível de recursos utilizado. O processo de avaliação baseia-se na teoria das opções reais e no processo de simulação *least squares* Monte Carlo (LSM), com algumas adaptações, já que se considera o tempo de execução estocástico, e não determinista.

Universidade de Coimbra, 29 de Julho de 2013

Doutoramento em Sociologia – Cidades e Culturas Urbanas

Cidades e Imaginários Turísticos – Um Estudo sobre Quatro Cidades Médias da Península Ibérica

Carina Gisela Sousa Gomes

Esta tese desenvolve uma abordagem acerca do estatuto, das possibilidades e dos desafios atribuídos ao fenómeno do turismo em cidades de pequena e média dimensão. Nessas cidades, onde se evidenciam, frequentemente, estratégias e projetos de *engrandecimento*, o turismo vem sendo encarado um fator decisivo na reorganização dos territórios e na redefinição de políticas de planeamento e desenvolvimento, sobretudo pelas expectativas de regeneração das paisagens e de revitalização das economias urbanas que lhe são associadas. Partindo das relações construídas, ao longo das últimas décadas, entre as cidades, o setor do turismo e os responsáveis e promotores de ambos, o presente trabalho tem nas cidades de Braga, Coimbra, Salamanca e Santiago de Compostela os seus referentes empíricos.

Embora tratando-se de um fenómeno complexo e multifacetado, o turismo deixa antever o envolvimento de um conjunto diversificado de profissionais, que compõem as *paisagens turísticas* das cidades. Todos contribuem, direta ou indiretamente, com responsabilidades distintas, repertórios variados e racionalidades nem sempre coincidentes, para a produção e difusão das imagens turísticas das cidades. Os resultados destas atividades permitem que se olhe para as cidades através de diferentes modos de avaliação e qualificação, isto é, de múltiplas ordens de grandeza associadas aos sucessos turísticos obtidos. A análise que aqui se apresenta mostra que as cidades turísticas não devem ser entendidas apenas como reflexo direto dos espaços urbanos que lhes deram origem, mas também como resultado dos processos, das relações e das estratégias gerados no decurso da conceção e promoção de um lugar como destino turístico. A abordagem centra-se, pois, nos modos de conceção, planeamento e promoção das atividades turísticas nas

cidades, considerando os atores envolvidos, suas ações e perspetivas acerca dos ambientes urbanos em que operam.

O que representa o turismo para as cidades estudadas? Que aspirações e projetos lhes estão associados? Que estratégias enformam os seus modos de promoção? Que forma e que conteúdos modelam as suas imagens turísticas? Que racionalidades se manifestam na sua conceção? E que leitura encontram na visão de quem, turisticamente, experiencia as cidades? São estas as questões que comandaram a investigação, por referência a um universo de reprodução imagética que é, necessariamente, complexo e heterogéneo e, por isso, um terreno plural para os produtores e consumidores do espaço turístico urbano.

Universidade de Coimbra, 30 de Julho de 2013

Doutoramento em Economia

Modeling and Numerical Analysis in Option Market with Memory

Júlio Cezar Alves Thomaz

This thesis provides a new proposal for modeling the dynamics of financial prices that takes into account memory structures. In order to motivate new option pricing models, this thesis presents several models for the price of the underlying asset, beginning with the classical models and increasing the complexity until more sophisticated models with memory in price and in volatility. In this framework, new pricing models are derived for plain vanilla options. These models are represented by differential systems with no analytical solution, and therefore they impose the use of numerical methods. Here it is adopted the Galerkin method, and the solution of the algebraic problem is found using two methods: the Interactive Method of Successive Over-Relaxation (SOR) and Picard algorithm.

Throughout this thesis there is a significant mathematical effort aiming to model option prices in the presence of memory structures (JTDD process). Given the need for statistical theory, in particular for the Itô's Lemma, here it is shown the formulation of the Itô's lemma for JTDD process with non-constant coefficients. Also of great importance in the stochastic calculus field, the thesis presents a demonstration of the exponential stochastic process for JTDD.

An important issue for financial economics is the possibility that series have some kind of persistence, at least in a high frequency setting. In this thesis this aspect of the prices time series is captured through the consideration of Telegraph processes.

Universidade de Coimbra, 23 de Setembro de 2013

Doutoramento em Relações Internacionais – Política Internacional e Resolução de Conflitos

Peace as Government: The (BIO) Politics of State-Building

Ramon Blanco de Freitas

Observing current international scenario, it is notorious the centrality that peace and its construction have. Peacekeeping, peacebuilding and state-building have become fundamental processes of present international politics. In this regards, it is indisputable that the latter has emerged as a crucial activity and one of the most pressing issues regarding peace and conflict transformation in contemporary international relations. In fact, state-building constitutes the very core of international policies directed towards peace, development and security in our time and, consequently, it has became a pivotal practice of central states and international organizations, especially the United Nations (UN). Departing from theoretical and conceptual tools developed by the French philosopher Michel Foucault, this thesis reproblematizes the UN approach regarding post-conflict reconstruction efforts and transformation of international violent conflicts arguing that the construction of peace in our time is an attempt of international normalization of 'post-conflict' states and their populations. The pursuit of this normalization, as this thesis argues, is rendered operational through the international government of 'post-conflict' states and their populations' lives at a global scale. In order to pursuit such process, the state-building emerges as the most suitable instrument. It is through the deployment of a state-building *dispositif* to 'post-conflict' scenarios that it is pursued the conduct of conducts of both 'post-conflict' states, through their discipline, and their populations, through biopolitics, towards a determinate end – making them resemble more like liberal-democratic entities. In order to render its argument operational, this thesis analyses the UN 'post-conflict' state-building reconstruction process carried out in Timor-Leste. Due to its broad range, depth, and duration, the UN engagement with Timor-Leste is the most appropriate case to have a more comprehensive understanding of the practice of statebuilding in 'post-conflict' settings. This thesis analyses how Timor-Leste emerged in the international scenario as an urgent need that *needed* to be addressed and, consequently, the functioning of the state-building *dispositif* deployed towards the country as a result of this understanding. Along its analyses, this thesis elucidates that the state-building process, albeit rhetorically framed as building peace and underpinned by power-denying notions such as 'capacity-building', is a normalizing *dispositif* directed towards 'post-conflict' states which operates through the pursuit of disciplining such state and exercising a biopolitical power over the political, the economic, the social, and the security spheres surrounding its population. This thesis evinces that, in the end, state-building is a process that seeks to make 'post-conflict' states and their populations behave more as what is constructed as the 'normal' behavior of current international relations – liberal-democratic entities.

Universidade de Coimbra, 11 de Outubro de 2013

Doutoramento em Sociologia (Sociologia do Desenvolvimento e da Transformação Social)

O Desenho na Internet, Forma, Referencialidade e Performatividade

Lino Dias de Azevedo Silva Fernandes

O presente trabalho de investigação, "O desenho na Internet, forma, referencialidade e performatividade", centra-se na análise do desenho dos Visualizadores de Informação criados especificamente para a Internet. Enquadra-se numa abordagem sociológica das estratégias operativas da teoria crítica, na sua vertente emancipatória, procurando articulá-las com a teoria dos media, com a teoria e filosofia da arte, e também com a estética da informação. Insere-se numa perspetiva aberta de desenho, nas filosofias e teorias do design, e tem em conta os contributos das teorias da visão, da psicologia e da neurologia. A metodologia incluiu: i) extensa análise bibliográfica sobre o papel do desenho ao longo da história; recolha de informações e documentos sobre duzentos e dezoito Visualizadores de Informação, Gráficos de Informação e Mapas Geográficos de Informação; ii) análise qualitativa do desenho dos Visualizadores de Informação em duas fases, sendo a primeira referente à análise da amostra dos cento e dezassete Visualizadores de Informação de forma a relacionar três dimensões do desenho: forma, referencialidade e performatividade, e à compreensão do papel do desenho nestes produtos; e a segunda fase referente à análise do desenho dos Visualizadores de Informação mais representativos e distribuídos por áreas de referencialidade: Internet, locais da Internet, bases de dados, redes sociais, textos, números e quantidades, sons e música, engenharia e ciência, emancipação, vigilância, arte e arquitetura; de forma a mostrar o papel desempenhado por estes produtos na construção de um conhecimento social. Nas conclusões sugerem-se considerações interessantes sobre as hipóteses fundamentais desta investigação ao nível da comprovação do lugar do desenho nos Visualizadores de Informação que se configura de acrescida importância; ao nível do papel do desenho, evidenciado pelos Visualizadores de Informação, tanto na componente criativa manifestada na fase de projeto, como pelas suas qualidades intrínsecas que representam a nossa a inteligência visual, e que permitem cruzar e visualizar a informação contida nos dados estatísticos, patentes nos interfaces diagramáticos dos Visualizadores de Informação; e, por fim, ao nível do papel dos Visualizadores de Informação na sua contribuição para uma emancipação, assim como, na construção de um conhecimento social.

Universidade de Coimbra, 3 Dezembro de 2013

Doutoramento em Relações Internacionais – Política Internacional e Resolução de Conflitos

O Direito pela Paz – Contributos para a Superação da "Síndrome das Duas Culturas" entre as Relações Internacionais e o Direito Internacional

Mateus Pereira Kowalski

O problema de partida do presente estudo enquadra-se numa preocupação teórica centrada na dinâmica entre a paz (da perspetiva das Relações Internacionais) e o Direito Internacional. No atual quadro liberal de "fim da história" o Direito Internacional não tem cumprido o seu papel de forma satisfatória porque não tem capacidade para regular adequadamente o poder, quer porque se deixou manipular pela política do poder quer porque simplesmente capitulou face à sua força esmagadora. A isto acresce que certos discursos académicos sobre a paz, como o dos Estudos para a Paz, foram cooptados e deturpados em favor de uma política de paz com tiques hegemónicos. Esta política de paz encontrou algum conforto naquele discurso do Direito Internacional manietado pelo poder. Esta observação, que põe em causa os fundamentos daquela relação, indicia a existência de uma crise da dinâmica entre a paz e o Direito Internacional.

O argumento subjacente ao presente estudo é, então, o de que a superação da crise de relacionamento entre a paz e o Direito Internacional no quadro liberal atualmente dominante exige a visualização da relação por outra perspetiva teórica. Uma perspetiva que receba os impactos da incapacidade de resposta das teorias da paz liberal e dos seus correspondentes no Direito Internacional e que arranque daí para um exercício que, por ser feito de outras paisagens - mais micro e em que a emancipação tem um papel central -, desafiará o Direito Internacional a ir também em busca de outros referentes.

Neste sentido, foram traçados três grandes objetivos sequenciais para a tese. Em primeiro lugar, investigar a existência de uma dinâmica relevante entre a paz e o Direito Internacional, sendo analisado para tal o período que decorre entre o final da Primeira Grande Guerra e o final da Guerra Fria (Parte I). Depois, em segundo lugar, evidenciar a crise desta dinâmica no contexto liberal dominante, identificando igualmente possíveis insuficiências e contradições da narrativa, e demonstrando as suas consequências (Parte II). Finalmente, e em terceiro lugar, equacionar uma narrativa alternativa de inspiração pós-positivista como caminho para novas formas teóricas de sustentação de uma narrativa entre a paz e o Direito Internacional (Parte III).

A estratégia de investigação assentou numa ampla e sólida carga teórica. A revisão bibliográfica constituiu, pois, o elemento base para este estudo. No que respeita à metodologia foram privilegiados os seguintes métodos: a recolha de dados documentais preexistentes (literatura específica de cada um dos domínios científicos em análise e documentos oficiais) e a análise de conteúdo.

Percorrido este percurso, foi possível concluir que existe uma dinâmica implícita entre os discursos da paz e do Direito, que essa dinâmica se encontra atualmente em crise e que a narrativa proposta do "Direito pela paz" - simultaneamente "segundo a paz" e "para a paz" numa perspetiva diversa da teoria da "paz pelo Direito" proposta por Kelsen -, de base pós-positivista, é uma alternativa teórica viável para a relação entre as duas variáveis no contexto de uma "comunidade moral". Uma narrativa alternativa assente num discurso explícito que pode ter efeitos concretos positivos na superação do modelo liberal vigente, em direção a uma paz emancipatória, empática e do quotidiano, reforçada por um Direito dotado de uma mesma ontologia e epistemologia. O presente estudo tece igualmente contributos para: alinhavar de forma explícita as bases para a criação teórica interdisciplinar que permita a maximização do contributo do Direito para a paz, bem como servir de referente para manifestações práticas futuras; a atualização da teoria sobre a relação entre o Direito e a paz; reforça a ideia da abordagem interdisciplinar como metodologia de leitura, analise e construção socio-internacional,

contribuindo em concreto para a superação da "síndrome das duas culturas"; uma revisão de bibliografia que poderá contribuir para outras investigações direcionadas para uma análise conjunta do Direito e das Relações Internacionais, em particular no que respeita à paz.

Universidade de Coimbra, 11 Dezembro de 2013

Doutoramento em Sociologia – Relações de Trabalho, Desigualdades Sociais e Sindicalismo

Os Dilemas da CUT no Início do Século XXI: Rumo a uma Nova Institucionalização Sindical?

Fernanda Forte de Carvalho

Esta dissertação tem como objetivo central compreender como a Central Única dos Trabalhadores (CUT) se posiciona durante a vigência do Governo Lula no período 2003-10. Momento em que, no espaço da cidadania, para além da pauta sindical relacionada às reinvindicações trabalhistas e às ações de confronto, a CUT passa a priorizar a articulação de uma pauta em prol do desenvolvimento do país, com uma ampla agenda de negociação. A ação da CUT, neste período, passa a incorporar novos atores sociais, em especial, as centrais sindicais. Neste sentido, objetiva-se apreender os significados desta relação associativa.

O estudo busca averiguar quais foram as influências deste governo para a possível conformação de uma nova institucionalização da central sindical no início do século XXI. Sendo assim, identificar-se-ão não só os fatores que determinaram maior intensidade da ação desenvolvida entre as centrais sindicais, mas também as perspectivas para uma *nova institucionalização* neste período.

No âmbito nacional, são realizadas entrevistas com os Diretores Nacionais da CUT e com os representantes das centrais sindicais com as quais a CUT vem estabelecendo uma parceria regular, sendo estes: a Força Sindical, a União Geral dos Trabalhadores (UGT), a Central dos Trabalhadores e Trabalhadoras do Brasil (CTB) e a Central Geral dos Trabalhadores do Brasil (CGTB), Neste estudo, optou-se, também, por realizar uma entrevista com um representante da CONLUTAS, pois embora não tenha obtido o reconhecimento jurídico pelo Ministério do Trabalho e Emprego, esta Coordenação de Lutas agrupa um significativo número de ex-dirigentes da CUT. Em suma, priorizou-se a aplicação de entrevistas com os movimentos sociais,

organizados em torno da Coordenação dos Movimentos Sociais (CMS), no perímetro nacional.

Os resultados obtidos permitiram concluir que a CUT não experimenta uma fase de forte crescimento e de aceleração do processo de institucionalização, entretanto, é considerada uma instituição forte atualmente. As perdas e recomposições políticas, vivenciadas desde 2003, não conseguiram desestabilizar o tamanho das delegações nos congressos da CUT, nem o número de entidades filiadas. Por isso, o período 2003-10 marcado por uma fase que se caracteriza como estabilização institucional. O exercício de um sindicalismo aberto ao exterior, a partir de uma agenda cidadã conforme pretendido no discurso da instituição, é ainda um desafio. A dificuldade em estabelecer um posicionamento efetivo em direção a uma ação sindical cidadã tem relação com a capacidade de superação dos dilemas, principalmente por dentro da instituição, em específico no que tange ao projeto político e organizativo. Portanto, é a superação destes limites que poderá contribuir para uma nova institucionalização da CUT no início do século XXI.

Universidade de Coimbra, 19 Dezembro de 2013

Doutoramento em Direito, Justiça e Cidadania no Século XXI

Os Tribunais como Espaços de Reconhecimento, Funcionalidade e de Acesso à Justiça – O Estudo de Caso dos Tribunais de Família e Menores em Portugal

Eliana Patrícia Carvalho Branco

Um dos tópicos mais negligenciados ao nível da reflexão sobre o direito e o sistema jurídico tem sido a questão da arquitetura dos espaços da justiça ao serviço da aplicação da própria justiça. Ora, a arquitetura, na medida em que organiza e estrutura o espaço, torna-o inteligível, decifrável, passível e possível de ser interpretado; sendo que os seus exteriores e interiores, bem como os materiais e objetos aí presentes podem facilitar ou inibir as nossas atividades através da forma como significam e representam determinadas mensagens. Daí que se torne necessário proceder a uma análise dos espaços da justiça - e aqui tenho sempre em mente o Tribunal como espaço público privilegiado de justiça - atendendo às circunstâncias do tempo, do lugar da jurisdição, do contexto histórico, político, normativo, sociocultural e da tradição jurídica. Intentou-se, assim, colmatar uma ausência de pesquisa ao nível dos estudos sociojurídicos, mormente em Portugal, criando um estado da arte original.

Deste modo, o objetivo geral desta pesquisa foi o de analisar os espaços da justiça dos tribunais, ou seja os espaços onde se dirimem litígios, onde se cruzam relações de poder, mas também relações sociais de vulnerabilidade, no sentido definido no contexto do debate teórico e jurídico do acesso ao direito e à justiça em Portugal. Analisei, assim, as tendências (internacionais e nacionais) de evolução da sua construção e/ou adaptação (tipos de edifícios e sua organização interna, com enfoque nas diferentes valências e acessibilidades) e respetiva utilização incorporando, aqui, as representações e práticas espaciais dos próprios intervenientes (cidadãos-profissionais e cidadãos-utentes), para depois analisar a eventual conexão da construção,

adaptação ou uso dos espaços da justiça, em geral, e, em especial, dos tribunais, com a questão do acesso ao direito e a justiça.

Como objetivo específico, o estudo de caso incidiu sobre os Tribunais de Família e Menores portugueses. O direito da família e das crianças é hoje chamado a responder a novos problemas, de contornos ainda pouco definidos, que se manifestam entre uma tendência para a privatização/negociação e uma tendência para a (re)publicização, designadamente em matéria de novas conjugalidades e de defesa dos direitos das crianças. Surgiu, assim, a necessidade de analisar os espaços da justiça numa área tão rica e complexa, na qual a interação com o sistema judicial é associada, a maior parte das vezes, com a devassa da vida privada, a fragilidade e a emotividade, decorrentes não só do tipo de ação em causa (divórcios, responsabilidades parentais, delinquência juvenil, crianças negligenciadas, entre outras), como da própria relação com os espaços.

Se o intuito que a arquitetura deve jogar é o de tornar a vida das pessoas mais confortável, impõe-se pensar num novo modelo de tribunal, atendendo em especial a um novo modelo de tribunal da família e das crianças, atendendo as funções de reconhecimento, de funcionalidade e de acesso ao direito e à justiça.

Universidade de Coimbra, 19 Dezembro de 2013

Doutoramento em Sociologia

Fintar Fronteiras – Migrações Internacionais no Futebol Português

Carlos Manuel Simões Nolasco

O futebol é um dos mais importantes fenómenos sociais contemporâneos. Atualmente, os resultados desportivos traduzem-se em algo mais do que meras vitórias e derrotas de um jogo, sendo também a expressão de ganhos ou perdas culturais, políticas e económicas. Num contexto de intensa competição, acentuada pelas dinâmicas da globalização, o universo futebolístico procura maximizar desempenhos tornando, por isso, imperativa a procura incessante de jogadores com características físicas, competências técnicas e táticas e mentalidade competitiva, capazes de materializar em vitórias as aspirações dos adeptos, dos clubes e dos investidores. Quando esses jogadores não são encontrados no espaço nacional, ou a relação de procura e oferta sugere outros mercados de trabalho, são procurados fora do país, suscitando processos migratórios. Desta forma, tal como noutras áreas onde se regista uma elevada mobilidade internacional de trabalhadores, também no futebol ocorrem relevantes processos de mobilidade internacional de jogadores. Um volume crescente de futebolistas profissionais tem, assim, vindo a deslocar-se entre países, determinando a forma como as competições decorrem.

O futebol português não ficou indiferente a tais dinâmicas migratórias. Não sendo um processo recente, adquiriu nos últimos anos importância pelo enorme número de jogadores estrangeiros a representar clubes portugueses, bem como pelo elevado número de jogadores portugueses em clubes estrangeiros. É na compreensão das dinâmicas migratórias do futebol português que se centra este trabalho. Assume, como ponto de partida, a relevância sociológica do desporto, e em particular do futebol, enquanto expressivo fenómeno social das sociedades contemporâneas. Parte-se, para tal, da

consideração de que as sociedades contemporâneas são marcadas por "turbulências" migratórias, evidentes na diversidade e complexidade dos fluxos de pessoas. Considera que o futebol profissional, enquanto atividade laboral, suscita migrações internacionais de trabalho desportivo que, apesar da sua especificidade, se inserem na dinâmica da "idade das migrações". Assume como objeto de análise essa entidade de contornos difusos que é o futebol português, a qual engloba todo o futebol praticado em Portugal, incluindo o que é praticado por jogadores estrangeiros em Portugal e por portugueses no estrangeiro. Propõe como hipótese principal de trabalho que o processo migratório de futebolistas se constitui como um movimento de trabalhadores, num contexto de globalização, onde a sociedade portuguesa, sendo simultaneamente pais de imigração e emigração, funciona como "plataforma giratória" de jogadores entre a periferia e o centro.

O trabalho de investigação realizado pressupõe o recurso a uma estratégia metodológica plural, que conjuga abordagens quantitativas e qualitativas enquanto estratégia para abranger, de forma ampla, a realidade em análise.

Através do trabalho empírico constata-se que as migrações do futebol português inserem-se nas dinâmicas migratórias da arena desportiva global, com a particularidade de serem em simultâneo movimentos de entrada e de saída de jogadores, e os clubes portugueses serem espaços de origem e de destino de fluxos migratórios. Estes movimentos seguem duas tendências: por um lado, as características do mercado de trabalho futebolístico que funcionam simultaneamente como fator de atração e repulsão de jogadores; por outro, afinidades históricas e sociais, que inserem as migrações de jogadores no amplo sistema migratório lusófono.

Universidade de Coimbra, 23 Dezembro de 2013

Doutoramento em Democracia no Século XXI

Developing Change - A Psychosociological Action Research with Civil Servants Engaged in Participatory Processes

Roberto Falanga

Changes in public service answer the multiple claims and pressures that, in the last few decades, have demanded profound reflections on the enhancement of democracy worldwide. In this respect, since public administrations govern social transformations through managing and implementing public policies consistent with specific political agendas, participatory devices have recently represented one of the most important international phenomena. As a result, participation compels deep scientific investigation about changes in organizational structures, processes and cultures of public administrations. We argue that the overlapping dimensions of tradition and innovation expressed through new back-office and frontline functions within changing political and administrative rationales, testify the key role played by civil servants. Despite the fact that scientific literature concerning participation has increased in recent decades, a specific overview of civil servants managing and implementing participatory processes, as well as the cultural relevance of their contribution to change, has been limitedly studied.

We propose an exploratory investigation through the meanings of change, by intercepting participatory processes as those "symbolical objects" experienced by civil servants. By interpretively analyzing the ways they construct such meanings, we define different cultural patterns in order to open up areas of reflection about the possible development of participatory processes. Towards this aim, we carried out an action research with the Municipality of Lisbon based on the psychosociological ISO Methodology, and supported by an interdisciplinary framework constructed through a dialogue with critical sociology, organizational studies, political sciences, and public policy analysis. We analyze four participatory processes implemented in Lisbon in 2012 - Participatory

Budget, Simplis, Local Agenda 21 and BIPZIP program – administered by two distinct units and responding to two different city councilors. The observation of both the internal and external management and implementation of these processes integrates the interpretation of the four cultural patterns emerging from the analysis of the narratives constructed by 29 interviewed civil servants. Such patterns transversally refer to their work with participation and put emphasis on different aspects: the internal administrative organization; the rules of the game of participatory methodologies; the overall role of political institutions in society; the commitment to social integration. In assuming the cultural construction of participatory processes as a crucial aspect concerning participation, we open up areas of reflection concerning possible ways for their development. The articulation of four indicators of development emphasize respectively: the necessity to change administrative structures and procedures in order to address participation to enhance public service; the opportunity to orient technical expertise towards achievable participatory goals; the political character of the functions displayed by civil servants exposed to a public interface with society; the necessary correspondence between territorial integration and coordinated government agency.

As a final point, we argue that the hypotheses of the action research are accomplished because they provide: new knowledge concerning participatory processes by setting new methods and interdisciplinary perspectives in this field of study; new questions concerning participation as a change to be developed within public administrations in transformation; new light on the complex and resourceful roles played by civil servants with participatory processes in terms of administrative cultural change; new possible advancements of the action research with the Municipality of Lisbon and with other contexts; and finally, new interdisciplinary interactions and exchanges consistent with the scientific commitment to the challenges and changes that democratic regimes are demanded to govern worldwide.

Universidade de Coimbra, 27 Dezembro de 2013

Doutoramento em Sociologia

Para um Direito sem Margens: Representações sobre o Direito e a Violência Contra as Mulheres

Maria Madalena dos Santos Duarte

As reivindicações pela não discriminação, pela inclusão e por justiça social têm sido traduzidas em apelos pela redação e implementação de textos jurídicos emancipatórios. As expectativas, coletivas e individuais, recaem no Direito, perspetivando-o como uma forma de resistência contra a predação neoliberal, a degradação ecológica, o racismo, o patriarcado, a homofobia, a incapacitação das pessoas com deficiência, entre outras.

Neste cenário, é necessária uma reinvenção do Direito no enlaço de uma justiça de alta intensidade. A justiça de alta intensidade exige que os tribunais ousem olhar para os conflitos substantivos e estruturais que subjazem nas nossas sociedades, indo, assim, ao encontro das reivindicações atrás mencionadas.

O patriarcado é, sem dúvida, uma das formas de silenciamento e subalternização mais resistentes e transversais nas diferentes sociedades, tornando-se premente analisar, num espaço e tempo em que os quadros jurídicos normativos nacionais e internacionais tendem a ser promotores de igualdade entre homens e mulheres, as conquistas que o Direito tem efetivamente possibilitado e com que intensidade. É certo que o Estado de Direito e a democracia representativa criam a impressão de que todos/as os/as cidadãos/ãs têm direitos iguais e o mesmo valor social. Mas quando rasgamos um pouco mais a capa de aparente igualdade promovida pelo liberalismo, somos confrontados/as com múltiplas discriminações e desigualdades. Impõe-se, então, indagar se o Direito oferece efetivamente aos feminismos instrumentos úteis nessa luta contra o patriarcado. A perspetiva que me move funda-se numa política de reconhecimentos, ou seja, na ideia de que uma “ecologia de reconhecimentos” (Santos, 2003b: 743) toma parte na transformação do

que existe criando novos espaços de possibilidade. Ou seja, ao reconhecer eixos emancipatórios no Direito, a sociologia das ausências explora aqui a possibilidade do seu uso em lutas feministas.

A luta feminista selecionada foi a luta contra a violência exercida sobre as mulheres nas relações de intimidade, mormente designada por violência doméstica, que permanece na atualidade como uma relevante fonte de exclusão social. Com uma crescente visibilidade na esfera pública, traduzida num claro aumento das denúncias, este tipo específico de violência tem sido objeto de diversas políticas, em particular dirigidas à sua criminalização.

Assim, a presença do Direito no combate à violência doméstica e nas reivindicações e expectativas quer de vítimas, quer das organizações de mulheres, é incontestável. Com efeito, uma critica feminista do Direito permitiu constatar que o recurso ao direito tem tanto de temeroso quanto de inevitável. Tendo este pressuposto de base, de ceticismo mas também de crença, esta tese parte de uma questão específica ancorada empiricamente num estudo de caso – quais os obstáculos e as potencialidades do Direito no combate à violência contra as mulheres nas relações de intimidade? – para almejar a resposta a um desassossego teórico mais geral: o Direito tem lugar na luta feminista?

Universidade de Coimbra, 27 Dezembro de 2013

Doutoramento em Relações Internacionais – Política Internacional e Resolução de Conflitos

Coming Into Life: The Concept of Peacebuilding in the United Nations, from an Agenda for Peace to the Peacebuilding Commission

Fernando Carlos Cavalcante Barros Rodrigues

Esta tese analisa como o conceito de 'consolidação da paz' ganhou vida na Organização das Nações Unidas (ONU) no início dos anos 1990 e as implicações deste processo para a abordagem da Organização em relação a sociedades afetadas por conflitos armados. O principal argumento aqui avançado é que a forma como o conceito de 'consolidação da paz' surgiu e ganhou notoriedade no particular contexto das Nações Unidas teve uma influência profunda e duradoura na prestação de apoio, por parte da Organização, a sociedades afetadas por conflitos armados, uma vez que este processo não apenas influenciou o significado central, como também impediu mudanças significativas do conceito de consolidação da paz. De um conceito avançado no relatório do Secretário-Geral «Uma Agenda para a Paz», de 1992, a 'consolidação da paz' tornou-se uma atividade central das Nações Unidas no domínio da paz e da segurança internacionais. O conceito tem oferecido a base, motivado, legitimado e informado as estruturas cuja interação resultou na implementação de políticas concretas em vários cenários de pós-conflitos armados, incluindo El Salvador, Moçambique, Camboja e Timor-Leste. Mais recentemente, o conceito teve papel central no estabelecimento e no funcionamento da Comissão de Consolidação da Paz (PBC), do Escritório de Apoio à Consolidação da Paz (PBSO) e do Fundo de Consolidação da Paz (PBF). Esta tese ocupa-se da trajetória daquele conceito ao construir uma narrativa teoricamente informada sobre as origens e os diferentes significados e manifestações da 'consolidação da paz' no contexto das Nações Unidas. A tese dialoga com a chamada literatura da crítica da paz liberal, que caracteriza a consolidação da paz contemporânea em termos de uma agenda

top-down (de cima para baixo) e proativa de promoção de normas e valores liberais democráticos como solução para os desafios enfrentados por sociedades afetadas por conflitos armados. Em termos teóricos, esta narrativa parte de princípios construtivistas sobre a construção social da realidade para delinear como teorias acadêmicas específicas, em uma versão simplificada e politizada, ajudaram a moldar o conceito de 'consolidação da paz' nas Nações Unidas em diferentes momentos históricos. Metodologicamente, a tese baseia-se fortemente na observação participativa dos trabalhos da ONU em Nova York, em pesquisa documental e em entrevistas realizadas em primeira mão com indivíduos diretamente envolvidos em processos de consolidação da paz das Nações Unidas desde os finais dos anos 1980 até o presente. As abordagens teórica e metodológica aqui adotadas ajudam a abrir a 'caixa preta' das organizações internacionais e a investigar em profundidade o funcionamento diário das Nações Unidas, destacando a importância de aspectos não materiais, de estruturas burocráticas, bem como da agência de indivíduos na determinação da conceitualização e da prática da ONU no que respeita a construção da paz. As principais contribuições desta tese são duas: lançar um novo entendimento sobre as origens do conceito de 'consolidação da paz' nas Nações Unidas, especialmente conforme definido no já citado relatório «Uma Agenda para a Paz»; e utilizar conhecimentos produzidos pela crítica da paz liberal para examinar a criação e o funcionamento da Comissão de Consolidação da Paz, do Escritório de Apoio à Consolidação da Paz e do Fundo de Consolidação da Paz a partir da perspectiva de desenvolvimentos ocorridos no interior das Nações Unidas.

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Doutoramento em Relações Internacionais – Política Internacional e Resolução de Conflitos

Citizenship and Post-Armed Conflict Statebuilding: Re-Engaging with Power and Politics in Spaces of Intervention. The Illustrative Case of Guatemala

Marisa de Fátima Inácio Horta Borges

Post-armed conflict statebuilding has come to be considered as a fundamental element of building a viable and sustainable peace in the aftermath of armed conflict. Though this compromise with state was in the first years mainly directed to democracy promotion, its policies and premises have evolved towards a more technical project of institutional capacitation, which seeks to address states' fragility and create the condition for a lasting peace. This evolving compromise has been subjected to wide reflection, both in the policy circles engaged in intervention spaces and in the academia. The critiques and reflections were mainly guided by two perspectives: a first one, which questioned whether statebuilding contributed to creating peace; and a second one, which mainly questioned the type of peace created. On one hand, the appeals to refocus on state-society relations and to promote local ownership emerged as necessary conditions to create an effective, sustainable and legitimate state able to contribute for the creation of peace. On the other hand, critics progressively exposed how statebuilding represented an external-oriented exercise of stabilisation which ultimately put in motion a depoliticisation process of the post-armed conflict spaces and subjects. However, and when one explores this discussion, one deals with an awkward silence towards citizenship, the concept which has traditionally framed the political condition of individuals and state-society relations, and responsible for investing states with legitimacy. More important, we have identified this silence not only in the normative policy papers of major international organisations but also in the debates that have criticised the limited achievements of statebuilding or how it has produced a depoliticising narrative of the local spaces of intervention through its technical mantra. Accordingly, this work seeks to

explore this silence and bring citizenship back to this discussion. For that purpose we depart from the concept of citizenship and the condition of citizenship that has emerged in Guatemala in formal peace and how the discourses and practices of post-armed conflict statebuilding have contributed to the (re)creation of a peaceful sociability in the country. Our purpose is to depart from the possibilities opened by an analysis centred on citizenship to re-engage with power and politics on spaces of intervention in order to overcome the current narratives and recognise the political condition of individuals and groups in these spaces.

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Doutoramento em Pós-Colonialismos e Cidadania Global

Acesso para Quem Precisa, Para Quem Luta, Direito para Quem Conhece. Dinâmicas de Colonialidade e Narra(alterna-)tivas do Acesso à Justiça no Brasil e em Portugal

Élida de Oliveira Lauris dos Santos

A pergunta "depois do fracasso da promessa de acesso à justiça, ainda há esperança para as/os pobres?" é o ponto de partida deste estudo. Para responder a esta questão, dedico-me à análise dos mecanismos que detém o dever institucional charneira de inclusão das/os pobres no direito, a assistência jurídica. Contrariando a tendência geral dos estudos comparativos sobre acesso à justiça, a tese traça uma comparação das realidades brasileira e portuguesa. Convoca-se tanto o realismo da carência, quanto o potencial da promessa de acesso à justiça. Na conjugação dessas duas extremidades, reinvidica-se uma reflexão crítica quer sobre as condições de desenvolvimento dos mecanismos de acesso, quer sobre as direções apontadas e seguidas pelos estudos sociojurídicos. Com suporte em métodos de análise qualitativa e ancorados numa abordagem culturalista do direito, os resultados do estudo apuram uma constelação de significados, interpretações e experiências subjetivas inerente aos processos societais de criação, aplicação e uso do direito. As condições de cumplicidade entre a proposta de igualdade jurídica formal e as relações de dominação consagradas pelo sistema jurídico são desveladas a par do conhecimento ilustrativo do funcionamento dos serviços jurídicos de assistência.

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Doutoramento em Gestão de Empresas

O Contributo da Auditoria Interna para o Governo das Sociedades

Isabel Maria Loureiro Pais Esteves Martins

Nos últimos anos temos vindo a assistir a uma constante preocupação de reforma da estrutura de poder e controlo das empresas, mais concretamente após os grandes escândalos financeiros muito divulgados nos órgãos de comunicação social a nível global. São exemplos, nos Estados Unidos, as empresas Enron, WorldCom e Tyco, e na Europa, as empresas Royal Ahold, Skandia Insurance of Sweden e Parmalat. Para dar resposta aos imperativos de mudança (Jackson, 2012 p. 36), os países tem vindo a reforçar a sua legislação relacionada com o governo das sociedades, introduzindo penalizações gravosas para os incumpridores, bem como os organismos reguladores dos mercados de valores mobiliários e das ordens profissionais relacionadas com a contabilidade, auditoria e finanças, aos níveis nacional e internacional, através de autorregulação.

Nesta perspetiva, foi efetuada uma revisão da literatura a fim de identificar a metodologia a seguir e definir algumas hipóteses de investigação. Foram analisados os relatórios de governo de sociedade adotado das quarenta e quatro empresas cotadas na Bolsa de Valores de Lisboa (não foram incluídas as três Sociedades Anónimas Desportivas, atendendo as suas especificidades), relativos ao exercício económico de 2010, a verificar o modelo adotado, a presença de administradores executivos e não executivos, independência desses administradores, órgãos de fiscalização e comissões especializadas, incluindo a comissão executiva, a auditoria externa e interna.

Tendo em conta a autorregulação das empresas, e com base no inquérito global realizado pelo The Institute of Internal Auditor (IIA) sobre a atividade de auditoria interna à escala global, foram analisados alguns pontos considerados pertinentes nesta investigação: caraterização do auditor interno; caraterização da atividade de auditoria interna, medição de desempenho, monitorização das ações corretivas e perceção da contribuição de valor acrescentado, testando algumas hipóteses.

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Doutoramento em Gestão de Empresas (Especialidade em Finanças)

Fatores Determinantes da Moral Tributária em Portugal: Uma Análise através da Aplicação de um Modelo de Equações Estruturais

Cristina Isabel Branco de Sá

Esta dissertação tem por objetivo analisar os fatores determinantes da moral tributária dos contribuintes portugueses. Assim, o trabalho enquadra-se na temática tributária, em particular na categoria dos trabalhos empíricos dedicados ao estudo das motivações subjacentes ao cumprimento fiscal. Partindo da caracterização da diversidade de comportamentos exibida pelos contribuintes perante as suas obrigações fiscais, este trabalho apresenta, primeiramente, as diferentes abordagens existentes para a explicação desses comportamentos. Os primeiros estudos sobre este tema, desenvolvidos na década de 70, suportados pela teoria da utilidade esperada, consideram os fatores de dissuasão, nomeadamente a probabilidade de deteção e as sanções, como os determinantes da tomada de decisão por parte dos contribuintes. Porém, nas últimas décadas as abordagens multidisciplinares têm vindo a prevalecer face aos denominados modelos económicos tradicionais. Os fatores psicológicos, morais e sociais são decisivos na explicação do comportamento dos contribuintes na generalidade dos países, salientando-se a moral tributária como elemento decisivo na compreensão dos níveis de cumprimento fiscal existentes. O conceito de moral tributária, o estudo dos fatores que a influenciam e a sua importância na explicação do comportamento dos contribuintes são os aspetos mais relevantes abordados nesta dissertação. As principais conclusões obtidas no âmbito desta investigação são relevantes tanto para a comunidade académica como para os decisores políticos. A melhor compreensão da motivação intrínseca dos indivíduos para o cumprimento fiscal poderá auxiliar a definição de medidas mais eficazes no aumento do cumprimento fiscal e no combate à fraude fiscal. O estudo empírico realizado permitiu o desenvolvimento de um modelo multidisciplinar que mostra a influência dos fatores de natureza política e social na moral tributária. Através deste modelo também foram estudados os efeitos sobre a moral tributária das características sociodemográficas, do nível de aversão ao risco e do grau de identificação dos indivíduos com o país. Neste estudo empírico foram utilizados dados do European Values Study (EVS) disponibilizados em 2010, e recolhidos em 2008. A amostra é composta por 1.553 indivíduos representativos da população portuguesa. O EVS recolhe um conjunto de informações relativas aos valores e ideais dos cidadãos europeus, e a sua utilização apresenta diversas vantagens face aos objetivos desta pesquisa. Sendo o tema da moral tributária ainda pouco abordado em Portugal, pretendemos aprofundar a investigação sobre os seus determinantes nos contribuintes portugueses e apresentar um contributo empírico relativamente à temática do comportamento dos contribuintes. O trabalho desenvolvido permitiu, fundamentalmente, realçar a influência dos determinantes de natureza não económica na motivação intrínseca dos indivíduos para o pagamento dos impostos. Os resultados obtidos mostram que as condições políticas e sociais em que pagamento de impostos é exigido aos cidadãos influenciam a sua motivação intrínseca. Também os fatores psicológicos e as características sociodemográficas. No que se refere aos fatores políticos a existência de sistema político democrático reflete-se num aumento da moral tributária. Concluímos também que os indivíduos que apresentam maior grau de satisfação com a vida tendem a manifestar maior disponibilidade para o pagamento de impostos. Os resultados obtidos mostram ainda que essa motivação é influenciada pelo reconhecimento e valorização da democracia, como regime político, pela satisfação individual e pela religiosidade. No que se refere às características sociodemográficas os resultados mostram que os viúvos, os reformados, os indivíduos com menores rendimentos, maior nível de formação académica e os mais velhos

declaram maior predisposição para o pagamento de impostos. Os indivíduos mais avessos ao risco, e os que apresentam maior orgulho em serem portugueses revelam também um nível de moral tributária mais elevado.

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