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THE ECONOMICS OF LEGAL HARMONIZATION

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The Economics of Legal Harmonization

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Abstract

The global legal landscape is undergoing substantial transformations, adapting to an increasingly global market economy. Differences between legal systems create obstacles to transnational commerce. Countries can reduce these legal differences through non-cooperative and cooperative adaptation processes, fostering networks of trade that link diverse legal traditions. In this article, we study the process of legal adaptation, looking at non-cooperative and cooperative solutions that can alternatively lead to legal transplantation, harmonization and unification. The presence of adaptation and switching costs renders unification extremely difficult. In the general case, cooperative solutions reduce differences to a greater extent than non-cooperative solutions, but rarely lead to complete legal unification. We consider the case of endogenous switching costs and show that when countries have the possibility to reduce their own switching costs to facilitate harmonization, they may actually choose to raise them. This may lead to the paradox that countries engaging in cooperative harmonization end up with less harmonization than than those that pursued non-cooperative strategies. This explains why differences are often bridged by private codifications and by the evolving norms of the lex mercatoria.

JEL Codes: K10, K33, D70

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1 Introduction

Nowadays we live in a world that, contrary to the past, changes fast in time and tends towards globalization. Differences between systems tend to narrow over time. This is especially true in the economic laws and customs that govern transnational commerce. Harmonization of legal regimes was unnecessary in economies characterized by closed national markets. With the gradual abolishment of legal and geographical barriers to trade, present-day commerce is gradually moving towards globalization. Transnational exchanges are no longer the exception to the rule, but are as important, in terms of their number and total value, as internal, domestic ones.

It is a matter of fact that the harmonization of legal regimes lags behind the fast process of market unification. Legal systems remain substantially different in space. Countries are attached to their legal traditions, which is perceived to reflect the norms and accepted usages of their citizens, guaranteeing a stable environment where economic agents could produce and trade with other national partners. Individual transactions are subject to domestic law. When the transaction has points of relevant connection with more than one legal system, conflict of law rules provide a basis for identifying the applicable law. Alternatively, the parties may negotiate and introduce a choice of law clause in their contract.

In all such instances, the diversity of legal systems creates costs to transnational trade. To reduce such costs, private associations often try to cope with the slow process of legal harmonization carried out by national legislative bodies, formulating uniform standards and drafting model codes that could be chosen to regulate transnational transactions (*lex mercatoria*). Due to the high information and transaction costs, however, the adoption of such uniform rules for international commerce is not always a viable alternative for individual non-professional traders. Such legal regimes are adopted prevalently by professional traders, who are willing to opt out of the applicable legal regime with express choice of law and choice of forum clauses in their contracts.

In this paper we try to explain why countries delay or avoid a process of legal harmonization that could reduce barriers to international trade. In the present globalized market, countries face conflicting incentives. On the one hand, there are advantages in preserving local laws due to switching and adaptation costs. On the other, there is an increasing need to homogenize commercial laws for a uniform regulation of transnational trading flows. A large variety of instruments are utilized to to reduce differences among legal systems, harmonizing national legal rules for the creation of a leveled playing field for transnational commerce.

First, legal systems can unilaterally amend their internal rules and adopt rules that are more frequently observed in other legal systems. In the comparative law literature, this form of harmonization is referred to as "*legal transplantation.*" Legal transplantation consists in the introduction, in national legal systems, of statutes and principles belonging to other systems, be they legal rules of other countries or customs whose acceptance is widespread.[1] Legal transplantation reduces or potentially eliminates differences between legal systems through the unilateral non-cooperative effort of one system. Examples of legal transplantation include the adoption of the 1804 French Civil Code by Louisiana (under the form of the 1808 Digest of the Civil Laws in Force in the Territory of New Orleans) and the subsequent adoption of the French Code by several European nations. The wholesale transplantation of the 1900 German Civil Code (BGB) in Japan is another example of unilateral adoption of legal principles belonging to a foreign system.

Second, legal systems can bilaterally or multilaterally coordinate their efforts by harmonizing or unifying their national systems. With "*legal harmonization*" nations agree on a set of objectives and targets and let each nation amend their internal law to fulfill the chosen objectives. With "*legal unification*" nations agree to replace national rules and adopt a unified set of rules chosen at the interstate level. Although legal harmonization and legal unification are often pursued with different legal instruments, they both result from cooperative efforts of the countries involved. The results of legal harmonization and legal unification differ however in the degree to which systems are effectively homogenized. Examples of harmonization and unification are frequently observed in the recent development of the national laws of EU member states. With the use of "directives" member states of the EU harmonize their national legal systems by setting common goals and standards. With "regulations" EU countries instead agree to replace their respective national laws with a common rule which becomes directly applicable in the national systems of all member states.

Through these non-cooperative and cooperative adaptation processes, the global legal landscape has undergone – and continues to undergo – substantial changes adapting to an increasingly global market economy. Processes of transplantation, harmonization and unification foster networks of trade, linking diverse legal traditions and often bridging principles of Civil and Common law.[2]

[1] See Mattei (1997), Sacco (1991) and Watson (1995) for an extensive analysis of legal change through processes of legal trasplantation.

[2] As noticed by Galgano (2005), judge made law is gaining more and more importance in civil law countries. We are witnessing what we could call the *Americanization* of law. Interestingly, the harmonization of law is not only between North America and Europe, it

Notwithstanding the undeniable benefits of legal harmonization, countries are not trying to eliminate legal differences to the extent one would expect. We could think that this is possibly due to the presence of switching costs and to costs of international cooperation. It is then plausible to assume that, in the absence of such costs, either full transplantation or unification would occur. A logical implication of this result is that, if countries had the opportunity to do so, they would choose to reduce switching costs to facilitate legal harmonization. Surprisingly, we find that this is not necessarily the case. Even if given the opportunity to reduce switching costs, a country might choose to keep high switching costs, and in some circumstances, it might even decide to incur a cost to raise its own switching costs.

This counter-intuitive result is driven by the strategic nature of countries' efforts to reduce the difference among respective legal systems. We find that efforts are strategic substitutes, *i.e.* the marginal benefit from increasing one country's effort is decreasing in another country's effort. This implies that a country has the incentive to decrease its own effort when another one increases its own. Vice-versa, a country tends to increase its own effort when another decreases it. By raising switching costs, a country credibly commits itself to a low effort, inducing the other countries to increase their effort because of strategic substitutability. Interestingly, the incentive to increase switching costs arises when the other country is expected to exert high levels of harmonization efforts. Countries that can control their own switching costs can thus put themselves in an condition to free ride on other countries' legal harmonization effort.

This conclusion is reinforced by the finding that the elasticity of one country's effort with respect to changes in another country's switching costs, affect the incentives to change switching cost. As a consequence, it might well happen that a country has stronger incentives to increase its switching costs when the country expects to enter into a cooperative harmonization plan in the subsequent stage of the game. It is then possible that, due to the strategic incentives to increase their switching costs prior to a cooperative stage, there may actually be less harmonization when countries engage in cooperative efforts than when they proceed non-cooperatively with independent transplantation efforts.

We believe that our model provides an accurate description of the processes of legal transplantation and harmonization, giving an account of both the fact that market globalization runs ahead of legal harmonization and

also involves eastern countries, especially from Asia and this process, together with the fast rate of economic growth affecting some of these countries (like China and India), might prelude to the end of the western hegemony in the world economy hence on international commercial law.

that gaps have often to be bridged by means of customary rules and *lex mercatoria.*

We consider the simple case of two countries or legal families A and B that initially have different legal systems. We describe the differences between these legal systems as a "legal distance." The distance between legal systems imposes costs on the countries' ability to foster private transnational transactions. Working within the same legal system increases the frequency and the profitability of commercial transactions as it reduces the uncertainty stemming from not knowing the legal rules governing the contract.

In order to reduce legal distance, countries can undertake unilateral transplantation of the rules of one system into the other. Alternatively, countries have the opportunity to negotiate a solution under which the preexisting legal systems are harmonized or even unified through international cooperation agreements. The adaptation of legal systems to shorten legal distance, however, is not without costs. In our analysis we consider the switching costs that legal systems have to face when unilaterally or bilaterally adopting a new legal rule. The switching costs brought about by legal innovation are due to the need to adapt preexisting legal rules and institutions (e.g., obsolescence of preexisting case law, information costs to judges, lawyers and legal academics, possible surge of litigation due to lack of legal precedents and doubts on the interpretation of the new laws by courts, etc.).

Cooperative solutions are modelled as alternative or subsequent to non-cooperative unilateral solutions. In negotiating a cooperative legal harmonization or unification agreement, countries maximize their joint welfare subject to the constraint that none of them obtains a payoff from the cooperative agreement that is lower than the payoff of the unilateral non-cooperative transplantation strategy. It is possible to show that there exist a cooperative solution, where countries take their respective non-cooperative solutions as their threat points and where the treaty agreement involves a reduction of the legal distance obtainable via unilateral non-cooperative transplantation. This creates incentives towards cooperative harmonization or unification solutions, which may however be hindered by positive switching costs.

The paper is organized as follows. In Section 2 we introduce the model. In Section 3, we study the non-cooperative processes of legal change leading to legal transplantation. In Section 4, we analyze the cooperative processes of legal change leading to harmonization and unification. In Section 5, we provide an explicit example with quadratic cost functions. In Section 6, we consider the more complex case where countries can endogenously affect switching costs. The possibility of cooperative harmonization and unification is studied as a two-stage game where one or both countries have the opportunity to affect their respective switching costs by making a costly investment

prior to the beginning of cooperative bargaining. Section 7 concludes offering some ideas for possible future extensions.

2 The model

We consider a simple scenario with two countries that have different legal systems. Country A has legal system a while country B has legal system b.[3] There are legal and contractual transactions between the two countries, as well as transactions that take place within the domestic sphere of each country. The difference in the substantive law of legal systems a and b imposes a cost on both countries A and B, reducing the net benefits from transnational commercial transactions. The difference between the legal systems imposes no cost on the domestic transactions that take place within each system.

We model the difference in the substantive law of the two countries as a continuous variable and refer to it as *legal distance* D. We assume complete and symmetric information, such that countries know each other's legal systems and have knowledge of constitutional and legislative processes that the other country might be required to utilize to carry out legal change. Symmetric information further avoids mis-coordination problems, where A might paradoxically adopt B's legal rules in situations where B has meanwhile decided to adopt rules from a.[4] Countries also know the exact value of legal distance D at any moment in time. Moreover, we abstract from efficiency considerations assuming that a and b are equally efficient and concentrate instead on the costs that legal distance imposes on countries' transnational transactions and the switching costs incurred by countries in the process of transplanting, harmonizing, or unifying legal rules to shorten legal distance.[5]

[3] The terms A and B can also be interpreted as "legal families" (i.e., groups of countries that share a common legal tradition).

[4] The danger of mis-coordination would increase the expected costs from unilateral transplantation and would likely reduce the extent to which individual countries are willing to adapt their system to another, absent explicit cooperation. However, in the real world information about legal systems is easily available and the introduction of uncertainty would not necessarily provide interesting insights.

[5] In our setting, assuming that one system is more efficient (*e.g.* a is better than b) would imply that in equilibrium a higher fraction of a would be adopted by B and that a lower fraction of b would be adopted by A. The process of legal change – whether it is carried out via transplantation, harmonization, or unification – would generally tend towards the more efficient legal system. However, the adoption and spread of the more efficient legal system is not always guaranteed. As we have shown in a different paper (Carbonara and Parisi, 2005) the adoption of legal rules is a path-dependent process, where network externalities play a crucial role and it is plausible that more efficient norms are abandoned or are simply unable to spread.

We normalize legal distance, such that when the two systems are one-hundred percent different from one another distance D would be equal to 1. When looking at legal change in both non-cooperative and cooperative settings, we denote by x_A the percentage of legal system b adopted by A and by x_B the percentage of legal system a adopted by B. In our model, the quantities of the foreign system that each country transplants into its own domestic law are strategic *substitutes*. The unilateral move of one system (say, system A) towards the other (system B), reduces the incentives for system B to move closer to A. After countries undergo legal change, the remaining distance between legal systems can be defined as the difference between the original distance and the portions of foreign law that have been respectively adopted by B and A, namely $D = 1 - x_B - x_A$. This definition implies that when countries make no effort to approach each other's systems, the distance between legal systems remains at 1. Similarly, if only one of the two countries modifies its legal system, the remaining distance will depend entirely on the extent of that country's adaptation efforts. Finally, in case of legal unification where both countries modify their domestic law and succesfully eliminate all legal differences, $x_A + x_B = 1$, the residual distance will be null, $D = 0$. Ideally, such complete form of legal unification could occur through both independent non-cooperative transplantation strategies and cooperative efforts. However, our model shows that, in the presence of adaptation costs, complete unification is a more plausible outcome of cooperative efforts. In a cooperative regime, in fact, countries reduce legal distance more.

By assuming that countries invest in legal change in order to reduce differences with other legal systems only, we are able to exclude the paradoxical danger of "leapfrogging".[6] With leapfrogging countries would "transplant too much" of each other's legal system so that new differences appear the other way round (system A has adopted much of the former system B and vice-versa): despite the substantial efforts of both countries, legal systems would remain different from one another.

To illustrate how the definition of distance adopted here works in practice we present a numerical example. Suppose that country A adopts 30% of legal system b as part of its own system, whereas B adopts 70% of a, so that

[6]Note that setting $D = 1 - x_A - x_B$ implies that $D < 0$ whenever legal change is characterized by a paradoxical leap-frogging $x_A + x_B > 1$. If such leap-frogging were allowed, it would then be necessary to take the absolute value $|1 - x_B - x_A|$ to measure the new legal differences occasioned by excessive reciprocal transplantation. The conditions of our model and the assumption of complete and symmetric information exclude such paradoxical result, such that in equilibrium, $1 - x_B - x_A \geq 0$. For simplicity, we thus proceed without absolute value notations.

$x_A = 0.3$ and $x_B = 0.7$. As an effect of such legal change, the two legal systems will be modified such that country A's new legal system a' will be reflect the 30% of adopted rules from b and 70% of the preexisting rules of a, resulting in $a' = 0.7a + 0.3b$. Likewise, country B's new legal system will be represented by $b' = 0.7a + 0.3b$. It is immediate to see that $a' = b'$ and that the two legal systems have converged de facto adopting a unified common system. In fact, through their reciprocal adaptations, $x_A + x_B = 1$ the differences between their legal systems have been entirely eliminated, $D = 0$. In other, more likely situations, the legal systems may partially converge, leaving some positive difference. Suppose, for example, that $x_A = 0.2$ and $x_B = 0.1$. Now, the new composition of system a will be $a' = 0.8a + 0.2b$ and the new composition of system b will be $b' = 0.1a + 0.9b$. The common core of the two systems would thus be represented by the adopted 10% of a and the adopted 20% of b, with a total common share of 30% of rules, with a remaining distance $D = 1 - 0.1 - 0.2 = 0.7$. As discussed before, complete and symmetric information allows us to ignore mis-coordination and leap-frogging outcomes. For example, we assume that countries avoid mis-coordination where they adopt each other's rule on any given legal issue and as a result remain different. Likewise, we exclude paradoxical leap-frogging results such as $x_A + x_B > 1$, where the two countries would switch legal systems, ending up with a positive legal distance.[7]

We can now characterize the payoff functions. Countries obtain a payoff f_i $(i = A, B)$ from engaging in domestic and transnational commercial transactions. To simplify our notations, we assume that transnational transactions will still take place when countries have different legal systems, but at a higher cost. Since transactions are not prevented by legal diversity, the gross benefit from such transactions is assumed not to change with the distance between legal systems. The transaction costs incurred in transnational commerce however depend on the distance between legal systems, such that net payoffs become a decreasing function of legal distance $d_i(D)$, with $d_i'(\cdot) > 0$, $d_i''(\cdot) > 0$, $d_i(0) = d \geq 0$ and $d_i'(0) = 0$. Such transaction cost function captures the information and coordination costs that arise when foreign parties enter into legal transactions with one another. Countries have the

[7] If we relaxed this hypothesis, there would always be the positive probability that a country makes a mistake and transplants parts of the other legal system the other country has or plans to change on its own. For example, in the absence of complete information, we could observe the case where $x_A = x_B = 0.6$. Here $a' = 0.4a + 0.6b$ and $b' = 0.6a + 0.4b$ and, in spite of the substantive adaptation that both contries undertook, the two systems would only have 40% of a and 40% of b in common. The difference would in this case be positive, notwithstanding the very high adaptation effort: the absolute value of D would in fact be 0.2.

chance to reduce distance (hence transaction costs) by adopting (part or the whole) of the legal system of the other country. This "shortening" of legal distance D can take place through non-cooperative unilateral transplantation or else through cooperative harmonization or unification. When countries adopt – via non-cooperative or cooperative action – foreign rules, they face adaptation cost $s_i(x_i)$, where $s_i(0) = 0$, $s_i^{'}(\cdot) > 0$, $s_i^{'}(0) = 0$ and $s_i^{''}(\cdot) > 0$.

Given x_j, $j \neq i$, country i's problem is to

$$\max_{x_i} \quad w_i(x_i, x_j) = f_i - d_i(D) - s_i(x_i) \tag{1}$$

where the hypotheses on the cost functions guarantee that the welfare function of country i is globally concave in x_i.

3 The process of legal transplantation

Countries can reduce transaction costs caused by legal distance by importing foreign rules and legal doctrines into their domestic system. This form of unilateral adoption of another system's laws is known as legal transplantation. In this case countries act independently of one another in a non-cooperative manner, choosing their own degree of transplantation x_i given the other country's transplantation x_j.

As it will be shown in the following, countries always have some positive incentive to transplant some of the other country's legal system into their own to reduce the transaction costs occasioned by differences with other legal systems. However, by acting unilaterally in a non-cooperative manner, the presence of positive switching costs leads to a Nash equilibrium where distance is not fully eliminated and legal systems mantain some difference.

This can be seen by looking at the first order conditions of country A's and country B's optimization problems:

$$\frac{\partial w_A(x_A, x_B)}{\partial x_A} = -d_A^{'}(D)\frac{\partial D}{\partial x_A} - s_A^{'}(x_A) = 0 \tag{2}$$

$$\frac{\partial w_B(x_A, x_B)}{\partial x_B} = -d_B^{'}(D)\frac{\partial D}{\partial x_B} - s_B^{'}(x_B) = 0 \tag{3}$$

Given global concavity of the contries' welfare functions, the Nash equilibrium solution yields transplantation levels x_A^N and x_B^N, where the superscript indicates that these values form a Nash equilibrium.[8]

[8] We assume that the condition for equilibrium uniqueness and stability is satisfied. Such condition requires that the slope of A's reaction function is larger than the slope

The countries' reaction functions are negatively sloped. This can be proved by totally differentiating country i's welfare function, which yields $\left.\frac{dx_j}{dx_i}\right|_i = -\frac{\partial^2 w_i/\partial x_i^2}{\partial^2 w_i/\partial x_i \partial x_j}$. Since $\partial^2 w_i/\partial x_i^2 < 0$, $sign\left[\left.\frac{dx_j}{dx_i}\right|_i\right] = sign\left[\frac{\partial^2 w_i}{\partial x_i \partial x_j}\right]$. Differentiating country i's welfare with respect to x_j yields $\frac{\partial^2 w_i(x_i,x_j)}{\partial x_i \partial x_j} = -d_i^{''}(D)\frac{\partial D}{\partial x_i}\frac{\partial D}{\partial x_j} < 0$, given $d_i^{''}(D) > 0$ and $\frac{\partial D}{\partial x_i} < 0$. Then according to the terminology introduced by Bulow et al. (1985) x_A and x_B are strategic substitutes. In fact, an increase in x_i means an increase in the degree of legal transplantation carried out by country i, hence a more favorable attitude towards the other country. When a country backs up, reducing the percentage of rules transplanted, the other country faces higher transaction costs and welfare maximization requires higher transplantation effort of its own, in order to reduce the cost of legal diversity.

In a Nash equilibrium, we find that when countries are involved in transnational commercial transactions, they will have incentives to engage in some transplantation, such that both x_A^N and $1 - x_B^N$ would be positive. This can be also seen by observing that the optimal response to any level of partial (or even null) transplantation by the other country is always to transplant a positive percentage. However, in a Nash equilibrium distance always remains positive, meaning that the existence of switching costs and the concavity of welfare functions prevent the two countries from reaching complete legal unification by means of non-cooperative unilateral efforts. Define $D^N = 1 - x_A^N - x_B^N$ the distance in the Nash equilibrium.

Lemma 1 *In the Nash equilibrium, $x_A^N > 0$ and $x_B^N > 0$ always.*

Proof. >From the first order conditions in (2) and (3) it can be readily seen that, for any given x_j, $-\left.d_i^{'}(D)\frac{\partial D}{\partial x_i}\right|_{x_i=0} - s_i^{'}(0) > 0$ since $s_i^{'}(0) = 0$. Therefore $0 < x_i(x_j)$ for all $x_j \in [0,1]$. This, together with the conditions for the existence, uniqueness and stability of the Nash equilibrium, implies that $x_A^N > 0$ and $x_B^N > 0$ always. ■

Proposition 1 *Given the existence of positive switching costs $s_i(x_i)$, in a Nash equilibrium distance D^N is positive, implying that there will never be complete legal unification by means of non-cooperative unilateral efforts.*

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of B's reaction function, *i.e.* $\left.\frac{dx_B}{dx_A}\right|_A > \left.\frac{dx_B}{dx_A}\right|_B$. A sufficient condition for this to happen is $\left.\frac{dx_B}{dx_A}\right|_A > 1 > \left.\frac{dx_B}{dx_A}\right|_B$, that is $\left|\frac{\partial^2 w_A}{\partial x_A^2}\right| > \frac{\partial^2 w_A}{\partial x_A \partial x_B}$ for A and $\left|\frac{\partial^2 w_B}{\partial x_B^2}\right| > \frac{\partial^2 w_B}{\partial x_B \partial x_A}$ for B. This condition ensures that the reaction functions cross only once, while also guaranteeing stability of the equilibrium. In fact the equilibrium is stable (locally) if $\frac{\partial^2 w_A}{\partial x_A^2}\frac{\partial^2 w_B}{\partial x_B^2} > \frac{\partial^2 w_A}{\partial x_A \partial x_B}\frac{\partial^2 w_B}{\partial x_B \partial x_A}$ which is implied by the first condition.

Proof. The proof goes by showing that, for any given level of the other country's transplantation effort x_j it would not be optimal for country i to set $x_i = 1 - x_j$ thus bringing distance to 0. From the first order conditions in (2) and (3), at $D = 0$, $-d_i^{'}(0)\frac{\partial D}{\partial x_i} - s_i^{'}(x_i) < 0$ since $d_i^{'}(0) = 0$. Therefore, for any $x_{j,}$ the best response is to set x_i so that $D > 0$, i.e. $x_i < 1 - x_j$. This is true for all $x_j \in [0, 1]$ and therefore it must be true in the equilibrium; $x_A^N + x_B^N < 1$. ■

The result in Proposition 1 should be understood in light of the following considerations. The main assumptions driving our result are that the marginal cost of a change in distance is zero when $D = 0$ and that the gross payoff from commercial transactions f_i is not influenced by legal distance (*i.e.* transnational contracts become more costly but are not entirely prevented by differences between legal systems). The first hypothesis about transaction costs is a typical regularity assumption satisfied, for example, by all quadratic cost functions. It states that when distance D is zero, an infinitesimally small increase in distance does not produce a sensible increase in total distance costs. It is therefore a very plausible assumption. Dealing with a legal system that is virtually identical to the domestic one does not provoke a substantial increase in costs. The second hypothesis, that legal distance only affects transaction costs for transnational contracts and does not entirely eliminate the surplus from such transactions, can be easily relaxed, introducing a function $f_i(D)$ that is decreasing in the distance, with $f'(D) \leq 0$ and $f''(D) < 0$.[9] However, the introduction of $f_i(D)$ in the welfare function can lead to the overinvestment paradox where, in equilibrium, $x_i^N + x_j^N > 1$. This can be avoided by assuming that the only incentive to invest in legal change is the desire to reduce differences with other legal systems, such that when differences have already been eliminated by the other country there is no remaining reason to implement change.[10]

Although Proposition 1 and its proof show that, under the conditions of our model, legal differences are never entirely eliminated through non-cooperative unilateral efforts, one might consider special situations where one of the countries has such a high marginal benefit from reducing legal distance that it finds it optimal to transplant the entire legal system of the

[9] The sign of the second derivative represents a sufficient condition for global concavity of the country's welfare function

[10] This implies that also $f(D)$ is maximized when $D = 0$, so that the reaction function is such that the best response to an effort $x_j = 1$ by the other country is $x_i = 0$. However, this leads back to the situation where, in the equilibrium, distance is not completely eliminated, as the best response to $x_j = 0$ is $x_i < 1$.

other country, thus reaching full legal homogeneity. This happens when

$$f_i^{'}(0)\frac{\partial D}{\partial x_i} \geq s_i^{'}(1) \tag{4}$$

where the right hand side of expression (4) represents the marginal benefit of eliminating distance, whereas the left hand side is the marginal cost and $f_i^{'}(0) < 0$. In the equilibrium we then have $x_i^N = 1$ and $x_j^N = 0$.

4 Harmonization, unification and transnational legal cooperation

Countries often pursue legal harmonization or unification through international cooperative efforts. The creation or mutual recognition of common legal principles can be achieved through international treaties (e.g., the 1980 Rome Convention on the Private International Law of Contracts), delegation to supranational organs (e.g., the EU's delegated authority to issue *directives* with the effect of harmonizing the national laws of member states, or *regulations* with the direct effect of unifying the member states' national rules on a given issue), and by establishing commissions or sponsoring academic projects (e.g., the Lando Commission on the European Law of Contracts; the Trento Common Core Project). Through these cooperative instruments, systems increase to a greater or lesser extent the degree of similarity between their legal systems.

In this Section, we model the process of legal change that may take place through these cooperative instruments. In our setting, countries bargain cooperatively to choose a target level of legal change that would reduce differences between their domestic systems. They do so by fixing the percentages of legal change, x_A and x_B, to be implemented in their respective national laws, ultimately determining the distance between their legal systems. These cooperative processes provide an alternative to the non-cooperative process of unilateral transplantation discussed in the previous Section. We refer to these cooperative processes of legal change, using the legal terms of *harmonization* and *unification* of legal systems, rather than transplantation. In the process of harmonization and unification countries fix x_A and x_B cooperatively, whereas with transplantation they do so independently. When the process of cooperative legal change leads to the complete equality of legal systems (meaning that distance $1 - x_A - x_B = 0$) we have *unification*. Such cooperation agreements are assumed to be binding and unilateral withdrawal from a cooperative solution is assumed to be costly. This assumption allows us to avoid ex post enforcement issues.

We model the process of harmonization as a cooperative game, where countries choose x_A and x_B to maximize the sum of individual welfare functions. Being a co-operative solution, harmonization allows countries to reach a higher total surplus. Countries share the surplus from cooperation which goes to augment the payoff otherwise obtainable in the non-cooperative Nash equilibrium.

The sharing of the surplus will take place according to one of the conventional sharing rules of cooperative bargaining. For example countries can share the surplus from cooperation reaching a point on the welfare possibility frontier where the ratio of country A's welfare to country B's welfare is equal to the pre-existing ratio of their non-cooperative equilibrium payoffs. Alternatively, countries could share the surplus from cooperation according to the allocation generated by a Nash bargaining solution. In that case countries would implement legal change that maximizes the product of their respective gains in welfare over the status quo non-cooperative outcome.[11] If countries have the same bargaining power and welfare functions, the sharing under a Nash bargaining solution would assign each country exactly one half of the cooperative surplus. Otherwise, Nash bargaining would yield shares that increase in bargaining power and in the slope of the other country's marginal welfare function.[12]

In this paper we assume that the surplus is allocated according to a sharing rule that assigns a fraction α of total cooperative surplus to A and a fraction $\beta = 1 - \alpha$ to B. This allows interpretations that are consistent with the alternative sharing rules discussed above.[13] As a result, the payoff that country i $(i = A, B)$ obtains from cooperative legal change becomes

$$\hat{w}_i = w_i^N + \kappa_i(\hat{W} - w_i^N - w_j^N) - T \tag{5}$$

where w_i^N is country i's welfare in the non-cooperative Nash equilibrium $(i = A, B,\ i \neq j)$, $\hat{W}$ is total welfare in the cooperative harmonization or unification regime and κ_i is country i's share $(\kappa_A = \alpha)$. T represents the fixed transaction costs of negotiating and carrying out the cooperative agreement between the interested countries. These fixed transaction costs may occasionally exceed the obtainable cooperative surplus and could thus

[11] In our case the status quo non-cooperative outcome corresponds to the Nash equilibrium with individual transplantation.

[12] For a thorough analysis of different bargaining rules and outcomes and their comparison with the Nash bargaining solution see Thomson (1994).

[13] If α and β are interpreted as the countries' bargaining power, our solution would resemble the Nash bargaining solution with different bargaining power. Alternatively, α might represent the ratio of A's to B's welfare, in which case we would have a proportional sharing rule.

prevent cooperative solutions. The presence of transaction costs T could thus explain situations where countries do not coordinate harmonization efforts and prefer to carry out unilateral transplantation strategies, even though, in the absence of T, the cooperative outcome would always be preferred to the non-cooperative outcome, since $\hat{W} - w_i^N - w_j^N > 0$ by definition.

When countries agree on a cooperative solution, they choose x_A and x_B maximizing their joint welfare and then apply the sharing rule to determine $\hat{w}_A$ and $\hat{w}_B$ as in expression (5). The joint-maximization problem for A and B thus becomes

$$\max_{x_A, x_B} \hat{W}(x_A, x_B) = w_A(x_A, x_B) + w_B(x_A, x_B). \tag{6}$$

We assume that once the countries have reached a cooperative solution, such solution will be executed. Whether the cooperative solution is reached through formal treaty agreements, delegation of authority or other instruments, we thus assume that the countries' agreements are enforceable and sustainable also in a one-shot game.

We are now going to show that, when transaction costs T are sufficiently low, countries will reach an agreement involving a lower distance than that obtained through non-cooperative unilateral transplantation. In what follows, the superscript C denotes values obtained via cooperative harmonization or unification processes.[14]

Proposition 2 *In the cooperative equilibrium countries set levels x_A^C and x_B^C such that distance D^C is smaller than distance in the non-cooperative Nash equilibrium D^N.*

Proof. We obtain the first order conditions for x_A and x_B from the objective function (6), substituting (1) to $w_i(x_i, x_j)$:

$$\frac{\partial \hat{W}(x_A, x_B)}{\partial x_A} = -\left[d_A^{'}(D) + d_B^{'}(D)\right] \frac{\partial D}{\partial x_A} - s_A^{'}(x_A) = 0 \tag{7}$$

$$\frac{\partial \hat{W}(x_A, x_B)}{\partial x_B} = -\left[d_A^{'}(D) + d_B^{'}(D)\right] \frac{\partial D}{\partial x_B} - s_B^{'}(x_B) = 0 \tag{8}$$

Keeping in mind that (7) and (8) do not represent reaction functions but conditions that x_A and x_B have to satisfy simultaneously in the cooperative equilibrium, it is immediate to see that (7) implies that in the cooperative solution country A will choose higher levels of x_A for any given x_B, compared

[14] The assumptions on the cost functions guarantee that the second order conditions are satisfied.

to the alternative non-cooperative transplantation strategy. The same holds for x_B. This means that the point where (7) and (8) are satisfied simultaneously must lay in the area above the reaction functions of A and B, as Figure 1 shows. All points in the region above the two reaction functions is closer to the line $x_B = 1 - x_A$, the line representing the locus where $D = 0$, than the Nash equilibrium point N. Hence, the cooperative solution must be characterized by a lower legal distance, $D^C < D^N$. ■

It is important to notice that, even if the overall distance is lower in a cooperative solution, the levels of legal change x_A^C and x_B^C carried out by the respective countries can be higher or lower than the corresponding non-cooperative levels. The point is shown in Figure 2. We can thus have situations where $x_A^C > x_A^N$ and $x_B^C < x_B^N$, so that the larger share of legal transformation is borne by country A (Fig. 2a), situations where both $x_A^C > x_A^N$ and $x_B^C > x_B^N$ such that A and B share the burden increasing their levels of legal change compared to the alternative non-cooperative strategies (Fig. 2b), and finally cases where $x_A^C < x_A^N$ and $x_B^C > x_B^N$, such that B bears the higher cost of legal change (Fig. 2c). Obviously, a case where both $x_A^C < x_A^N$ and $x_B^C < x_B^N$ cannot occur in equilibrium, since it would negate the result in Proposition 2 and lead to higher overall distance under cooperation.

In Section 5, we shall discuss the conditions under which each of the three cases presented above are likely to occur, with the use of quadratic cost functions. For the moment, however, it is important to anticipate that there are obvious distributive consequences from the undertaking of cooperative solutions, which creates possible incentives for strategic behavior in the pre-negotiation phase, in order to minimize the ex post burden of legal change in a cooperative equilibrium.

We conclude this Section, presenting a result analogous to that in Proposition 1, namely that also in the cooperative equilibrium, distance D^C is likely to be positive, implying that complete legal unification is not viable when positive switching costs are present, unless very specific assumptions about payoff functions are made. The proof of this Lemma is similar to the proof of Proposition 1 and is therefore omitted.

Lemma 2 *Given the existence of positive switching costs $s_i(x_i)$ at the cooperative equilibrium distance D^C is positive, implying that complete legal unification does not occur.*

5 Optimal legal distance with quadratic cost functions

In this section we present an example using specific cost functions with the properties of the general cost function introduced in the previous sections. This will allow us to characterize with more precision the results obtained above, and to provide further analysis where the general model above does not present enough structure to lead to unambiguous conclusions.

We assume that the costs from legal distance are quadratic and are equal to $\frac{d_i}{2}(1 - x_i - x_j)^2$, $i = A, B$, with $d_i > 0$. Similarly, switching costs are $s_i(x_i) = \frac{s_i}{2}x_i^2$, $s_i > 0$. These cost functions present all the characteristics of the general functions $d_i(D)$ and $s_i(x_i)$ introduced in Section 2. The objective function for country i becomes

$$w_i(x_A, x_B) = f_i - \frac{d_i}{2}(1 - x_i - x_j)^2 - \frac{s_i}{2}x_i^2 \tag{9}$$

The equilibrium levels of investment in distance reduction by A and B and the distance both in the case of non-cooperative individual transplantation and of cooperative harmonization and unification are presented in Table 1 below. It can be checked that the results of this example are consistent with the general qualitative results proved in the previous Sections.

	Transplantation	Harmonization and Unification
x_A	$\frac{d_A s_B}{d_B s_A + (d_A + s_A) s_B}$	$\frac{(d_A + d_B) s_B}{s_A s_B + (d_A + d_B)(s_A + s_B)}$
x_B	$\frac{d_B s_A}{d_B s_A + (d_A + s_A) s_B}$	$\frac{(d_A + d_B) s_A}{s_A s_B + (d_A + d_B)(s_A + s_B)}$
D	$\frac{s_A s_B}{d_B s_A + (d_A + s_A) s_B}$	$\frac{s_A s_B}{s_A s_B + (d_A + d_B)(s_A + s_B)}$

TABLE 1

>From Table 1 the difference between level of legal distance in the non-cooperative transplantation case and in the cooperative harmonization and unification case can be computed

$$D^N - D^C = \frac{s_A s_B \left(d_A s_A + d_B s_B\right)}{\left(d_B s_A + (d_A + s_A) s_B\right)\left(s_A s_B + \left(d_A + d_B\right)\left(s_A + s_B\right)\right)}. \tag{10}$$

It is possible to see that the difference in (10) is always positive. This is an intuitive result, since through bargaining and cooperation countries are induced to choose solutions that bring their legal systems closer together, thus increasing total welfare with respect to the non-cooperative case.

We can now proceed to compare the levels of investment in legal change undertaken by the two countries in the alternative non-cooperative and cooperative cases.

>From Table 1, $x_A^C - x_A^N = \frac{s_A s_B (d_B(d_B+s_B)-c_A^2)}{(d_B s_A+(d_A+s_A)s_B)(s_A s_B+(d_A+d_B)(s_A+s_B))}$. Then $x_A^C > x_A^N$ (implying higher effort under cooperation) if and only if

$$d_A < d_A^A = \sqrt{d_B(d_B + s_B)} \tag{11}$$

Similarly, $x_B^C - x_B^N = \frac{s_A s_B \left(c_A^2 - c_B^2 + c_A s_A\right)}{(d_B s_A+(d_A+s_A)s_B)(s_A s_B+(d_A+d_B)(s_A+s_B))}$ and $x_B^C > x_B^N$ if and only if

$$d_A < d_A^B = \frac{-s_A + \sqrt{4d_B^2 + s_A^2}}{2} \tag{12}$$

It is possible to show that $d_A^B < d_A^A$. Then the following cases are possible:

1. $d_A < d_A^B < d_A^A$, then $x_A^C > x_A^N$ and $x_B^C < x_B^N$. In this case, country A bears the highest cost of this cooperative agreement. Further, given that distance is smaller in a cooperative regime, this means that A's increase in effort more than compensates for B's reduction: x_A increases more than x_B decreases. According to definitions (11) and (12), this happens when d_A is very low relatively to both d_B and s_B. Since x_A^N is increasing in d_A, a low d_A implies that in the non-cooperative Nash equilibrium country A put relatively low effort in reducing distance, thus inducing B to put relatively high effort (because of strategic substitutability of efforts). The cooperative bargaining levels this situation. This is the case illustrated in Fig. 2a.

2. $d_A^B < d_A < d_A^A$, then $x_A^C > x_A^N$ and $x_B^C > x_B^N$. In this case d_A is higher than before and relatively high with respect to d_B. The uneven non-cooperative efforts presented in the previous case are less likely to occur here and the cooperative solution leads both countries to increase their legal change efforts. Which country will have to make the larger adaptation effort (i.e., whether $x_A^C - x_A^N$ will be greater or lower than $x_B^C - x_B^N$) depends on the parameter values. This case is illustrated in Fig. 2b.

3. $d_A^B < d_A^A < d_A$, then $x_A^C < x_A^N$ and $x_B^C > x_B^N$. This case mirrors case 1. Here d_A is relatively high, so that x_A^N is likely to be high and x_B^N consequently low. In the non-cooperative Nash equilibrium country B put relatively low effort in reducing distance, thus inducing A to compensate for it with higher effort. The cooperative bargaining leads to a more balanced effort by the two countries. This is the case illustrated in Fig. 2c.

6 Transplantation versus harmonization when countries can control switching costs

As discussed in the previous analysis, the extent to which countries are willing to invest to reduce legal differences with other legal systems highly depends on the cost of legal adaptation. Switching costs are a crucial variable in a country's decision on legal change. In the preceding analysis, we have assumed that such costs are exogenous and countries optimize given the transaction costs occasioned by differences in legal systems and the switching costs that would be incurred as a result of legal change.

In this Section we relax this assumption, endogenizing switching costs. We do so by introducing a stage prior to the non-cooperative (transplantation) or cooperative (harmonization and unification) stage, in which countries have the possibility to change their switching costs by making a costly investment. We consider situations where countries can alternatively increase or decrease their switching cost and find the conditions under which a country may prefer to increase rather than decrease switching costs.

There are two main effects of switching costs that should be highlighted. The first, and more obvious effect is that higher switching costs imply larger costs of reducing legal distance. With an increase in switching costs, legal change efforts x_i will decrease, with a resulting increase in legal distance and decrease in country $i's$ welfare. The second effect is due to the fact that a larger marginal switching cost, increasing $s_i(x_i)$ for each level of x_i, implies a downward shift of the reaction function, leading to lower x_i but to an increase in x_j due to strategic substitutability. This effect is observed in both the non-cooperative and cooperative equilibria. Consider, for example, the effect of an increase of $s_A^{'}(x_A)$ in A's first order condition of the non-cooperative problem (equation (2)) or in the corresponding first order condition of the cooperative problem (equation (7)).[15]

The presence of these two effects creates conflicting incentives for a country that has the opportunity to affect its own switching costs. On the one hand, there may be non-strategic incentives to make an ex ante investment to reduce subsequent switching costs. On the other hand, strategic incentives may be present to make a costly investment that renders subsequent adaptation more costly.[16]

[15] The same effect can be observed explicitly in the equilibrium values given in Table 1 with quadratic cost functions.

[16] This strategy would be the equivalent of a precommitment or hands-tying strategy (Schelling, 1960) that improves the position of the country that undertakes the strategic precommitment at the expense of the other country. In this specific application, overall welfare is reduced by such a strategic choice.

When countries invest ex ante to reduce switching costs, greater levels of cooperative harmonization or unification can be achieved. Countries will have an incentive to invest in ex ante reduction of switching costs when such investment cost r is lower than the benefits obtained by the reduction of legal difference or the cost that countries would have had to incur through unilateral transplantation.[17]

Alternatively, countries may strategically choose to invest in order to increase switching costs. This investment amounts to a precommitment strategy by one country to reduce its ability to adapt itself to foreign law in the subsequent stage of the game. Countries may rationally choose to make a positive investment r to raise their switching costs when they expect the other country to compensate the resulting decrease in level of transplantation by increasing its own transplantation. Similarly, raising switching costs is a strategic device by which a country tries to take advantage of the other country's incentive to shorten the legal distance via unilateral concessions at the treaty stage. This case is likely to happen when the country behaving strategically faces relatively lower costs from legal distance and relatively high switching costs, whereas the other country is characterised by opposite conditions. Under such conditions, the former country may have incentives to invest strategically in r since it expects a greater effort to reduce distance from the latter state.

The incentive to raise switching costs strategically may be present in both non-cooperative and cooperative situations. In the former case, investment r gives credibility to the country's subsequent non-cooperative choice of transplantation, while in the latter case, investment r represents a precommitment strategy affecting the solution of the subsequent cooperative game. Interestingly, the strategic investment in r might be higher when states expect the following stage to be cooperative, rather than non-cooperative.

To analyze the incentives described above we devise a two stage model. In the first stage countries can invest to change their switching cost. To simplify the analysis we assume that only one country, say country A, has this opportunity.[18] We work with the quadratic cost framework presented in the previous section. Initially, country A has switching costs equal to $s_A(x_A) = s_A\frac{x_A^2}{2}$. It can choose to either increase or decrease the marginal cost of x_A, s_A, by making an investment k_A. Specifically, k_A can take values in the interval $[-\bar{k}, \bar{k}]$, $\bar{k} > 0$. We assume that countries can never decrease their marginal cost below zero, i.e. $\bar{k} \leq s_A$. However, changing switching

[17] Technically, this happens when the first order condition with respect to switching cost is always negative or when the function is non monotonic.

[18] The case where both countries can change switching costs is discussed below.

costs is not a costless process. A change equal to k_A (whether an increase or a decrease) requires an amount of resources equal to $r\frac{k_A^2}{2}$.

In the second stage countries choose x_A and x_B either separately, via independent transplantation, or via cooperative harmonization and unification.

The second stage is exactly equal to the games presented in Sections 3 and 4 above, so we can concentrate on the first stage. Solving the game by backward induction, we obtain the equilibrium values of x_A and x_B as a function of k_A. We then move backwards and analyze A's choice of k_A.

The effect of a change in k_A on A's welfare can be obtained by totally differentiating A's welfare function after substituting the values of x_A and x_B obtained in the second-stage equilibrium. We refer to such values as $x_A^*(k_A)$ and $x_B^*(k_A)$, where the star indicates equilibrium value, in both non-cooperative and cooperative settings. The effect of investing in k_A on $A's$ welfare is given by

$$\frac{dw_A^*(x_A^*(k_A), x_B^*(k_A))}{dk_A} = \frac{\partial w_A^*}{\partial k_A} + \frac{\partial w_A^*}{\partial x_A^*(k_A)}\frac{\partial x_A^*(k_A)}{\partial k_A} + \frac{\partial w_A^*}{\partial x_B^*(k_B)}\frac{\partial x_B^*(k_A)}{\partial k_A} \quad (13)$$

The effect on w_A^* of the change in country A's second-period action x_A^*, $\frac{\partial w_A^*}{\partial x_A^*(k_A)}\frac{\partial x_A^*(k_A)}{\partial k_A}$, is zero by the envelope theorem, so that expression (13) becomes

$$\frac{dw_A^*(x_A^*(k_A), x_B^*(k_A))}{dk_A} = \frac{\partial w_A^*}{\partial k_A} + \frac{\partial w_A^*}{\partial x_B^*(k_A)}\frac{\partial x_B^*(k_A)}{\partial k_A} \quad (14)$$

The first term on the right hand side in expression (14) represents the direct (or cost reducing) effect of a change in k_A and is always negative. An increase in k_A increases A's switching costs and is in itself costly, thus reducing A's welfare.

The second term in the rigth hand side of (14) is the indirect (or strategic) effect and is the result of country B's second-period reaction to A's choice of k_A. The strategic effect can be rewritten fully as

$$\frac{\partial w_A^*}{\partial x_B^*}\frac{dx_B^*}{dx_A}\frac{dx_A^*}{dk_A} \quad (15)$$

where $\frac{dx_B^*}{dx_A}$ is the slope of $B's$ reaction function and is negative[19]. The term $\frac{dx_A^*}{dk_A}$ is negative, as it can be checked from the first order conditions (2) and (7) and the expressions for x_A^N and x_A^C in Table 1. Finally, we know that $\frac{\partial w_A^*}{\partial x_B^*}$ is positive, since an increase in x_B increases A's welfare by reducing legal

[19] In the case of the cooperative solution, $\frac{dx_B^*}{dx_A}$ indicates how the optimal x_B changes as x_A changes and is again negative (see Section 4).

distance. The strategic effect of an increase in k_A thus is positive. By raising its costs, a country induces the other country react, spending more effort in reducing the distance between legal systems. This indirect effect increases the welfare of the country acting strategically.

If the direct effect dominates, so that the total derivative in equation (14) is negative, A would have incentives to invest to reduce switching costs to the maximum extent, so that $k_A = -\bar{k}$ and switching costs become $(s_A - k_A)\frac{x_A^2}{2}$. If $\bar{k} = s_A$, then switching costs would be totally eliminated by country A in stage 1, paving the way to its subsequent unification strategy. In such a case, A always faces incentives to set $x_A = 1 - x_B$, so that the only equilibrium would be where $x_A = 1$ and $x_B = 0$. This means that, after investing to reduce its switching costs in the first period, country A would adopt the entire legal system b, with a resulting unification of legal systems.

If the indirect effect dominates, the total derivative in (14) is positive. In this case, A would instead have incentives to increase its switching costs (up to $k_A = \bar{k}$), so that switching costs would become $(s_A + k_A)\frac{x_A^2}{2}$. This would lead to a lowering of the subsequent harmonization efforts x_A^*, forcing B to increase its own effort in equilibrium.

Suppose finally that there exists a value $\hat{k}_A$ such that $\frac{dw_A^*(x_A^*(\hat{k}_A),x_B^*(\hat{k}_A))}{dk_A} = 0$.[20] In this case country A would choose $\hat{k}_A \in \left[-\bar{k}, \bar{k}\right]$, that can take up either positive or negative values, meaning that A can increase or decrease its switching costs in the first period. This is an interesting case, as it allows us to investigate if and how the incentives to change switching costs are affected by the nature – non-cooperative versus cooperative – of the second-stage game.

Before considering how the optimal investment r varies in the two regimes, we prove that the effect of a change in k_A on $B's$ equilibrium welfare $w_B^*(x_A^*(k_A), x_B^*(k_A))$ is always negative.[21] In fact

$$\frac{dw_B^*(x_A^*(k_A), x_B^*(k_A))}{dk_A} = \frac{\partial w_B^*}{\partial k_A} + \frac{\partial w_B^*}{\partial x_A^*(k_A)} \frac{\partial x_A^*(k_A)}{\partial k_A} \tag{16}$$

by the envelope theorem. The direct effect $\frac{\partial w_B^*}{\partial k_A}$ is zero, since a change in country $A's$ switching cost does not have a direct impact on $B's$ welfare. The impact is only indirect, through the change in x_A^* and is negative, since $\frac{\partial w_B^*}{\partial x_A^*(k_A)} > 0$ and $\frac{\partial x_A^*(k_A)}{\partial k_A} < 0$. Therefore, whenever it is rational for A to reduce

[20] We assume that the second order conditions are satisfied and that $\frac{\partial^2 w_A^*(x_A^*(k_A),x_B^*(k_A))}{\partial k_A^2} < 0$.

[21] Using the terminology Fudenberg and Tirole introduced in their famous 1984 paper, investment in increasing switching costs makes country A tough.

its switching costs, the welfare of both A and B is increased. Conversely, whenever it is rational for A to raise its switching costs in the first stage, the welfare of A is increased but the welfare of B is decreased.

We can now compare A's level of investment r in the cases where the second stage is one of non-cooperative transplantation as opposed to cooperative harmonization or unification.

Given our hypothesis of quadratic cost functions, the first order condition in expression (14) for the case of subsequent non-cooperative transplantation is

$$\frac{dw_A^N}{dk_A} = -\left(rk_A + \frac{x_A^N}{2}\right) + d_A D^N \frac{\partial x_B^N}{\partial k_A} = 0 \tag{17}$$

where $\frac{\partial x_B^N}{\partial k_A} = \frac{d_A d_B s_B}{(c_B(k_A+s_A)+(c_A+k_A+s_A)s_B)^2} > 0$ from Table 1. The first term, between parentheses, on the right hand side of (17) is the direct effect of an increase in switching costs. The second term is the strategic effect.

In the case where the subsequent stage is one of cooperative harmonization or unification, the first order condition for k_A is

$$\frac{dw_A^C}{dk_A} = -\left(rk_A + \frac{x_A^C}{2}\right) + d_A D^C \frac{\partial x_B^C}{\partial k_A} = 0 \tag{18}$$

where $\frac{\partial x_B^N}{\partial k_A} = \frac{(d_A+d_B)^2 s_B}{(s_B(k_A+s_A)+(k_A+s_A+s_B)(d_A+d_B))^2} > 0$ from Table 1. Again, the term between parentheses on the right hand side represents the direct effect of a change in switching costs and the second term represents the strategic effect.

Given the complexity of expressions (17) and (18) we shall study these results with the help of simulations, considering country A's behavior under different sets of parameters. The results of the simulations are presented in Table 2.

In Simulation 1 we consider a case where A faces relatively high transaction costs from legal distance and B faces instead relatively high switching costs. This implies that in equilibrium A would have greater incentives to reduce legal distance compared to B. Here, it is not surprising to find that A's first order condition for optimal k_A is always decreasing, no matter whether the second stage will be non-cooperative or cooperative. Thus A will invest up to the maximum amount possible in cost reduction ($k_A^N = k_A^C = \bar{k}_A$) and legal distance will subsequently become very small. Legal distance might even be eliminated entirely if A is able to reduce its switching costs to zero. In that case, A will set $x_A^N = x_A^C = 1$ and B $x_B^N = x_B^C = 0$. Distance will be completely eliminated by A alone.

In Simulation 2 B faces both higher transaction costs from legal distance and higher switching costs than A, with $d_B > s_B$. In this case, the effort

produced by B is quite low. Then A is willing to reduce its marginal switching costs from $s_A = 1$ to $0 < s_A - k_A < 1$, with $k_A < \bar{k}_A$. Given that $A's$ marginal cost of distance d_A is lower than in Simulation 1, A does not invest as much as $\bar{k}_A$. Moreover $A's$ investment in cost reduction is higher when the second stage is cooperative. Values of the parameters are in fact chosen to reflect the ranking $d_A < d_A^B < d_A^A$ (where d_A^B and d_A^A have been defined in section 5), so that $x_A^C > x_A^N$ and $x_B^C < x_B^N$. It is then intuitive that A invests more when total switching costs are higher, *i.e.* in the cooperative regime, when its effort is higher.

We then present four different examples where A increases its switching costs. In the first three of these examples $k_A^C > k_A^N$, *i.e.* the increase is larger when the second stage is cooperative. In the last example the opposite occurs and $k_A^C < k_A^N$.

In Simulation 3 values are chosen so that $d_A < d_A^B < d_A^A$, and $x_A^C > x_A^N$, whereas $x_B^C < x_B^N$. A has a very low transaction cost from legal distance compared to B, which has relatively low switching costs. This gives A the incentive to exploit $B's$ effort so that $A's$ investment goes in the direction of increasing switching costs. It is possible to check that the elasticity of in x_B with respect to k_A is much larger when the second stage is cooperative ($\frac{\partial x_B^C}{\partial k_A}\frac{k_A}{x_B^C} > \frac{\partial x_B^N}{\partial k_A}\frac{k_A}{x_B^N}$). Given that B seems to be particularly reactive to an increase in k_A when the second stage is cooperative, $k_A^C > k_A^N$ and $A's$ investment in increasing switching costs is sensibly larger in this case.

In Simulations 4 and 5 we raise d_A. Specifically, in Simulation 4 we choose $d_A^B < d_A < d_A^A$ (and $x_A^C > x_A^N$; $x_B^C > x_B^N$) whereas in Simulation 5 we choose $d_A^B < d_A^A < d_A$ (and $x_A^C < x_A^N$; $x_B^C > x_B^N$). All other parameters are the same as those used in Simulation 3. In both simulations 4 and 5 values are such that $\frac{\partial x_B^C}{\partial k_A}\frac{k_A}{x_B^C} > \frac{\partial x_B^N}{\partial k_A}\frac{k_A}{x_B^N}$, so that reactivity of B's effort is larger under cooperation. This confirms the result that A invests sensibly more in increasing switching costs when the second stage is cooperative. These examples show that country $A's$ first - stage decision is driven by the elasticity of $B's$ effort with respect to $A's$ choice of legal change (which is in turn affected by $A's$ marginal switching cost $s_A + k_A$), and is not influenced by the absolute magnitude of B's legal change in the second stage. Therefore, regardless of the magnitude of A's and B's efforts in non-cooperative and cooperative settings, A's incentives to increase strategically its switching costs will vary with B's expected reaction to changes in k_A.

The relevance of B's elasticity of effort with respect to k_A, is also confirmed by Simulation 6, which introduces a set of parameters for which $\frac{\partial x_B^C}{\partial k_A} < \frac{\partial x_B^N}{\partial k_A}$, so that B's effort is shown to have greater elasticity when the second stage is non-cooperative. As expected, in the non-cooperative equi-

librium A makes a greater investment to increase its switching costs and k_A is higher. The combined presence of very low switching costs and relatively high transaction costs for legal distance for B, guarantee its willingness to make high investments in legal change in equilibrium. In this simulation, A's legal distance costs are very high compared to switching costs, so that $d_A^B < d_A^A < d_A$ and $x_A^C < x_A^N$, $x_B^C > x_B^N$. In sum, the above examples confirm that a larger increase in k_A will be observed in a cooperative setting when B is expected to react more in a cooperative setting, and vice-versa.

The Simulations in Table 2 also reveal that adding the initial stage where country A invests to change switching costs always reduce total welfare in comparison with a case where it is not possible to control switching costs. The only case where the investment in switching cost reduction is outweighted by the benefit is Simulation 1, where country A invests up to the point of eliminating switching costs completely. In Simulation 2, although country A invests to reduce switching costs, reduction is only partial (A does not invest up to the maximum amount possible as in Simulation 1) and the cost of investment outweights the benefits in terms of reduced legal distance. In all other simulations, where A invests to increase switching costs, A's opportunistic behavior clearly reduces total welfare.

Finally, when both countries have the opportunity and incentives to reduce switching costs in the first stage, legal unification would obtain in the subsequent non-cooperative or cooperative stage. However, this would create the possibility of having multiple equilibria, inasmuch as any pair $\{x_A, x_B\}$ could be a Nash equilibrium in the non-cooperative transplantation game as long as $x_A^N = 1 - x_B^N$. Similarly, the solution to a cooperative game could be given by any pair $\{x_A^C, x_B^C\}$ as long as the sum of harmonization efforts adds up to 1.

The case where A's and B's optimization problems with respect to k_A and k_B have an interior solution for each level of the opponent's investment k_i is definitely more complex. We assume that changing switching costs by k_B costs B an amount of resources equal to $r\frac{k_B^2}{2}$ (equivalent to $A's$ cost of change $r\frac{k_A^2}{2}$). In that case we would define a best response function $k_A(k_B)$ for A and $k_B(k_A)$ for B. It is possible to check from the first order condition in (17) that $k_A(k_B)$ is decreasing (so that k_A and k_B are strategic substitutes) if and only if $(d_A + k_A + s_A)(k_B + s_B) - d_B(k_A + s_A) > 0$. A similar condition holds for $k_B(k_A)$.[22] Clearly, the solutions to the problem are very different according

[22] In order to determine the sign of $\left.\frac{dk_A}{dk_B}\right|_A$ and $\left.\frac{dk_B}{dk_A}\right|_B$ one needs to check $sign\left[\frac{\partial^2 w_i}{\partial k_i \partial k_j}\right]$. If $\frac{\partial^2 w_i}{\partial k_i \partial k_j} < 0$ then k_A and k_B are strategic substitutes, vice-versa they are strategic complements.

to the strategic nature of the game. We might have cases where one country responds to another country's increase in switching costs by reducing its own. But we may also have cases where both countries strategically increase their costs, and end up with a higher legal distance relative to the case where countries do not control their switching costs.

Real life situations are likely to be characterized by asymmetries. Countries are likely to differ in their willingness to change their legal system and to be open to the adoption of foreign legal principles. Usually their willingness to change depends on the degree of openness of their economies, where more open countries are generally more prone to undertake legal change.[23] Although the analysis of the issue of legal harmonization in such asymmetric settings should be the subject of future research, we can anticipate some of the main insights from the study of the limiting case where only A can control switching costs. In our setting, A can be viewed as a closed country, trying to minimize legal change, exploiting other countries' willingness to adapt their own legal systems to reduce distance.

7 Conclusions

Differences between legal systems increase transactions costs for parties involved in transnational contracts. Legal systems can reduce these transaction costs in a variety of ways. First, countries can reduce legal differences by unilaterally transplanting foreign rules and legal principles. This form of legal change does not necessitate cooperation between countries. Second, countries can undertake cooperative efforts to reduce differences between legal systems leading to the harmonization and possible unification of legal systems. Through these alternative non-cooperative and cooperative adaptation processes diverse legal traditions can converge towards each other bridging historic differences and legal rules. In this article, we have studied the process of legal adaptation, looking at the features of these alternative solutions. The availability of a common legal language increases the frequency and the profitability of commercial transactions. This means that an increase in the scope of transnational commerce relative to domestic commerce boosts the countries' incentives to promote legal homogeneity. The presence of switching and adaptation costs however can delay or impede legal unification. When adopting a new legal rule, preexisting rules and principles need to be abrogated or modified, with non trivial information costs for the legal community and the parties involved. The existence of positive switching costs often prevents

[23] Notice that openness of a country is not necessarily correlated with switching costs.

countries from reaching solutions where the distance between their respective legal systems is fully eliminated.

Another friction in the process of legal harmonization is given by the transaction costs of negotiating and carrying out the cooperative agreement between the interested countries. These transaction costs if sufficiently high, can prevent international cooperation leading to legal harmonization. This may explain why there are situations where countries don't pursue a cooperative solution and choose to reduce legal distance unilaterally through legal transplantation.

In negotiating a cooperative legal harmonization or unification agreement, countries maximize their joint welfare. We have shown that if international negotiation costs are not excessively high, there exists a cooperative solution, where countries take their respective non-cooperative solutions as their threat points and where the treaty agreement involves a reduction of the legal distance obtainable via unilateral non-cooperative transplantation. This may create incentives towards cooperative harmonization or unification solutions even for countries that have already undeertaken steps toward unilateral transplantation.

After studying the features of non-cooperative and cooperative forms of legal adaptation, we have considered cases with endogenous switching costs. When countries have the opportunity to affect their respective switching costs endogenously, interesting results can be obtained. Although countries generally have interest to invest ex ante to reduce switching costs, occasionally they may actually have interest to increase their own switching costs. The latter, less intuitive, strategy amounts to a precommitment strategy that reduces a country's ability to adopt foreign law at a later stage, via transplantation or harmonization. Countries may in fact rationally choose to tie their hands increasing their own switching costs when expecting the other country to compensate a decrease in level of legal change by increasing its own level. Through this strategy a country thus tries to take advantage of the other country's elastic response and willingness to reduce distance at its own cost. The incentive to raise switching costs strategically may be present in both non-cooperative and cooperative situations and strategic precommitment investments are often higher when states expect the following stage to be cooperative, rather than non-cooperative.

Future research should consider the combined effect of asymmetries in the countries' propensity to introduce foreign principles in their own legal systems and in switching costs on the equilibrium levels of harmonization. Further work should also consider the effect of multidimensional legal diversity where more than two states are involved in the process of legal harmonization. There, legal differences may materialize in a multidimensional space,

necessitating a reinterpretation of the concept of legal distance adopted in the present study and leading to a more complex optimization problem. The sequence of individual states' moves would become relevant inasmuch as distance should be weighted according to the number of countries that adopt a given legal solution. The order with which countries undertake legal change would likewise affect the direction of global legal evolution.

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SIM. NO.	PARAMETERS VALUE	k_A^N	k_A^C	SECOND STAGE EFFORT	TOTAL NON COOPERATIVE WELFARE WITH OUT INVESTMENT	TOTAL COOPERATIVE WELFARE WITHOUT INVESTMENT	TOTAL NON COOPERATIVE WELFARE WITH OUT INVESTMENT	TOTAL COOPERATIVE WELFARE WITHOUT INVESTMENT	ELASTICITY UNDER NON COOPERATION $\frac{\partial x_B^N}{\partial k_A}\frac{k_A^N}{x_B^N}$	ELASTICITY UNDER COOPERATION $\frac{\partial x_B^C}{\partial k_A}\frac{k_A^C}{x_B^C}$
1.	$d_A=2, d_B=1, s_B=2$	$-s_A$	$-s_A$	$x_A^N = x_A^C = 1$ $x_B^N = x_B^C = 0$	19.9	19.9	19.69	19.72	-	-
2.	$d_A=1, d_B=2, s_B=1.5$	-0.0515	-0.12	$x_A^N = 0.311$; $x_B^N = 0.393$ $x_A^C = 0.531$; $x_B^C = 0.312$	19.71	19.76	19.70	19.75	0.017	0.077
3.	$d_A=0.5, d_B=3, s_B=0.5$	0.0066	0.083	$x_A^N = 0.066$; $x_B^N = 0.800$ $x_A^C = 0.288$; $x_B^C = 0.623$	19.80656	19.8435	19.8067	19.8478	0.000434	0.011
4.	$d_A=3, d_B=3, s_B=0.5$	0.0456	0.0779	$x_A^N = 0.291$; $x_B^N = 0.608$ $x_A^C = 0.301$; $x_B^C = 0.649$	19.8324	19.8378	19.835	19.8421	0.0127	0.0216
5.	$d_A=4, d_B=3, s_B=0.5$	0.033	0.078	$x_A^N = 0.356$; $x_B^N = 0.552$ $x_A^C = 0.302$; $x_B^C = 0.651$	19.8286	19.8365	19.8306	19.8409	0.013	0.022
6.	$d_A=4.5, d_B=3, s_B=0.2$	0.053	0.041	$x_A^N = 0.211$; $x_B^N = 0.740$ $x_A^C = 0.158$; $x_B^C = 0.820$	19.9125	19.9178	19.9134	19.9185	0.011	0.006

TABLE 2: All simulations are run setting $s_A = 1$ and $r = 0.2$.

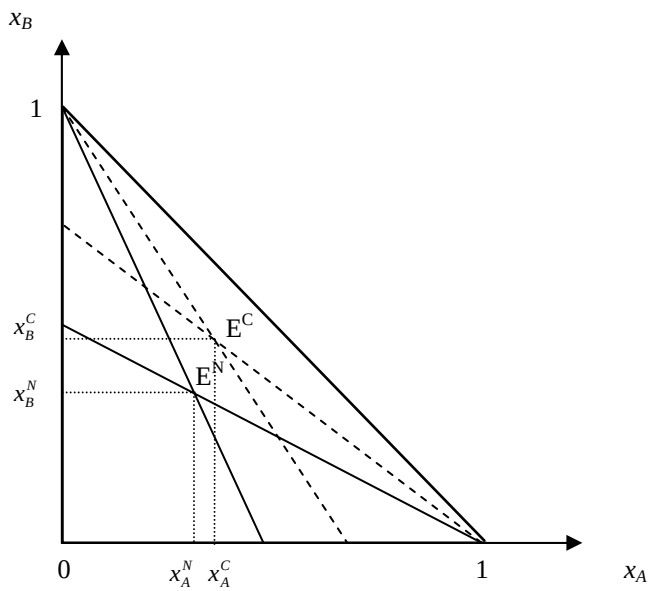

Fig. 1: The cooperative equilibrium E^C must lie above the reaction functions relative to the non cooperative transplantation case and closer to the $x_B = 1 - x_A$.
LEGEND: _____ reaction functions (where *A*'s reaction function is the steeper one).
---------- first order conditions in the cooperative case.

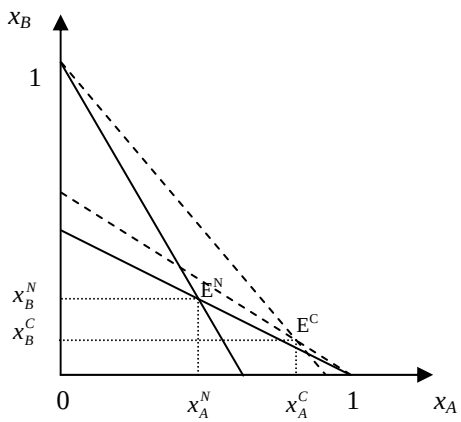

Fig. 2a

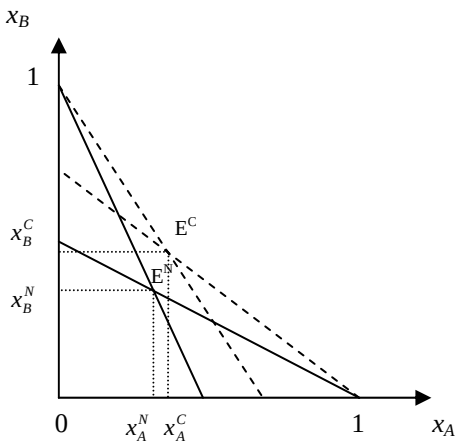

Fig. 2b

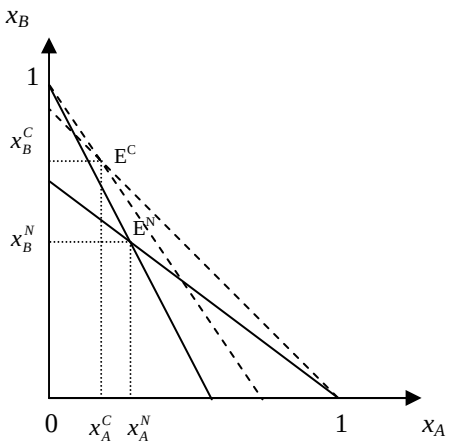

Fig. 2c