Economic Drivers of Family Reunification in the Context of International Migration

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Abstract

Migration is a family decision. Often the family is separated after the migration of one of its members and the desire to reunify can drive many decisions and choices made by the family. Will there be a reunification? After how long will the family reunify? Where will the reunification occur - in the host country or in the source country? Family-based migration requires a closer look at sequential migrations when migration involves an initial stage of separation before reunification. This paper develops a simple model of the utility-maximizing behavior of a representative household composed of two spouses. It presents insights about how wages, price levels, age at migration, and cost of migration impacts both the duration of separation and the location where the family reunifies. Empirical evidence on migration between Africa and Europe (MAFE database) is provided. I use survival analysis methods to investigate the timing of reunification. My results confirm some of the model's predictions concerning the role of differences in the standards of living and the costs of migration, namely the price levels, the wealth in both countries, the costs of migration.

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Vains objets dont pour moi le charme est envolé ;
Fleuves, rochers, forêts, solitudes si chères,
Un seul être vous manque et tout est dépeuplé.
L'isolement. - Alphonse de Lamartine

1 Introduction

In this paper, I propose to revisit the concept of family migration by investigating the question of family reunification. The literature has so far addressed family migration by focusing on only one of the two types of reunification: either the migrant is a returnee, or the family will migrate as well. A reunification does not necessarily imply the migration of other family members, it can be a return migration as well. A restatement of Max Frisch in this light would be: "We wanted a labour force, but *families* came" - or the labour force left.[1]

Family reunification bridges permanent and temporary migrations as the location of reunification leads to the choice of one migration type. It is important for the policy makers of both countries to better anticipate the flows of migration induced by either permanent migration or temporary migration. Where does the family reunify? When do the family members reunify? I aim to address these questions using a simple utility-maximizing framework. My model follows the work of Djajić (2010) and introduces a second agent within the household. In this framework, the rational household selects the country and the separation duration options that maximize its discounted utility. Both members of the households are taken into consideration in the decision of reunification. The family decides the optimal consumption levels of each member as well as the duration of the separation. The two *extrema scenarii* consist of a separation that never ends - so that there is no reunification at all - and in a migration of the entire family at once - migration and reunification are then *simultaneous*.

Incorporating the timing of reunification is a key dimension - and innovation - of the model. Most of the related literature analyzes the simultaneous family migration and usually does so in an internal context in which the costs of migration (both financial and psychological) are extensively lower than in

[1] Max Frisch: "We wanted a labour force, but human beings came."

the context of international migration. The literature on family-based migration is scant and a large part of migration literature deals with internal movers as in the seminal paper by Mincer (1978). It also assumes that migration is undertaken by all the involved agents at the same time: family migration is supposed to happen simultaneously as in Munk et al. (2017).

Migration can be - and often is - *sequential*: there is the possibility that family migration occurs as a chain. This better relates to the real frame of family migration where, mostly due to legal constraints in international migration, family-based migration is sequential. The legal frame for family reunification procedures in the European Union usually imposes the first migrant to have stayed in the host country for a specific time period (generally between 12 to 18 months before bringing their family). Borjas and Bronars (1991) and Jasso and Rosenzweig (2010) study sequential family migration where only the family back in the source country faces a choice: to migrate and initiate chain migration, or not to migrate and remain separated. As often is the case, however, the entire family, including the migrant, makes this choice.[2]

In this paper, I take a case of international migration in which migrants choose the country of reunification. A *migrant* is defined as an individual who is a foreign-born person who does not initially have the nationality of the country s/he is living in. A *reunifier* can be either the initial migrant returning to the source country or the spouse migrating into the host country. Whether the reunifier is the initial migrant or spouse left behind will indicate which pattern of migration the family is on - permanent migration or return migration.

The model developed in the paper provides insights about the reasons to stay in separation longer. A given duration of separation may be needed in order to accumulate enough savings, which will allow for either the return migration or the reunification in the host country. A lower price level in the host country can postpone the host reunification and speed up the source reunification. The younger the migrant, the longer the separation of the family. The wage of the reunifier (the person making the second migration) has an uncertain impact: it stresses the tension between the desires of accumulating savings and reunifying faster.

[2] Western countries are frequently facing two opposite ideologies, one claiming that *chain* migration can lead to the destruction on the local identity, the other one stating that family reunification is required to ease the process of integration of the migrants.

I test the predictions of the model empirically, using the Migration betweem Africa and Europe (MAFE data). The data provides retrospective details of migration paths of each migrant and his or her relatives as well as information on returned migrants. It covers a period of about 50 years till 2010. Channels of migration between Africa and Europe have not been extensively studied. I apply survival analysis methods to highlight the drivers of the duration of separation. Moreover, survival analysis is helpful in overcoming the issues of right censoring. A lack of coherent databases from several sources and host countries is a key reason for this approach to be useful. The MAFE database has been built to change this *status quo*. This also explains why I test the model's predictions with the MAFE data. In testing the prediction of my model using the MAFE data, I hope to contribute towards a better understanding of migration between Africa and Europe.

This paper contributes to the literature by linking two apparently distinct migration paths of return migration and of permanent migration. Return migration has generally been studied through the lens of the *guest-worker* as in Djajić and Milbourne (1988). Permanent migration has been mostly analyzed through the problematic of integration (economic, political, cultural, *etc*) as in Borjas (2014). It does so by pursuing work on family migration: the model makes sequential migration as well as return migration possible outcomes. Family migration has also been empirically studied such as Foged (2016) or Gillespie et al. (2020). Frequently though, the research focuses on migration between developed countries (North to North). Beauchemin (2018), among others, have built a first understanding of the migration routes between Africa and Europe. I intend to contribute to this part of the literature with a focus on the family reunification dynamics.

Administratively, the migrant can enter a country for different motives such as studies, labor, family, asylum. Different migration administrative motives lead to different drivers and the Roy-Borjas type of selection might fit to some motives better than others. Family migration motives account for more than a third of total migration in the European Union and for two thirds in the United States (where the share of family migration largely increased from 1966 to 2011).[3] Belgium, Finland, France, Ireland, Korea, Portugal, Sweden all have similar patterns of family migration.[4] A discussion of family

[3]See the following OECD presentation.

[4]It should be mentioned, however, that the way to measure family-based migration changes across countries. Therefore, those comparisons are mere illustrations but should not be taken as flawless data for international comparison. As an example, the US includes

migration can be found in Appendix A.

Family migration is an important challenge for policy makers as well: the integration of migrants when the reunification happens in the host country can be sensitive to the demographics, the culture and social norms in the host country (Bonjour and Kraler (2015)). A chain migration can increase endogamy which tending to slow down the integration process in the host country (Algan et al. (2013)). Further, return migration can raise other difficulties for the migrant, such as the need to (re)integrate back in the source country and with the (extended) family (see Arowolo (2000) or more recently Kuschminder (2017)).

The paper is organized as follows: first, I provide a literature review that gives an understanding of the literature related to family migration. Second, I develop a model based on very simple assumptions in order to only catch few aspects of the migrant's decisions. A calibration exercise gives several insights that the reunification can occur in both countries. Third, an empirical illustration of the separation duration is conducted in the context of South to North migration. Last, I provide some conclusions and future directions for research.

2 Literature Review

Interdisciplinarity The literature dealing with migration studies has emerged lately, mostly after 1950. In essence, this topic is interdisciplinary because it is not trivial to completely separate perspectives such as economic aspects along with demographic, legal, anthropological, sociological, historic (see for example Brettell and Hollifield (2014)). For most of the papers studied it should be highlighted that interdisciplinary methods are missing and a dialogue among disciplines appears to be scarce. However, it seems unlikely that family-based migration - and *a fortiori* family reunification - is entirely driven by economic factors. This present paper has a modest objective and does not intend to understand the full spectrum of the family reunification decision. As examples, the importance of the family structure itself seems to matter (Kraler et al. (2012)), the increasing conditions in terms of income and housing seems to lead to expand the role of social classes to ease the

many more components in it than most of the European countries such as several cases that could have been included in the "accompanying family of workers" category (accompanying spouse/children of workers).

process of reunification Kofman (2018).

Integration of migrants in the host society has been largely studied from different perspectives: economic (see for example Meurs et al. (2006) or Dostie et al. (2020)), educational attainment of second generation (Nieuwboer and van't Rood (2016)), political (Alesina et al. (2000) or Akkerman (2012)), social (Putnam (2000) for a critical approach), religion as in Reitz et al. (2009), *etc*. The literature is vast and rich about the integration of immigrants. On the other hand, the reintegration of the return migrant is somehow less studied. A migration that lasted several years can have modified the preference structures of the migrant as well as of the rest of the family. Dumon (1986) raises several components that can lead to a complicated reintegration, especially so in the case of second generation migrants. The transferability of the skills acquired in the host country can be poor. Fleischer (2008) highlights the importance of the family in welcoming back the migrant as the transition can be costly financially as well as mentally. The better the integration in the host country the more challenging the reintegration (see for example Jeffery and Murison (2011) or De Haas et al. (2015)). The remaining family plays a decisive role in the reintegration, but not only: Kuschminder (2017) stresses that public and private sector in the home country can adapt their policies to foster good reintegration.

Cumulative Causation Migration studies do not escape from the curse of causation issues. Migrants self-select for a wide range of reasons. They may be pushed to migrate because of higher expected gains (see the seminal article Roy (1951) or the the famous application to migration by Borjas (1987)) and gains can be both absolute or relative to other households in the source community (Stark and Taylor (1989)). On the other hand, part of them might be forced not to migrate, which is mostly due to liquidity constraints (Djajić and Vinogradova (2014) - for a theoretical analysis). Alternatively, some authors have proposed other types of models that would better fit with the above-average skill levels of migrants stylized fact when dealing with South-North migration (*e.g.* Chiquiar and Hanson (2005), or Clemens et al. (2016)). In any case, self-selection is a major issue that can bias empirical results and correcting from it generally requires longitudinal dataset to find the according instruments.[5] The cumulative causation process enlarges the

[5]But this is not always the case. Indeed, using the French dataset *Trajectoires et Origines*, Chabé-Ferret et al. (2018) - got instruments for remigration intentions using the

range of the variables that might impact migration decision: as written in Massey (1990): macroeconomic shifts such as employment growth can push migration trends upwards, which can in turn lead to an even higher growth in employment and the cumulative causation impact varies with the size of the city (Fussell and Massey (2004)). The present paper indicates that the reunifier is more likely to have entered the territory through a labor procedure. The different channels of migration themselves might describe a type of sequential migration.

Reunifying or Remitting Dealing with family reunification issues requires to understand the different alternatives that a migrant is facing as well as the context of migration. As such, it happens that migration is almost purely driven by individual motives but international migration, especially from Southern to Northern countries may also include other components, among which family (Dustmann et al. (2017)) or the community. Then, whatever the reunification schedule, an interesting behavior of the migrant is the remittance pattern. In the model displayed in this paper remittances are likely to happen when the family splits so that, depending on the complementarity in terms of consumption paths, the spouses' consumption is smoothened. Yang (2008) with the example of Philippines indicates that remittances have an impact on the remaining family's decisions such as the investment in housing or the child labor. Additionally, as explained in Dimova and Wolff (2011) with the case of European countries, remitting can also have a positive impact on the probability of reunifying in the host country. However, the macroeconomic impact of remittance on source countries is unclear (Clemens and McKenzie (2014)) or could even be detrimental in case of a *Dutch Disease* due to high amount of transfers (Acosta et al. (2009)).

In a fascinating paper Jasso and Rosenzweig (2010) deal with the choice between reunifying and remitting. In their study the reunifiers are the parents and the children initially stayed in the source country. They found out that reunification through the migrants' children occurs for the most educated children whose gains from migration are likely to be the highest. On the other hand, low-educated children are less prone to migrate but will rather benefit from financial transfers.

desire to get buried in the source country and the feeling of discrimination in the host country.

Family migration Since members of a household can all work on the labor market it matters to analyze how wages might affect the family-migration decision (Gemici (2007)). It may happen that only one of the spouses is better off in terms of wage perceived in the host country and then the wage *premia* of the first migrant should outweigh the loss of the second migrant. Moreover, this subtraction ought to be net of the opportunity cost of coming back home for the initial migrant. Mincer (1978) looks at the conditions under which family migration can occur in terms of household net wage gains. Family migration might happen even if one spouse loses out on it as long as this loss is offset by the wage *premia* of the other spouse due to migration. Mont (1989) provides a similar analysis with the use of a search model that explains the selection of the migrating couples and in which setting the couples can be composed of double-tied stayers. A empirical exercise with Swedish internal migration finds that migration for family motives leads to a labor market deterioration for the household Gillespie et al. (2020).

The thin thread of literature that followed bring insights about who in more likely to migrate given the expected gains from migrating. Borjas and Bronars (1989) use the canonical Roy model in the case of a household composed of two migrants. Using immigration to the US over the 1970s they found out that family migration under this frame is more self-restrictive. Conversely, Munk et al. (2017) obtained the opposite result with Danish emigration to other Scandinavian countries: self-selection is reduced. Eliasson et al. (2014) find similar result with Swedish internal migration. Foged (2016) includes both internal and international family migration and finds that the share of each spouses, in terms of education level, matters in deciding whether to migrate. In any case, family migration is understood as a *simultaneous* migration.

Migration occurs through 4 main channels based on 4 different motives to emigrate: (i) escape danger in the source country (asylum), (ii) study in another country, (iii) get a job in a new country, (iv) join the family in another country.[6] The two last categories generally dominate the absolute number of migrants flows. Hence it seems important to also analyse *sequential* migration. It is worth exploring whether there are differences between them concerning the economic performances. Jasso and Rosenzweig (1995)

[6] Obviously those are the large categories and subtle separations can be added. As such, what it named "new theory of international migration" indicates that migrations can be driven by a risk-limiting behavior. Migration is understood as a diversifying process. See for example Rosenzweig and Stark (1989)

compares the performance of both groups in the US between 1977 and 1990. Labor migrants perform better than the family reunification migrants but the gap seems to decrease over time without vanishing completely.

A Bridge between Permanent and Temporary Migration Permanent and temporary migrations are generally viewed as following completely different patterns. Temporary migration can be more intuitively explained through consumption and savings' maximization behaviors as in Djajić and Milbourne (1988), Djajić (1989), Dustmann (2003a) and Dustmann (2003b). Indeed, the migrant decides to migrate in order to benefit from a higher wage (but higher price levels as well) that might allow her to save money that can be used in the future once back to the source country. A key question then is: when does the return migration take place in the migrant's lifetime. It is likely that temporary migrants are less risk averse than their non-migrants counterparts. Permanent migrants, as well as temporary migrants, introduce non purely economic and individual characteristics such as family, network, political instability in the source country, *etc.* Those factors are simply included in a different type of reasoning: what period time time is optimal before a reunification in the host country.

In practice, except for the famous guest-worker programs (*e.g. Gastarbeiter* in Western Germany, and *Bracero* between the US and Mexico) which were major migration channels during the postwar era, return migration is not much studied empirically with few exceptions such as Dumont et al. (2008). Return migration accounts for 20 to 50% of immigrants recently arrived (less than 5 years) in the host country. The authors observe a U-shaped frame of return frequencies and age: returns migrants are mostly young whose professional life remains to be set and retirees who seek to better benefit from their pensions.

This paper aims to analyze in what case a migrant prefers to return instead of trying to bring the family in the host country. Migrants whose spouses initially remained in the source country are implicitly facing a choice between temporary and permanent migration. De Coulon and Wolff (2010), indicated that a couple with child actually has one more choice: circular migration. They studied the desires of immigrants once retired and checked how the type of migration was impacted by the location of the child(ren). Djajić (2008) provides a framework under which return migration of parent is a possibility, depending on the interests of their children to remain in the host country or return to the source country.. Even if it would be an interesting alternative as this might concern one fourth of the retiree migrants, I do not include this option in the model for several reason: I rather aim to analyze family reunification between spouses and this event is more likely to happen during the active period of life. Additionally, the MAFE dataset only deals with few distant pairs of countries, implying that the cost of migration would be prohibitive in the case of multiple migrations.[7]

3 A Model

3.1 Basic Setting

Our aim is to provide an economic understanding of the family reunification phenomenon. This simple framework ought to shed some light on key determinants of the family reunification process.

Most of the time, family reunification concerns the spouse of the migrant. The concept of family, which would require a longer discussion as in, for instance Kraler et al. (2012) or Foppiani and Scarlatescu (2018)), is shrunk here to a household composed with two spouses only.

As mentioned above, the present setting is restricted to two phases that are split by the family reunification. there is no refinement about the route of the migration that can imply transit countries, there is no circular migration migration either.

3.1.1 Assumptions

The model is restricted to migrants who have relatives and more specifically spouses in the source country.[8] I assume that the migrant is the one taking all decisions in light of the spouse's preferences. Therefore, the migrant will look

[7]On the other hand, that does not include transit migration as analyzed by Djajić (2017) Migration from Africa to Europe appears to hide "checkpoints", *i.e.* few transit countries.

[8]This is a restrictive assumption that allows some more coherence as we assume a specific household lifetime and that both agents are in working age - even if this second aspect can be dropped easily. Moreover, using the MAFE data presented later in this paper one can see that the most frequent decider of the migration, if the the migrant him or herself is the spouse and the partner, among the different people, is the most likely to have financially contributed to the migration.

at the household's lifetime total utility and compare four cases. First, the family reunifies in the host country, which means that she brings the spouse there (Belgium, France, Italy, the Netherlands, Spain, the United Kingdom) at an optimally chosen point in time. Second, after some (optimal) time spent in the host country, the migrant decides to go back to the source country and reunify with the family there. Third, the migrant does not reunify and the family remains apart forever. Fourth, the spouses migrate simultaneously.

I also assume that there is neither uncertainty nor information asymmetry. It follows logically the hypothesis of a common worldwide interest rate, r. This will also be useful to drop any strategic arbitrage the migrant can be pushed to make in case of interest rate differential as in Djajić (2010). Additionally, the household's wage can be spent without friction costs in any of the two countries when the family is separated. S/he decides to reunify or not according to the best situation possible in terms of household utility. According to the type of reunification the period of separation can differ.

3.1.2 Economic Variables[9]

Wages in the two countries are different as well as wages earned by the two spouses. Wages are denoted as following: for each period the household earns a sum of both spouses wages, $w_{\tilde{w},w_s}$ denotes the total wage obtained by the couple when the migrant works in the host country and and the spouse works in the source country. It should be mentioned that individual wage, and most likely the spouse's wage(s) might be zero in the case of no activity on the labor market. This can be explained by gender inequality on the labor market, skill gap between the spouses, weekly number of hours worked, etc. The model includes prices of the consumption baskets of each spouse and prices are not necessarily the same in the two countries. It is more likely that the price index in the source country p would be lower than the price index in the host country $\tilde{p}$ but this is not obligatory (although I use this restriction for the calibration of the model, in line with the data I use in the present paper). I assume that migration from the source to the host country is costly and this cost is not necessarily the same for the two members of the family if it reunified in the host country, as the first migrant might have

[9]A practical comment: notation with s subscript indicates spouse, tilde notation indicates the host country. For the agent who does not move, there still are two situations, the one being separated and the one being reunified. Since separation occurs before, it will be denoted with the subscript "1" and the second period with the subscript "2".

built a network that allow avoiding some costs.

Within the lifespan of the representative household there would be a decisive moment, τ, when it chooses to reunify. There are four possibilities at time τ: (i) the migrant goes back to the source country to reunify with her family there, (ii) s/he reunifies the family in the host country, (iii) the couple is split forever $\tau \geqslant T$, (iv) there is no separation at all ($\tau = 0$). It should be stressed that if a reunification occurs, τ can vary according to the country of reunification.

Additively separable household utility To keep things as simple as possible, the household is assumed to maximize a Bergson-Samuelson joint welfare function. This is a subset of the CES framework where the substitution between the two spouses' utilities is perfect (it is equal to unity).

$$U(c_{1t}, c_{ts}) = \alpha u(c_t) + (1 - \alpha)u(c_{ts}) \tag{1}$$

Quite classically, α and $1 - \alpha$ accounts for the Pareto-weights accruing to each spouse. With households members fully altruistic among each others, the coefficient α is 1/2. The individual's utility functions are assumed to be well-behaved ($u'(c) > 0$ and $u''(c) < 0$). So this restriction erases the supermodularity property of the function which can partly explain the desire of both members of the household to increase each other's consumption level. Therefore, it would be interesting to compare the separable and Cobb-Douglas household utility functions, as the former does not include any complementarity between spouse consumption while the latter does. The results are quite similar.

Separation cost and migration psychological costs It seems realistic that the utility function should add a "separation penalty" when agents are not living together: they are supposed to suffer from the distance between them. To my knowledge, literature of the functional from this penalty should take over is rather modest. A constant penalty allows to considerably simplify the derivations but does not seem to catch reality very clearly. An always increasing and convex penalty might be convincing in the case of temporary migration as in Vinogradova (2016). Lastly, in the case of potential permanent migration the shape of the separation penalty might actually be either increasing but concave, or take the form of an inverse-U as it is implied in a Dutch case (Eurelings-Bontekoe et al. (2000)). For convenience, I stick to the easiest case where the separation generates a penalty on the household utility that is a function of the duration of separation. Let $\pi(\tau)$ be the remainder once the penalty has been taken in account with $0 \leq \pi(\tau) \leq 1 = \pi(0)$, $\pi'(\tau) < 0$ and $\pi''(\tau) > 0$. The household utility while being separated takes the form $\pi(\tau)U(c_{1t}, c_{ts})$.

A more classic cost of migration deals with the move from home. This does not only imply a (temporary) separation from the nuclear family, it also leads to a separation with the extended family, a network established locally, a climate, a culture, etc. Therefore, it will be assumed that for any given amount of consumption, a extra consumption will deliver a higher utility if consumed in the home country $\tilde{u}'(\tilde{c}) < u(c)$, $\forall\ \tilde{c} = c > 0$.

3.2 Model with reunification

When the family reunifies there must be an optimal moment for it and this will depend on the location of the reunification itself: source or host country. It clearly appears that one of the two agents would switch country, thereby switch wage earned as well as the price level she is facing. There is a break in the household utility function. Depending on the place of reunification the decision can appear at a different time as this moment is set endogenously in the model. Implicitly, a model without reunification implies (i) $\tau = 0$ in the case of the host country reunification, implying that spouses migrate together; (ii) $\tau < 0$ in the case of the source country reunification which implies no migration at all; (iii) $\tau > T$ in either case implying that, in the given scenario, the couple remains separated.[10]

3.2.1 Host reunification

In this setting the spouse of the migrant who initially remained in the source country eventually migrates. The objective function of the household is the following sum of discounted utilities, with δ as the discount factor:

$$V_{frhost} = \int_0^{\tau} \pi(\tau)U(\tilde{c_{1t}}, c_{ts})e^{-\delta t}dt + \int_{\tau}^{T} U(\tilde{c_{2t}}, \tilde{c_{ts}})e^{-\delta t}dt \qquad (2)$$

[10]This case isn't realistic but we stick to this possibility for completeness. Additionally, in the MAFE database there are few outliers who are still separated after an extremely long period of time, up to three decades.

subject to its budget constraint:

$$BC_{frhost} : \int_0^{\tau} (w_{\tilde{w},w_s} - \tilde{p}\tilde{c_{1t}} - pc_{ts})e^{-rt}dt +$$

$$\int_{\tau}^{T} (w_{\tilde{w},\tilde{w_s}} - \tilde{p}\tilde{c_{2t}} - \tilde{p}\tilde{c_{ts}})e^{-rt}dt + A_0 - K_0 - K_1 e^{-r\tau} = 0 \tag{3}$$

The intuition is straightforward: the household aims to maximize its utility subject to the resources available and the fixed cost incurred by the (potentially) several migrations.[11] Then I derive the first order conditions that would imply to get the two different consumption levels of the spouse as a function of the migrant's consumption. Since the choice of τ is endogenous there are five first order conditions:[12]

$$\frac{\partial L}{\partial \tilde{c_{1t}}} = 0 \Leftrightarrow \frac{\partial U(\tilde{c_{1t}}, c_{ts})e^{-\delta t}}{\partial \tilde{c_{1t}}} = \lambda_{frhost} \frac{\tilde{p}}{\pi(\tau)} e^{-rt} \tag{4}$$

$$\frac{\partial L}{\partial c_{ts}} = 0 \Leftrightarrow \frac{\partial U(\tilde{c_{1t}}, c_{ts})e^{-\delta t}}{\partial c_{ts}} = \lambda_{frhost} \frac{p}{\pi(\tau)} e^{-rt} \tag{5}$$

$$\frac{\partial L}{\partial \tilde{c_{2t}}} = 0 \Leftrightarrow \frac{\partial U(\tilde{c_{2t}}, \tilde{c_{ts}})e^{-\delta t}}{\partial \tilde{c_{ts}}} = \lambda_{frhost} \tilde{p} e^{-rt} \tag{6}$$

$$\frac{\partial L}{\partial \tilde{c_{ts}}} = 0 \Leftrightarrow \frac{\partial U(\tilde{c_{2t}}, \tilde{c_{ts}})e^{-\delta t}}{\partial \tilde{c_{ts}}} = \lambda_{frhost} \tilde{p} e^{-rt} \tag{7}$$

The first four Focs are straightforward: they provide the arbitrage among consuming one more unit - in each cases separately - against the cost it generates.[13] Marginal utilities of the migrant and the spouse once s/he migrated

[11] One can assume that this fixed cost is much smaller than the first migration's fixed cost: it is likely that a network has been previously set by the initial migrant. However, some costs still exist such as the cost of moving, the cost of the procedure.

[12] In practice, it seems reasonable to state that τ is endogenous as long as it is not small enough. Indeed, migrants are generally required to have lived in EU member State for at least 18 months to be able to implement the reunification procedure. Alternatively, it could be zero and both spouses migrate together.

[13] The langrange multiplier, λ, is a measure of the marginal utility of wealth as a relaxation of the BC will be expressed in terms of λ. Therefore, equation (4), for example, that provides the marginal utility brought by an extra consumption of the first migrant is the expression of the marginal cost in terms of marginal utility of wealth, the price level in the host country, the cost of separation at τ and the discounting.

are equal. Marginal utilities of the migrant before and after reunification are equal, once corrected for the cost of separation that only occurs before reunion. Therefore, if the costs of separation were zero, the consumption of the migrant might change at the reunification but the value of an extra consumption unit should remain the same. The marginal consumption of the spouse, before and after migration are the same, once corrected for the cost of separation and the price level encountered in both cases. If prices in both countries were equal, and if there were no separation costs, the marginal utilities would be equal and this would lead to $c_{ts} < \tilde{c_{1t}} = \tilde{c_{2t}} = \tilde{c_{2t}}$ because of the cost of being away from the home country.

Assuming for simplicity that $\delta = r$, then the consumption rate for each spouse within the two situations is constant, the move occurs with a change of migration status:[14]

$$\frac{\delta L}{\delta \tau} = 0 \Leftrightarrow [U(\tilde{c_2}, \tilde{c_s}) - \pi(\tau)U(\tilde{c_1}, c_s)] - \pi'(\tau)U(\tilde{c_1}, c_s)\int_0^{\tau} e^{-r(t-\tau)}dt = \lambda_{frhost}[(w_{\tilde{w},w_s} - \tilde{p}\tilde{c_1} - pc_s) - (w_{\tilde{w},\tilde{w_s}} - \tilde{p}\tilde{c_2} - \tilde{p}\tilde{c_s}) + rK_1] \quad (8)$$

The meaning of the last condition, equation (8), is crucial in the present analysis: the left-hand side (LHS) indicates the extra-cost in terms of forgone utility brought by delaying the reunification of the spouses and the RHS assesses the utility value of extra wealth brought by being separated one more instant. Since the separation cost π only enters in the period before reunification, the utility of household consumption is reduced in this period only. However, the cost of separation itself is a function of the length of separation. Therefore, the foregone utility by staying split an extra instant ought to be corrected by the change of the separation cost.[15] The Bergson-Samuelson functional frame given in equation (1) allows to simply the usual marginal utilities equivalences:

$$\pi(\tau)\alpha\tilde{u}'(\tilde{c_1}) = \alpha\tilde{u}'(\tilde{c_2}) = (1-\alpha)\tilde{u}'(\tilde{c_s}) = \pi(\tau)(1-\alpha)(\frac{\tilde{p}}{p})u'(c_s) \quad (9)$$

From equation (9) one can easily reformulate $\tilde{c_2}$, $\tilde{c_s}$, c_s as functions of $\tilde{c_1}$ so that equation (8) is rewritten as:

[14]Hence $U(\tilde{c_\tau}, c_{\tau s}) = U(\tilde{c_t}, c_{ts})$.

[15]One can easily notice that this additional term on the LHS drops whenever π is constant.

$$G \equiv [U(\phi(\tilde{c_1},\tau),\varphi(\tilde{c_1},\tau)) - \pi(\tau)U(\tilde{c_1},\psi(\tilde{c_1}))] - \pi'(\tau)U(\tilde{c_1},\psi(\tilde{c_1}))\int_0^{\tau} e^{-r(t-\tau)}dt -$$
$$\frac{\pi(\tau)\tilde{u}'(\tilde{c_1})}{\tilde{p}}[(w_{\tilde{w},w_s} - \tilde{p}\tilde{c_1} - p\psi(\tilde{c_1})) - (w_{\tilde{w},\tilde{w_s}} - \tilde{p}\phi(\tilde{c_1},\tau) - \tilde{p}\varphi(\tilde{c_1},\tau)) + rK_1] = 0 \quad (10)$$

with $\phi(\tilde{c_1},\tau) = (\tilde{u}_{\tilde{c_2}})^{-1}[\tilde{u}'(\tilde{c_1})\pi(\tau)] = \tilde{c_2}$, $\varphi(\tilde{c_1},\tau)) = (\tilde{u}_{\tilde{c_s}})^{-1}[\tilde{u}'(\tilde{c_1})\frac{\alpha}{1-\alpha}\pi(\tau)] = \tilde{c_s}$, $\psi(\tilde{c_1}) = (u_{c_s})^{-1}[\tilde{u}'(\tilde{c_1})\frac{\alpha}{1-\alpha}\frac{p}{\tilde{p}}] = c_s$ where $(\tilde{u}_{\tilde{c_2}})^{-1}[.]$, $(\tilde{u}_{\tilde{c_s}})^{-1}[.]$, $(u_{c_s})^{-1}[.]$ is are respectively the inverse functions of the marginal utilities of the migrant once reunified, the spouse after and before reunification. If one assumes that the individual utility function is identical, or is linearly related as it is the case here given that there is a psychological cost of consuming in the host rather than in home, one can further simplify the last equation. In this case, all consumption levels are positively and linearly related to each other. Therefore, all the consumption levels are similarly related to the exogenous variables.[16] The budget constraint can be integrated and modified in a similar fashion:

$$B \equiv (\frac{1-e^{-r\tau}}{r})(w_{\tilde{w},w_s} - \tilde{p}\tilde{c_1} - p\psi(\tilde{c_1})) +$$
$$(\frac{e^{-r\tau}-e^{-rT}}{r})(w_{\tilde{w},\tilde{w_s}} - \tilde{p}\phi(\tilde{c_1},\tau) - \tilde{p}\varphi(\tilde{c_1},\tau)) + A_0 - K_0 - K_1e^{-r\tau} = 0 \quad (11)$$

The system of equations (10) and (11) has two endogenous variables, $\tilde{c_1}$ and τ. G assesses the gain from reunifying an extra instant before and B simply evaluates the balances between accumulation during the separation period and overspending once reunified. Therefore, it is expected that an increase of B leads to more consumption $\tilde{c_1}$. An larger G will push down the duration of separation. Comparative statics can be classically obtained through the computations of partial derivatives of G and B with respect to both the two endogenous variables and the exogenous variables (I define $\mathbf{x}$ as the column vector with the exogenous variables for notation convenience). Here, the focus is put on wages, price levels, costs of migration and lifetime. One can apply the implicit function theorem (IFT) in the neighborhood of the equilibrium to obtain:

[16] The Pareto weight being an obvious exception when comparing consumption between the two spouses.

$$\begin{bmatrix} G_{\tilde{c}_1} & G_\tau \\ B_{\tilde{c}_1} & B_\tau \end{bmatrix} \begin{bmatrix} d\tilde{c}_1 \\ d\tau \end{bmatrix} = - \begin{bmatrix} G_{\mathbf{x^t}} \\ B_{\mathbf{x^t}} \end{bmatrix} d\mathbf{x} \tag{12}$$

The lack of explicit formulas and the use of IFT restricts the comparative statics to minor changes of each exogenous variables one by one. This nevertheless allows to sketch the consumption behavior as well as the duration of separation. From equation (12) it is rather straightforward to derive the comparative statics. One needs to ensure that the determinants of the Jacobi matrix of the endogenous components (denoted Δ) is positive.[17] In the present paper the focus is not on the consumption pattern itself but rather on the timing of reunification (and the country of reunification).

CRRA individual utility Since the procedure of this paper is based on a utility-maximizing approach, a key aspect is obviously the functional form of the utility function (based on Djajić models *e.g.* in Djajić and Milbourne (1988), Djajić (1989)) as the objective is to keep tractability in order to highlight the underlying mechanisms. Indeed, some of the comparative statics could be cumbersome and it highly facilitates the analysis to restrict the functional form of individuals' utility.

The migrant assesses the discounted utility all over the household's lifespan. Then, one can define each household member's utility based on a constant risk aversion function (henceforth CRRA) which is the following:

$$u(c_i) = c_i^{1-\theta}/(1-\theta) \tag{13}$$

$$\tilde{u}(\tilde{c_j}) = \gamma \tilde{c_j}^{1-\theta}/(1-\theta). \tag{14}$$

with $< \gamma < 1$ the (opposite) cost of being away from the source country, with i and j being either the migrant or the spouse.[18] This allows to verify the aforementioned condition: $\tilde{u}'(\tilde{c}) < u'(c)$, $\forall\ \tilde{c} > 0$ and $\tilde{c} = c$. We can call the cost accrued by γ the *heimat* cost, the cost of being away from the home country, the home culture, climate, *etc.*

The higher θ the higher the risk aversion of the agent. The fraction $1/\theta$ is the elasticity of inter-temporal consumption substitution of the agent.[19] The

[17] See Appendix (B) for a more careful discussion.

[18] γ is equal to zero when the cost in null and increases when γ decreases.

[19] Basic derivations indeed leads to

$$\frac{1}{\theta} = -u'(c_t)/u''(c_t) * c_t = -\frac{dln(c_t/c_t)}{dln(u'(c_t)/u'(c_t))}.$$

utilities of both agents in the household are based on the similar pattern as θ, the fixed measure of relative risk, is deemed as exogenous. This can be viewed as a restrictive simplification, as migrants generally have a specific risk aversion pattern and Dustmann et al. (2017) - showed that this not only applies to the individual but also to the household level.

Comparative statics for a host reunification is summarized in the following proposition.

Proposition 1 *In the case of South to North migration and the case of host reunification, with a price level in the host country relatively high (i.e. $\tilde{p}\theta > p$) and a not too large cost of separation the time being separated in the neighborhood of the optimal varies as:*

(i) $\frac{d\tau_h}{dK_0} > 0$, $\frac{d\tau_h}{dK_1} > 0$, $\frac{d\tau_h}{dA_0} < 0$

(ii) $\frac{d\tau_h}{dw_s} \gtreqless 0$, $\frac{d\tau_h}{d\tilde{w}_s} < 0$, $\frac{d\tau_h}{d\tilde{w}} < 0$

(iii) $\frac{d\tau_h}{dp} < 0$, $\frac{d\tau_h}{d\tilde{p}} > 0$

(iv) $\frac{d\tau_h}{dT} > 0$

Details can be obtained in (Appendix B). Results are rather intuitive. Larger costs of migration increases the time being split while a higher amount of initial savings reduces the duration of separation. This is intuitive: the more costly the first migration the longer the time to eventually afford the reunion and the higher the savings the easier it is to afford it. The time being separated is impacted by both spouses' wages. The spouse's earning before reunifying does not provide a clear answer as two forces are competing: a higher wage in the source country allows to reduce the pain from being split through a higher level of consumption but a higher wage in the source country also permits to afford reunification faster. Prices also refer the optimal choice of the household: the higher the price level in the source country the more likely the couple will reunify quickly as the spouse does not benefit from cheap consumption and both suffer from the separation. On the other hand, a higher price level in the host country leads to postpone the reunification in the host country as the cost of separation will be lower relatively to the better consumption opportunities in the source country. Lastly, a longer life expectancy allows the couple to delay the reunification and still enjoy the reunified period.

Then θ is the inverse of the sensitivity of consumption with respect to the change in marginal utility.

3.2.2 Source reunification

The procedure in the case of source reunification is exactly the same, only few ingredients change and can be easily noticed in the objective function and the budget constraint. Now the utility in the second period is based on the consumption of both spouses in the source country and thus prices and wages must adapt accordingly. The objective function and the budget constraint only differ from the host reunification scenario in the after reunion phase. A core element is that the time of reunification does not need to be the same in the two scenarii (I set the problem directly assuming $r = \delta$).

$$V_{frsource} = \int_0^\tau \pi(\tau) U(\tilde{c}, c_{1s}) e^{-\delta t} dt + \int_\tau^T U(c, c_{2s}) e^{-\delta t} dt \tag{15}$$

subject to its budget constraint:

$$BC_{frsource} : \int_0^\tau (w_{\tilde{w},w_s} - \tilde{p}\tilde{c} - pc_{1s}) e^{-rt} dt +$$
$$\int_\tau^T (w_{w,w_s} - pc - pc_{2s}) e^{-rt} dt + A_0 - K_0 - K_1 e^{-r\tau} = 0 \tag{16}$$

The procedure is similar: the household decides the best time of reunification as well as the consumption patterns. Therefore, one can easily obtain the equivalent B and G equations that parallel the equation (10) and (11). In this case, the comparative statics will be derived from:

$$\begin{bmatrix} G_{c_{1s}} & G_\tau \\ B_{c_{1s}} & B_\tau \end{bmatrix} \begin{bmatrix} dc_{1s} \\ d\tau \end{bmatrix} = - \begin{bmatrix} G_{\mathbf{x^t}} \\ B_{\mathbf{x^t}} \end{bmatrix} d\mathbf{x} \tag{17}$$

with the vector $\mathbf{x}$ being almost identical.[20] Source reunification can be summarised by the following proposition:

Proposition 2 *In the case of South to North migration and the case of source reunification,*

(i) $\frac{d\tau_s}{dK_0} > 0$, $\frac{d\tau_s}{dK_1} > 0$, $\frac{d\tau_s}{dA_0} < 0$
(ii) $\frac{d\tau_s}{d\tilde{w}} \gtreqless 0$, $\frac{d\tau_s}{dw} < 0$, $\frac{d\tau_s}{dw_s} < 0$
(iii) $\frac{d\tau_s}{dp} > 0$, $\frac{d\tau_s}{d\tilde{p}} < 0$
(iv) $\frac{d\tau_s}{dT} > 0$

[20] The wage $\tilde{w_s}$ of the spouse once reunified is replaced by w, the wage of the migrant after returning. The cost of reunification might also be different as re-migration does not imply the same costs as host reunification.

3.3 Comparison of the two models

The strategy here is quite simple: it aims to compare the objective functions of the two scenarii and how these change when exogenous variables are modified. In each scenario, when the optimal moment for reunification exceeds the household lifetime the "forever alone" option dominates. For $0 < \tau < T$ the household will reunify but the place of reunification remains to be defined.

The core idea is to check under which conditions one reunification is preferred over the other in terms of the exogenous variables of the model:

$$RF_{country} = \frac{V^*_{frhost}(w_{\tilde{w},w_s}, w_{\tilde{w},\tilde{w_s}}p, \tilde{p}, K_0, A_0, K_1, r, T, \pi, \theta, \gamma)}{V^*_{frsource}(w_{\tilde{w},w_s}, w_{w,w_s}p, \tilde{p}, K_0, K_1, A_0, r, T, \pi, \theta, \gamma)} \gtreqqless 1. \quad (18)$$

Whenever the ratio exceeds unity the household will seek to reunify in the host country. Even if the model is dangerously simplistic it catches a decent bulk of different variables but this has a cost. As such, it becomes tricky to derive the comparative statics. This is why I stick to calibrations and display several graphs that give the intuitions that the model brings about. Therefore, I will stick to the cases that are of interest in this paper, *i.e.* when the source country happens to be much less developed than the host country. That allows me to assert few bold assumptions, such as the wages are much higher in host than in source country, so are the price levels.

One can see that the two types of reunification involve in most cases opposite signs. This simply relates to the fact that push factors in one reunion scenario often consists in a pull factor in the other scenario.

4 Calibration[21]

Equipped with of the tools to make the decision, it is now possible to calibrate the model and provide results driven by the model. It appears crucial to analyze under what conditions is one type of reunification preferred over the other because the tractability of the model does not allow an analytical conclusion. In essence, while the descriptive statics answered the question when to reunify, the calibration will help understand where to reunify.

[21] Given the multidimensional aspects of the problem, the calibration are done on Mathematica using a very standard Nelder-Mead method to obtain the optimum at each point.

In the present context of South to North migration, it is likely that the source country, compared to the host country, will have lower wages and lower price level. Moreover, the difference is such that the real wages are larger in the host country as compared to the source country.

For wages and prices, I simply impose a larger wage in the host country for both spouses as well as larger price levels but less so, in order to limit the possibilities to settings where the host country would, *ceteris paribus* offer higher standards of livings ($\tilde{w} > w, \tilde{w_s} \geq w_s, \tilde{p} > p$ and $\frac{\tilde{w}}{\tilde{p}} > \frac{w}{p}$). Then, in the calibration, I display results of migration from a poorer country to a richer country, or at least from a country in which the agent's wage is lower to a country in which it is higher, which is in line with the scenario of migration from Africa to Europe. The analysis is restricted to $\theta < 1$ implying that agents are risk averse which is the most common setting even though this can widely vary (see Chetty (2006)). A obvious weakness of the calibration given in the table 1 is its arbitrary choice of default variables.

One can wonder whether one type of reunification would be privileged over another when, for instance, prices change or wages change. The values of τ are comprised between, *i.e.* $\tau = 0$ implying a simultaneous migration and the maximum value implying a forever separation ($\tau \geq T$). Depending on the situation, it can take value above the household lifetime, or below zero. In the first situation, this implies that there is no reunification at all; in the second case, that there is no separation at all (back to the initial model without reunification). I will bound the problem in the calibration to the minimum and maximum values τ can *realistically* take.

In the host reunification case, the optimal time for reunification increases with the price level in the host country and decreases with the price level in the country of origin. There is a price threshold in host country at which it appears better not to reunify at all. Fundamentally, a higher price in host country delays the reunification because the opportunity cost of being separated becomes relatively lower: they can wait more as this would otherwise imply to give up a significant purchasing power. Interestingly, below a given price level there is not reunification at all because there is no separation either: spouses migrate together. Therefore, the sequential migration happens only in a window of cases for which simultaneous migration is too costly and in which migrants suffer from being split.

An interesting result displayed in the figure (1) is that prices in both countries seems to have a similar effect. A low price level as well as a high price level leads to a larger ratio, which in turn implies a stronger preference

Variable	Default Value	Range for graph
$\tilde{p}$	2.5	[1.75 : 3.25]
p	1	[0.75 : 1.25]
$\tilde{w}$	8	[4 : 16]
w	1.5	[1 : 5]
$\tilde{w_s}$	5	[0 : 10]
w_s	1	[0 : 1.5]
r	0.05	[0.01 : 0.1]
δ	0.05	[0.01 : 0.1]
A_0	80	[0 : 150]
K_0	80	[0 : 150]
K_1	60	[0 : 100]
θ	0.81	[0.5 : 0.9]
T	40	[25 : 50]
γ	0.75	[0.5 : 1]
α	0.55	[0.3 : 7]

Note: The price level in the host country is taken from the MAFE weighted data, the price ratio would be 2.49 and so is the price level in host as source price level is normalized. I simply assume that the first migration is not constrained by liquidity access while the second migration is until τ quite large (above 20 years of separation). The risk aversion coefficient simply is fixed at the value estimated by Chetty (2006). This is the value when utility is additive and where the cross derivative is zero. Lastly, $\pi(\tau)$ is taken as discussed in Appendix B.

Table 1: Calibration Setting

for reunifying in the host country. The fact that host reunification is preferred in the case of higher host price level is counter intuitive. In essence, it means that, given the optimal choices of consumption of both spouses and the optimal reunification timing in both options, the host country will be preferred.

In a context of large wages gaps across countries: in the host country (by a factor of 4 or 5, as estimated for the US, see Clemens et al. (2016)) and of prices around 2.5 higher in the host country, migration is, of course, attractive. In this setting this is so attractive that source reunion is not meant to happen and thus the couple remains split. That would be changed with a higher cost of separation. This specificity explains why the source reunion case sometimes appears more profitable than the host reunification. Additionally, as shown in the graph (c) in figure (1), the psychological cost of being away from the source country (*heimat* cost) influence the preference of a source reunification over the other possibility. Indeed, at a large cost of separation (*i.e.* a low γ), the loss of utility due to living away from home pushes the migrant to prefer to reunify in the source country. Given the high differences in terms of standards of living the cost of being away from home should be rather high to push for a source reunification (about 25%).

(a) Price level in host country (b) Price level in source country (c) Psychological costs of living abroad

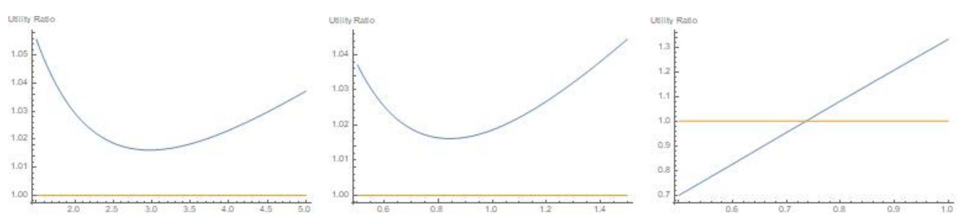

Figure 1: Objective Functions Ratio

The wage of the initial migrant is confronted to opposite effect that makes the conclusion difficult without calibration. The calibration results are displayed on figure(2). Interestingly, a larger wage earned by the first migrant in the home country makes the source reunification more appealing: the migrant can quickly accumulate enough earnings to later benefit from high standards of living in the source country and avoid both separation and *heimat* costs. On the other hand, the spouse wages in migration affects positively the preference to reunify in the host country. It is important to understand the key difference of those two wages: one is earned for sure by the migrant for at least τ years while the other will only be earned if the household decides to reunify in the host country. That makes the second wage more easier to compare as only one of the objective function, at optimum, will be affected. The impacts of a wage change for either spouses are provided in figure (3). In this case, the preference tends to go to a source reunification when the wages of either spouses in the source country is increasing. The first migrant's wage, once back home, does not need to be extremely important to make the source reunification preferred. In the calibration values selected, a ratio $\frac{\tilde{w}}{w} = 4$ is enough to obtain indifference between the two option ($RF_{country} = 1$). Those results about the wages raise the idea that the choice of reunification is not necessarily intuitive as it depends on the ratio of two optimal possibilities that have both consumption levels and timing of reunification as endogenous variables.

(a) Wage of the first migrant in host country (b) Wage of the spouse in host country

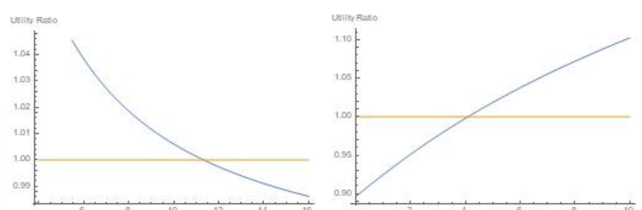

Figure 2: Objective Functions Ratio

(a) Wage of the first migrant in source country (b) Wage of the spouse in source country

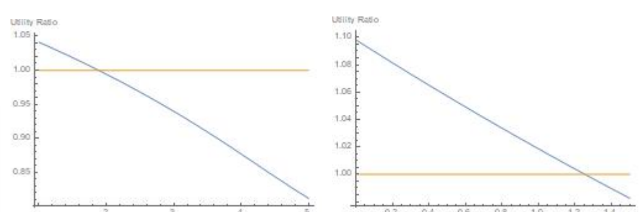

Figure 3: Objective Functions Ratio

Lastly, the figure (4) exposes the two costs of migration and the initial saving. Unsurprisingly, the first cost of migration and the initial saving are behaving symmetrically as they play in an exact opposite role in the optimizations. An increase in the cost of first migration will in fact lead to a preferred reunification in the host country. The household needs to benefit from host higher wages to pay back the migration costs. Initial savings's impact on the preferred reunification is the opposite. On the other hand, the second cost of migration leads to less obvious results. A larger second cost of migration tends to increase the preference for a host reunification above a given cost. Additionally, it appears that the concavity of the impact could lead to a preferred reunification in the source country for exorbitant costs of second migration. For completeness, the equivalent figures for a change in the depreciation rate (δ), the interest rate (r), the intertemporal elasticity on consumption substitution (θ), the life expectancy of the household (T) are provided in Appendix C.

(a) Cost of migration for the first migration

(b) Initial savings

(c) Cost of migration for the second migration

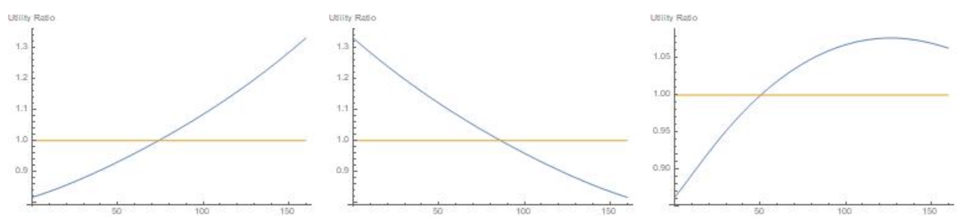

Figure 4: Objective Functions Ratio

5 The Empirics

5.1 MAFE data

To confront the insights of the model I proposed above, I use an empirical analysis with MAFE - Migration between Africa and Europe - data (for details about the database, please consult Beauchemin (2012)).[22] It covers

[22]The MAFE project is coordinated by INED (C. Beauchemin) in partnership with the Université catholique de Louvain (B. Schoumaker), Maastricht University (V. Mazzucato), the Université Cheikh Anta Diop (P. Sakho), the Université de Kinshasa (J. Mangalu), the University of Ghana (P. Quartey), the Universitat Pompeu Fabra (P. Baizan), the Consejo Superior de Investigaciones Científicas (A. González-Ferrer), the Forum Internazionale ed Europeo di Ricerche sull'Immigrazione (E. Castagnone), and the University of Sussex (R.

three countries in Africa: Democratic Republic of Congo, Ghana, Senegal; and six in Europe: Belgium, France, Italy, the Netherlands, Spain, the United Kingdom.[23] Only few pairs of migration channels are available. The survey was performed in 2009 on both continents and consists of a total of 5399 people surveyed. It is a cross-section retrospective database. The oldest information about a migration of someone having a partner goes back to 1958. There is a period of about 50 years that is covered but almost 90% of the observations are between 1988 and 2009.

The title of the database reveals that the focus is not only on a unilateral migration where it is expected to observe a South to North migration. Indeed, it suggests that it highlights the complexities of the migration patterns that usually occurs and for which the present study catches only one aspect. MAFE provides unique information about the two sides of the story, *i.e.* on reunifiers in the host country as well as on reunifiers in the source country. Another advantage is a legal one: practices in terms of family reunion are very similar across European countries, the UK being slightly different under few aspects (European Migration network Report (2016)). The legal constraint appears, at least in theory, to be similar in the host countries provided in MAFE data.

The questionnaire includes the entire milestone events of the surveyed, implying that all the migration, all the different periods of activity are both reported. Since some of the surveyed are on the separation period but might reunify in the future, the database is inherently *right censored* because several individuals will not have reunified at the moment of the study. The survival analysis will take this constraint into account. Moreover, the surveyed conveys information about his or her relatives: whether the person has a partner and what has been the partner's migration record. This highly

Black). The MAFE project has received funding from the European Community's Seventh Framework Programme under grant agreement 217206. The MAFE-Senegal survey was conducted with the financial support of INED, the Agence Nationale de la Recherche (France), the Région Ile de France and the FSP programme 'International Migrations, territorial reorganizations and development of the countries of the South'. For more details, see: http://mafeproject.site.ined.fr/

[23] In the present study, the case of Senegal can be worrisome since polygamia is rather widespread - up to one third of the adults are in a polygamous relationship. See Gning and Antoine (2015) for details. In Appendix F I alternatively drop one source country from the analysis, results are quite similar. Moreover, I run the regressions with an extra dummy variable that is equal to one if the surveyed is in a polygamous household. This variable does not impact the results.

detailed structure allows the computation of the duration of separation in both cases of - host or source - reunification.

A major drawback of MAFE, though not unsolvable, is the absence of unified wage. The information is unreliable as the researchers were asked to obtain the wages all over the life of the surveyed. Therefore, the currency could have changed during the period of activity. Since some countries experienced a change in currency (EU countries in MAFE except the UK) or a hyperinflation in the 1980s as in the case of the DRC, that makes the computation of the wages per period of activity highly unreliable and too noisy to be rigorously included in the analysis. Nevertheless, I construct a variable for each spouse that is 0 when the person is not active and 1 when the person is active on the labor market over time.

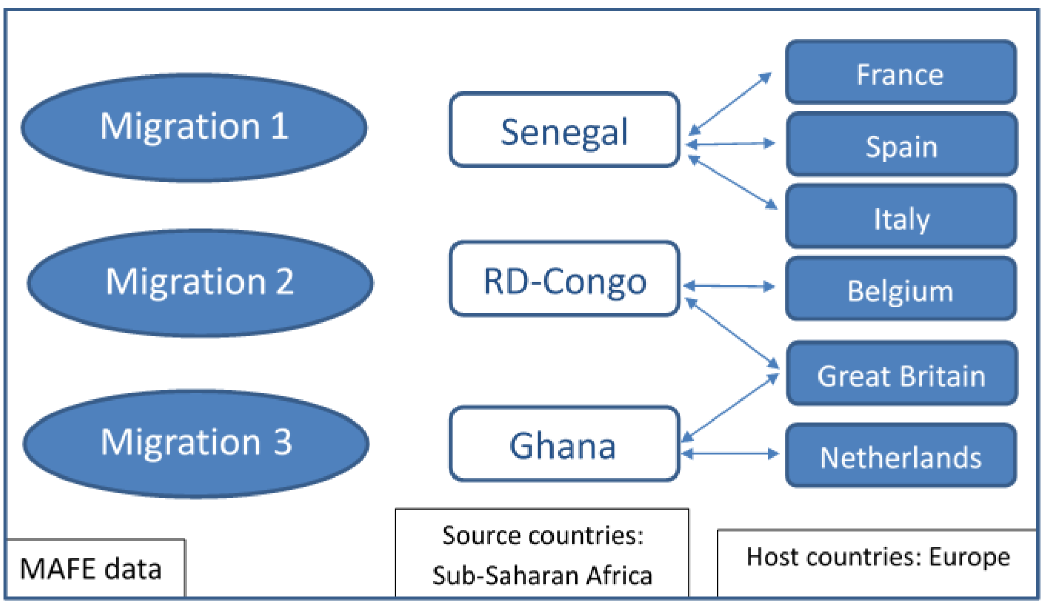

Figure 5: Countries involved in the MAFE Project

5.2 Other databases

As discussed above, I need a proxy to the standard of living because individual wages are unreliable. I simply refer to the World Development Indicators (WDI) database and use the GDP per capita in both the source and the host countries. From the WDI data, I also use the price levels in both types of countries. In addition; the GeoDist database from Cepii (Mayer and Zignago (2011)) allows to compute the geodesic distance from the capitals of both countries.[24] The GeoDist database also provides information about the language and the colonial past so that I build indicators variables for both variables, which takes the value 1 when the host and source countries share a language or when the host country was one former colonizer.

Since family migration can be understood as highly dependent on the legal frame that exist in the host country, I build two migration policy variables for the host country from the DEMIG (2015) database. This database is the result of a collection of migration reforms several countries over a large period of time. I build one variable - "exit restrictions" - that takes the values -1 when the the exit is made easier, 0 when nothing happened in the year or when the change is considered as neutral, 1 when the exit is more constrained. For example, Belgium in 1984 authorized the expulsion of students and I code it as 1 as this is clearly a more restrictive law that can affect the first migrant. I proceed similarly for another variable that is related to the entry and the integration of the migrant - "Entry or integration restrictions". For example, in 2001, Portugal enlarged the right of the migrants entering through the family channel. I coded it as -1. The host countries of the MAFE data are all part of the DEMIG so that I can match the years with legal changes. In the analysis, I will use the lag of the reform as I assume that a law usually requires some time after it is voted to be fully implemented (*e.g.* a reform about biometric passport that requires the systematic adoption of the technology at the borders).

5.3 Descriptive Statistics

Table (2) displays information about the share of sequential migration and hence justifies the analysis performed in the present paper: simultaneous migration is clearly less likely than sequential migration. Therefore, there must be some reasons why this is so. It can absolutely due specifically to legal constraints but it is worth analyzing whether economic reason are also involved. That would be the case if all the host reunification were to occur right after the migrant could legally reunify. In the European context, this

[24]Having the precise location might be more accurate but this will only change distances marginally as the distance between, for instance, Madrid and Dakar is not so different from the distance between Valencia and Dakar, or Barcelona and Dakar. Moreover, the MAFE database purposefully sample individuals from large cities, mostly for the capital and the suburbs. Therefore, the distance is likely to be reliable.

leads to a waiting time of 12 to 18 months. However, as it can been seen in Appendix D, the duration of separation often exceeds this bound. Other reasons must be part of the decision. In the MAFE data, it is noticeable that, for those who are not censored, reunification is more frequent. Even is the context of South to North migration, the share of returnee is sizable. It accounts to more than half of the observation in two of the source countries (DRC and Ghana) and for about a third for the last one (Senegal).

	DRC		Ghana		Senegal		Total	
	Freq.	Weighted	Freq.	Weighted	Freq.	Weighted	Freq.	Weighted
Simultaneous Migration	39	23%	41	23.9%	63	28.9%	143	26.1%
Source reunification	19	58.7%	49	50.3%	34	32.4%	102	42.8%
Host reunification	51	18.3%	67	25.7%	108	38.8%	228	31.2%

Note: The data as well as the weights are from the MAFE.

Table 2: Types of family migration

Table (3) illustrates few differences across the couples who experienced different migration patterns. There are four different groups: (i) those in which the spouse or the surveyed only is currently a migrant, (ii) those in which the spouse or the surveyed surveyed has returned, (iii) those in which both spouses are in the host country, (iv) those who migrated together. Therefore, the first group consists of the household still split (censored observation in the data); the second group characterises the source country reunification; the third display the spouses in the case of host reunification; the last one deals with simultaneous migration.

In general, migrants who have either returned or who reunified in host country migrated at a younger age, the youngest being on average the host reunifiers. The age at migration is close across the migration patterns: migrants are likely to be in their late twenties. This is partly implied by the constraint that migrants should be separated, implying that they have a partner and hence are likely to be older. Indeed, if one included all the migrants the average age would be lower. In the survey, most of migrants are males. In the last column in which the proportion is more balanced.[25] Family migrants appear to usually be more educated than migrants who are still separated. Polygamy is relatively frequent in one of the three source countries, Senegal Gning and Antoine (2015). In the data, it seems that this the case for a

[25]This last result might be driven by the survey design itself in which men might have been less likely available to directly answer.

minority of the individuals. It is less frequent for simultaneous migration, demonstrating that it might be more complicated to migrate together in the host country when being polygamous, which is not authorized in the host countries of MAFE data. The migrant is more frequently active than the spouse. Interestingly, the activity is lower for both spouses in the case of simultaneous migration. In light of this, it appears that simultaneous migration corresponds to different people than the family reunification. The GDP per capita in the host country is particularly high for a single migration, in which the separation is ongoing, and it is particularly low in case of simultaneous migration. In the case of source reunification the GDP per capita is significantly lower and in the case of host reunification it is somewhere in between. This suggests that when migration occurs in a richer country return migration is less likely. Source country per capita GDP demonstrate few notable differences with the exception of simultaneous migrants. Sequential migration happens more frequently when there is a large gap between source and host countries. This is also true with the price level variable. Additionally, it seems that host reunification is more frequent when the source price level is relatively high. When the host country was the former colonizer the migrants are more likely to stay there. This could be partly explained by the common language that the countries might still share but this might not be a sufficient explanation. There are institutional links among countries such as the *Commonwealth* or the *Francophonie*. Lastly, the mean number of years separated highly changes according to the groups. For the censored groups, *i.e.* when only one household member is currently in migration, the mean time being separated is much higher than for the groups of reunified. Among reunifiers host reunification seems to take longer, but this is not significantly higher. Including simultaneous migration would simply push down the mean time of separation in the case of both spouses are together in host country.

The policy variables seem to have a comparable influence on the two types of reunifications whereas the effects between the censored group (the migrant is still alone) and the simultaneous migration are reverted. Migrants are more likely to be isolated when the country is running restrictive reforms towards the exit. This effect mirrors the one for simultaneous migrants.

Lastly, τ has different values depending of the type of migration that is ongoing. The censored group seems to have specific characteristics postponing the reunification for a long time. Host reunification seems to happen later, on average, than source reunification. This is interesting as it implies that the accumulation of savings before returning can be achieved before the one before managing to perform a host reunification. This can be due to several drivers, such as a higher cost of migration in the second case, a lack of transferability of skills of the spouse so that the opportunity cost for reunifying in the host country is higher, the legal frame forbidding migrant to reunify as long as they do not match the *criteria* (wage, housing, *etc*).

Variables	**One migrant**	**Return migration**	**Both at migration**	**Simultaneous**
Age at separation	30.3	29.6	26.8	28
Gender of the first migrant		*Proportions*		
Male	94.3	78.7	88.6	58.6
Diploma	10	13.6	12	13.8
Polygamy	0.108	0.066	0.089	0.014
Active migrant	0.876	0.724	0.795	0.587
Active spouse	0.459	0.631	0.354	0.387
(ln) GDP per capita in host	10.36	10.14	10.01	9.74
(ln) GDP per capita in source	6.57	6.37	6.5	8.74
Price level in host	1.03	1.05	1.08	1.08
Price level in source	0.432	0.385	0.462	0.814
(ln)Distance	8.38	8.42	8.36	8.43
Is source a former colony?		*Proportions*		
	41.2	56.3	66.6	29.4
Do host and source share a language?		*Proportions*		
	43.6	63.5	68.2	85.4
Exit restrictions	0.036	-0.033	-0.031	-0.034
Entry or integration restrictions	-0.067	-0.20	-0.051	0.146
τ (no simultaneous migration)	8.64	3.63	4.59	0

Note: The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG.

Table 3: Characteristics of different types of couples

5.4 Estimation of τ - When reunifying?

The MAFE data provides a unique opportunity to estimate τ - the time being separated - either in the source reunification scenario or in the host reunification scenario or eventually with non-yet reunified couples (see Appendix D).

Survival Analysis Survival analysis appears to be a promising way of dealing with the research question for several reasons: (i) it is meant to study the waiting time until a defined even happens, here the reunification of the spouses; (ii) survival analysis has the key advantage to take into account censored data, which are the observations that have not encountered the "fateful moment". Usually the fateful moment is death or marriage, but this is not necessary. In my analysis, that will be τ, the reunification moment. In MAFE data, there are migrants who are alone in the host country with a spouse in the source country at the time of the study. Those observations are right censored. (iii) Survival analysis eventually allows to study the impact of predictors. Hence I will be able to assess how τ is impacted by several variables included in the model.

Competing Risks The present study requires a slight complication of the basic survival analysis as the fateful moment can either be host or source reunification. Both cannot happen simultaneously. Therefore, it is as if the two possible reunification events were competing with each other until one happens. Therefore, I will apply the competing risks analysis (see Cleves et al. (2008) or Dignam et al. (2012) or Austin et al. (2016) for simple presentations). This requires a slight refinement of the casual hazard and survival functions and derive cause-specific hazard as well as cumulative incidence functions. The data are then composed of three distinct groups: (i) the censored observations for which the separation is still ongoing, (ii) the ones who reunified in the source country, (iii) those who reunified in the host country. Estimated survival functions indeed differ across the type of reunion. It appears that the migrants choosing host reunification usually remain split longer. Indirectly this specification is helpful to avoid biases that would emerge through potential informative censoring. Indeed, one can notice in table (3) that censored observations bear differences with the other groups of interest. It matters as Lin and Wei (1989) stress that inference in Cox proportional model can still be obtained even though the vector of regression coefficients are misspecified. Given the very few variables used in the present analysis this property is clearly appealing.

The cause-specific hazard gives the probability of experiencing a failure for the reason i at a specific moment, provided that failure has not happened so far. It can be written in the following way:

$$h_l(t) = lim_{\Delta t \to 0} \frac{P[t < \tau < t + \Delta t, \text{failure from cause 1 } | t \leq \tau]}{\Delta t} \tag{19}$$

The only difference with classical hazard function consists in the additional constraint that failure has to happen for a specific reason. In this scenario, l is only a set of two components: $\{source; host\}$. Put differently, the subhazard accounts for the rate of failure for either reunifying in source or in host at a given instant and provided that reunification has not occurred so far. In the case of competing risks the Survival function is of little help as it does not distinguish the types of reunifiers; instead, it is common to rather use the Cumulative incidence function (CIF):

$$CIF_l(t) = P(\tau \leq t \text{ \& failure from cause l})$$
$$= \int_0^t h_l(x)S(x)dx = \int_0^t h_l(x)e^{-\sum_{j=1}^{2}\int_0^x h_j(u)du}dx \quad (20)$$

The CIF counts the number of failure per units of time - year - for a given reason. Hence the CIF is generally not bounded by unity as are classic cumulative functions but the sum of $CIF_l(T)$ is.[26]

Covariates As covariates, I include the GDP per capita of both source and host countries as well as the price conversion factor with respect to the purchasing power parity. The first variable is meant to proxy the wage of the migrant, the second to approximate the price level. Importantly, I pick the values at the time of reunification and in 2009 for the censored observation as the MAFE data was built in 2009. This is in line with two strong assumptions of the model, (i) agents do not suffer from any uncertainty and (ii) wages as well as price levels are assumed to be fixed. Hence the spouses can make their decision with the reunification values.

Distance from host and source countries is used as an approximation of the cost of migration. It will be added two proxies, one dealing with common languages between source and host countries, the other with a potential link with colonial past. From the MAFE data itself, I use the age of the surveyed at the separation. The smaller the age the higher the expected life expectancy of the migrant and, henceforth, of the couple. I also add the gender and a binary variable that take the value of one if the migrant's work is considered as intermediary or highly skilled (following isco taxonomy). The level of education, proxied by the number of year of schooling, can add some information about the wage of the surveyed. In contrast with the GDP per capita that is supposed to give a moment of location, education level would

[26]There is only one failure per individual and both type of failures cannot happen in the scenario I set up. However, this is a restriction as it is possible that a migrant got married several times and proceeded to several reunifications. Another possibility is that the reunification happens in the host country but then the couple decides that they are better off in the source country and hence go back in the same year. Since I cannot work with any finer time interval than year this can exist though it seems unlikely because of the high cost of migration.

rather highlight a plausible impact of the spread of the wages, assuming as in a Mincer-type regression that education impacts wages. It could also have an impact in a Roy-Borjas model, involving that remuneration would be dependant on the level of education (see Appendix A for a discussion of the potential Roy-Borjas setting in the family-based migration). In the case of source reunification, the issue would rather deal with the transferability: do return migrant who are relatively highly educated suffer more or less from reintegration? The issue is not raised in the theoretical model, though this is clearly an important question that can unleash future research. Among the individual-specific variables, I add the gender of the first migrant because it seems that there is a strongly unbalance proportion of males among migrants. Lastly, I use the two policy variables from DEMIG that I constructed to catch part of the push/pull legal drivers.

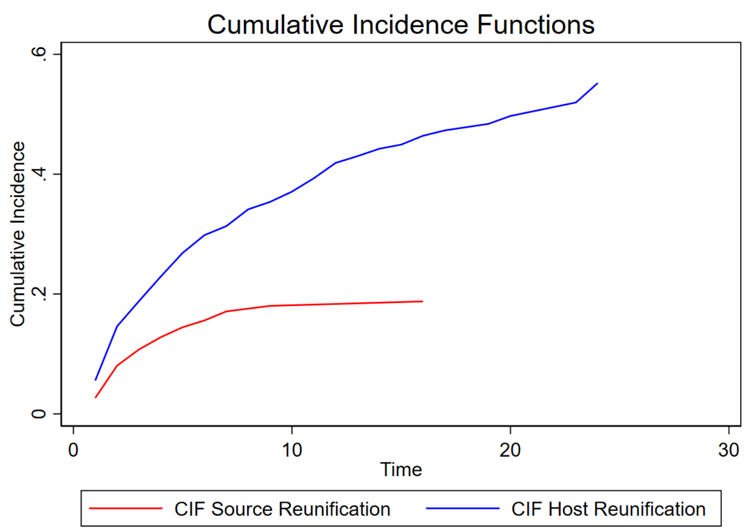

Figure 6: Non-parametric estimation of the Cumulative incidence Function

Cox Model The estimation of τ is done acording to the equation:

$$h_l(t|\mathbf{x}_i) = h_{0,l}(t)e^{\mathbf{x}_i\beta_x} \tag{21}$$

It denotes a simple Cox model with the refinement that hazards are specific to the cause of reunification. The theoretical model highlights the need for a competing risks structure, and the figure (**??**) illustrates that the probability of reunifying by year t differs across types of reunification and is more likely in the case of source reunification. Here, $\mathbf{x}_i$ accounts for the covariates presented above. Notice that I simply look at linear impact of the covariates on the probability of reunifying at time t for reason l. I proceed accordingly for the sake of simplicity of interpretation and comparison with the model's intuitions. Though very simple, the Cox model allows the baseline hazard function $h_{0,l}(t)$ to be unspecified (but nonnegative) and thus the baseline function can freely take any functions. It can be found in the appendix F equivalent regression performed with parametric models, results are similar. The Cox model remains it this very simple setting and the restrictive proportional hazards assumption does not seem to be violated.

Subhazard Function to Model the CIF In addition of the classic Cox model, I also display the subhazard function model derived by Fine and Gray (1999). This allows for different hazard patterns for the two competitive events. The hazard is slightly different than in equation (22) as it introduces the possibility of the other type of reunification given that the first one occurred. The sub-hazards are built according to the following limit:

$$\bar{h}_l(t) = lim_{\Delta t \to 0} \frac{P[t < \tau < t + \Delta t, \text{failure from cause 1 } | t \leq \tau \text{ OR } (\tau < t \text{ \& not 1})]}{\Delta t} \tag{22}$$

Obviously, this does not bring additional light to the model presented in this context, but it still enriches the analysis by better bridging the explanatory variables to cumulative incidence as it is the case in a non competing structure. It is very clear that the Fine and Gray approach parallels the classic Cox model, both are semi-parametric and assuming proportional hazards. Only the baseline function might differ.

$$\bar{h}_l(t|\mathbf{x}_i) = \bar{h}_{0,l}(t) e^{\mathbf{x}_i \beta_x} \tag{23}$$

	REUNIFICATION IN SOURCE		REUNIFICATION IN HOST	
	(1)	(2)	(3)	(4)
	Cox Model	Sub-hazards	Cox Model	Sub-hazards
Age at separation	0.015	0.020	-0.036***	-0.041***
	(0.013)	(0.013)	(0.011)	(0.011)
Gender of first migrant	0.126	0.082	-0.156	-0.168
	(0.263)	(0.262)	(0.222)	(0.215)
Years of schooling	0.043**	0.028	0.069***	0.061***
	(0.019)	(0.019)	(0.012)	(0.012)
ln(GDP/capita) in host	-0.326***	-0.299**	-0.002	0.072
	(0.106)	(0.120)	(0.108)	(0.118)
ln(GDP/capita) in source	0.296	0.317*	-0.478***	-0.506***
	(0.192)	(0.191)	(0.148)	(0.150)
Price level in host	1.290*	1.542*	-0.858	-1.142**
	(0.733)	(0.800)	(0.530)	(0.555)
Price level in source	-2.483**	-2.463**	0.124	0.592
	(1.004)	(0.979)	(0.618)	(0.626)
ln(distance)	-0.435	-0.249	-1.111***	-1.016***
	(0.345)	(0.363)	(0.275)	(0.297)
Colony	-0.228	-0.282	0.903**	0.868*
	(0.509)	(0.547)	(0.447)	(0.446)
Language	1.439***	1.398**	-0.771*	-0.867**
	(0.527)	(0.566)	(0.443)	(0.439)
Exit restrictions	-0.226	-0.169	-0.368	-0.262
	(0.444)	(0.460)	(0.254)	(0.268)
Entry or integration restrictions	-0.020	-0.078	0.452***	0.467***
	(0.235)	(0.235)	(0.166)	(0.178)
Polygamy	0.380	0.509	-0.275	-0.279
	(0.434)	(0.421)	(0.254)	(0.244)
Active migrant	-0.259	-0.209	-0.130	-0.024
	(0.224)	(0.230)	(0.187)	(0.189)
Active spouse	0.263	0.315	-0.029	-0.043
	(0.208)	(0.209)	(0.142)	(0.142)
N	4039	4039	4039	4039
Number of surveyed	792	792	792	792
Number of reunifiers	105	105	227	227
Number of competing events		227		105
Number of still separated		460		460
pseudo-R2	0.058		0.031	
chi2	69.076	57.062	84.140	70.078

Note: The table displays hazards ratios in Cox models and Sub-hazards models for both types of reunification as in Equations (21) and (23). The duration of separation in years, the age at separation, the gender of the first migrant, the years of schooling of the first migrant and the indicator variables about whether the migrant and the spouse are active are constructed from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Estimation on hazards of separation

The results The table displays the several models I exposed above. Both reunification types are depicted with the classic Cox model as well as with the subhazard model as it is stressed that both approaches should be included in the analysis (see Latouche et al. (2013) or Mozumder et al. (2017) for details). Differences are minor. Usually, it is said that cause-specific hazards better infer the rate of reunification while subdistribution hazards would better infer the risk of reunifying.

Given the small number of individuals, the results are not highly significant as the standard errors inflate. Indeed, only 105 surveyed reunified in the source country and 227 in the case of host reunion. There are 320 households that are separated at the moment of the survey.

It should be recalled that the results here concern the impact of the covariates on the hazards and not on τ. The impact on τ is reverted as an increase in one covariate pushes down the survival function if the coefficient related to the variable is positive ($\frac{\delta S(t)}{\delta x_i} < 0 \; \forall \; \beta > 0$). This is straightforward: a positive impact on hazard decreases the probability of surviving. Obviously, the impact on τ goes along the survival function and is then reverted to the one on hazard.

The table can be read in several manners. Firstly one can compare the results of the two suggested models. Cox and sub-hazards models provide fairly comparable results with very few differences. Secondly, a comparison between source and host reunification raises a key result: the variables often have opposite impacts (but coefficient are rarely significant for both types of reunification), as anticipated in the model, provided that the source country was much poorer than the host country. Thirdly, the table can be compared to the comparative statics provided above.

The model could not bring clear predictions about the variation of τ given an increase of the migrant's wage in the host country. The data suggest that a wealthier host country leads the migrant to postpone the source reunification while the impact on host reunification is unclear. On the other hand, the wealth in the source country leads to reduce the stay of a source reunifier (though the statistical significance is doubtful) and it will slow down the process of host reunification: the opportunity costs for the spouse to migrate increases. The level of education catches part of the heterogeneity in the earnings. It appears that both types of reunification have reduced durations of separation when the migrant is more educated. That can be explained by two factors: (i) a higher wage so a faster accumulation of saving to afford the second migration; (ii) a higher social capital to better adapt to the rules that are applied about family reunification.

It appears that higher prices in the source country contributes to postpone the source reunification: the migrant prefers to stay an extra-unit of time in the host country and benefit from *relatively* higher standards of living. The price level in host country speeds up the reunification in the source country but slows down the reunification in the host country, as predicted by the propositions of the model. The price levels in the host countries have opposite effects of those in the source countries and those effects are reverted according to the type of reunification.

The different proxies to the wages, the years of schooling, the GDP per capita in both countries, whether the spouses are active are different effects. The activities of the spouses do not affect the timing of reunification. The education level of the migrant, likely to lead to higher wages, is likely to accelerate the reunification in any country. Lastly, the GDP per capita have impact close to the propositions of the model. A higher GDP per capita in the host capita will postpone the source reunification because the migrant stays longer to accumulate. The opportunity cost of returning increases. The GDP per capita in the source country tends to speed up the reunification in the source country for the exact opposite reasons but it tends to slow down the reunification in the host country as the spouse will have to renounce to a large wage at home.

The age of the migrant at separation is a proxy for the household's life expectancy. The model predicts a similar impact in both sorts of reunification. However, the results highlight a difference: source reunification is not affected by the youth of the migrant while host reunification is faster when the migrant is older. Nevertheless, it should be stressed that this effect can catch an increase in the income due to experience that is supposed to be larger the older the individual.

Reunification timing of polygamous couples is not statistically different than a monogamous couple. The lack of significance can be due to the extremely small amount of observations that are polygamous. With a larger number of observation the result might gain statistical significance. The signs of the coefficients indicate that, if any effect, polygamy would delay the host reunification and accelerate the source reunification.

Distance contributes to delay reunification in the host country. A colonial past between host and source countries or a common official language might also take part of the cost of migration. Indeed, inclusion on the labour market is related with the language skills and a colonial past often implies institutional agreements and a stronger network of migrants already in the host country. When studying the source reunification, only the variable dealing with a common language seems to have a significant impact and it is in line with what the model predicts for the migration costs: it should reduce the delay.

Reforms in the host country have surprising impacts. The restrictions related to the exit do not affect the duration of separation in any types of reunification. On the contrary, entry restrictions seem to have an impact on the timing of host reunification. It appears that a more restrictive policy corresponds to a faster reunification. This apparently counter-intuitive result might be driven by the fact that the migrant feels the need to hurry the reunification before the situation gets even more complication to achieve the reunification. More research is needed to match the migration policies to the change in behavior towards reunification.

Without being fully convincing, the matching between the data and the model might seem surprisingly good, given the simplicity of the model that only includes general legal aspects. It is interesting to notice that gender does not impact the pace of reunifying. Foged (2016) shows that the gender is not a key determinant to family migration but the educational power of each spouse is. The result here seems to pursue this phenomenon as reunification appears to be independent from gender. Migrating is a cornerstone decision, not only of the individual, but also of the family and it seems that purely rational motives, in terms of economics, take a big part of the decision made.

Several robustness are built are displayed in Appendix F where I separate country by country, I use the post 1990 years only, I keep only people migrating after the age of 23 to avoid most of the potential students. I also look at other specifications such as parametric models, the insertion of cubic splines or of shared frailty. Those changes, with the exception of the last one - the shared frailty - provide comparable results as in table (4).[27]

5.5 Choice of reunification - Where to reunify?

A simple illustration The final step requires to check whether the value functions in the model lead to accurate prediction in terms of the choice of reunification. In order to do so, I simply use the dichotomous variable $y = 0$

[27]Given the choice of the variables, the shared frailty will catch most of the variance and therefore push down the effects of non-individual characteristics because I include the frailty at the corridor level.

$\forall$ *reunification in source* and $y = 1$ $\forall$ *reunification in host*. The setting is classic, one individual appears once, hence the number of observations is 332 which accounts for the sum of both types of reunifiers. The econometric model is extremely simple:

$$f(E[Y|\mathbf{x}_i]) = \mathbf{x}_i\beta \tag{24}$$

where $f(.)$ is the linear function in the case of linear probability model, the logistic function for a logit model, the inverse normal distribution for a probit model, the logarithm for a Poisson model. The vector of variables is exactly the one used above but with τ included. Given the simplicity of the specification, the objective of this analysis is to simply give an illustration of how the drivers are related to a choice of location.

As seen in figure (6) host reunification tends to take longer. A separation at a later age also tends to increase the odds to reunify in the host country. A high price level in the source country makes it less attractive and thus leads to a corresponding higher probability to reunify in the host country. Interestingly, the level of wealth in the source country also seem to increase the probability to reunify in the host country. Source country standards of living affect the decision about where to reunify whereas the host country standards of living seem not to impact the decision of reunification. A migrant who was older at migration is more likely to reunify in the source country. The migrant can indeed be more attached to the source country because his or her ties are stronger. At a younger age, the spouse of the migrant might be less anchored in the source country: the opportunity cost of migrating can be increasing even though the cost of separation $\pi(\tau)$ can offset it.

A number of variable do not seem to directly affect the probability to reunify in one country rather than the other. For example, the gender of the first migrant as well as the level of education appear to be unrelated to the choice of reunification. Interestingly, and surprisingly, the policy variables are not significantly related to the decision of the country to reunify. The legal aspect in the decision of the migration does not seem to have a strong impact. That can raise discussions in terms of what policy to implement in order to better accompany the migrant to either a temporary setting or a long term integration. Overall, the costs of migration do not impact the decision about where to reunify: distance, legal restrictions, colonial past all are not significant. The only exception is the language. A common language in source and host countries tends to make source reunification more likely. It can be that the transferability of the skills acquired by the migrant during the stay in the host country is positively related to higher expected earnings back home. It it noticeable that the colony and language variables are impacting though both are slightly collinear.[28]

[28]The variance inflating factor on an unweighted LPM would amount to 7.16 in the case of the colony variable. This might be troublesome but is not above the threshold usually used which is a VIF equal to 10.

	(1)	(2)	(3)	(4)
	LPM	Logit	Probit	Poisson
	b/se	b/se	b/se	b/se
Time being separated	0.015**	0.091*	0.058**	0.021**
	(0.007)	(0.050)	(0.029)	(0.009)
Age at separation	-0.010***	-0.054**	-0.031**	-0.017***
	(0.004)	(0.023)	(0.013)	(0.006)
Gender of first migrant	-0.046	-0.211	-0.144	-0.069
	(0.072)	(0.417)	(0.243)	(0.125)
Years of schooling	0.005	0.031	0.019	0.008
	(0.005)	(0.031)	(0.017)	(0.007)
ln(GDP/capita) in host	0.051	0.244	0.144	0.096
	(0.044)	(0.263)	(0.148)	(0.086)
ln(GDP/capita) in source	-0.123***	-0.660**	-0.397**	-0.196***
	(0.047)	(0.306)	(0.172)	(0.076)
Price level in host	-0.415*	-2.197	-1.334	-0.683*
	(0.231)	(1.502)	(0.838)	(0.389)
Price level in source	0.591***	3.351**	2.110***	0.859***
	(0.208)	(1.437)	(0.818)	(0.314)
ln(distance)	-0.042	-0.305	-0.153	-0.079
	(0.090)	(0.654)	(0.372)	(0.154)
Colony	0.136	0.837	0.453	0.260
	(0.168)	(1.280)	(0.694)	(0.317)
Language	-0.346**	-1.939	-1.112	-0.574*
	(0.163)	(1.266)	(0.678)	(0.307)
Exit restrictions	0.009	0.030	0.050	0.019
	(0.138)	(0.856)	(0.480)	(0.200)
Entry or integration restrictions	0.071	0.401	0.232	0.102
	(0.056)	(0.325)	(0.191)	(0.091)
Polygamia	-0.156*	-0.939*	-0.531	-0.223
	(0.091)	(0.570)	(0.332)	(0.139)
Current migration status of spouse	0.064	0.378	0.242	0.085
	(0.062)	(0.363)	(0.211)	(0.099)
Current migration status of spouse	-0.073	-0.420	-0.232	-0.113
	(0.050)	(0.317)	(0.179)	(0.078)
Constant	1.827	7.745	4.334	1.438
	(1.114)	(7.420)	(4.277)	(1.935)
N	332	332	332	332
r2	0.187			
Pseudo R2		0.144	0.145	0.030
chi2	91.359	43.714	50.543	55.888

Note: The table displays the estimation of Equation (24). The duration of separation in years, the age at separation, the gender of the first migrant, the years of schooling of the first migrant and the indicator variables about whether the migrant and the spouse are active are constructed from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Where to reunify?

6 Conclusion

This analysis has provided a first illustration of the family reunification migration problem when considered from an economic perspective. Reunification in either host or source country is possible and the household will choose rationally in order to maximize its utility, in turn dependent on the wages of the household members, the price levels in the two countries, the costs of migration, the costs of separation, the life expectancy of the household. This paper offers a first step to highlight how these variables impact the place and time in which reunification occurs. That is, where does the family choose to reunify and after what period of separation?

My empirical work studies the South-to-North sequential family migration process with the use of the MAFE database, which focuses on migration from Africa to Europe. In this context, a reunification in the host country occurs after a longer period of separation than a reunification in the source country. It seems that the source country standards of living have a greater influence on the decision about where to reunify than the host country standards of living. On the other hand, both matter in the choice of the timing of reunification. Though not all, several intuitions provided by the model are confirmed in the present empiric work.

It appears clear that family migration is rarely a simultaneous move of the entire family. Both host and source country are affected by the type of reunification as it impacts the labor market, the housing market and more generally the integration of either the migrants or the returnee.

Conceptually, the paper suggests an alternative perspective to study the migration dynamics. Future research can expand on this work by introducing circular migration and transit migration. International family migration, depending on the context, can concern sequences of migration rather than a direct move.

This analysis has provided some interesting insights into the family migration and the choice of whether to re-unite in the host or source country. However, it also brings up additional questions, which could be investigated in future research. For example, including children into the model is one promising alley of research. The model should also be tested in the case of South-South or North-North migrations, or even urban-rural migration within the same country. To study these questions and to improve the data analysis, micro-data should be used for the wages in order to better compare the family migration plan with the model. A richer model would also take into account the selection of migrant couples and that will connect this model with several existing models (Mincer (1978), Borjas and Bronars (1991), Mont in 1989 Mont (1989), Eliasson et al. (2014), Foged (2016) or in a different setting Munk et al. (2017)).

Future work, potentially bridging the discounted utility model and individual heterogeneity would be helpful in order to better understand the migration patterns. Utilization of the Roy-Borjas setting to distinguish among migrants would bring some additional insights into the choice of reunification. Transferability of skills on both waves of migrations will be key as well as the (heterogeneous) level of inequality faced by each spouse.

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A Family Migration - Some Additional Discussion

Table (6) is derived from Eurostat data which provide yearly number of legal migrants entering each EU countries. I use here the data from 2008 to 2016. It covers 30 host countries (Post Brexit UE plus Switzerland, Iceland, Norway) and 158 sources countries. The data is the sum of country-wise immigration flows and separates it into four main motives of migration: (i) education, (ii) family, (iii) occupation, (iv) other (which includes different motives such as health, asylum). One can notice that for all countries displayed here but the UK, the family-based migration accounts for a third up to a half of the immigration flow. The UK has a different legal frame, which justifies the role of outlier it plays here (see the European Commission Report (2016) for more details).

Table (7) is based on the MAFE data used in the core analysis. It is interesting to see how the data of the source countries corroborates the macro data from the host countries: indeed, around 40% of the migrants went to one of the European countries mentioned in table (6) through the family reunification channel. Mafe data is subjective in the sense that the interviewers directly asked people about the channel of migration without any means of controlling the veracity of the response. This is then more prone to measurement errors. Even though the comparison between the statistics from the two tables are highly disputable, it is striking to see how the objective measure from Eurostat data corroborates with the subjective measure from MAFE data.

	Belgium	France	Italy	Netherlands	Spain	UK
Education	12.9	30.3	7.7	18.8	11.3	40.5
Family	50.7	42.5	32.7	33.7	49.6	1.7
Occupation	10.1	9.4	39.8	18.8	26.8	20
Other	26.3	17.7	19.8	28.7	12.3	37.8

Table 6: Share of reasons of migration per host countries

	DRC	Ghana	Senegal
Education	9.6	14.7	11
Family	39.6	37.9	43.3
Occupation	3.2	22.3	30.4
Other	47.2	25.1	15.2

Table 7: Share of reasons of migration per source countries

A last check from Eurostat data is simply to run a excessively simple gravity model and to split the sample by the four categories described above. I cannot argue anything against all the biases simple gravity models suffer from because I do not deal with endogeneity issues. The objective of this illustration is merely to check whether the coefficients, biased similarly over the four sub-samples, would have similar magnitudes and statistical significance. In any case, one can assume that the biases over the different categories are comparable so that the difference among them is still noticeable and worth further analysis.

The econometric model can be written as such:

$$immigrants_{ijt} = \alpha + \beta LogDist_{ijt} + \gamma X_{it} + \delta Y_{jt} + \epsilon_{ijt} \tag{25}$$

with X_{it} and Y_{jt}, GDP/capita, Gini, Inflation and Population in source and host countries, respectively. Not surprisingly, the GDP and population coefficients have positive and significant coefficients, and distance has a negative impact. Results of the simple OLS are displayed on table (??).

Interestingly, the category "other" also shares those coefficients, implying that the refugees, likely accounting for most of the immigrants in this section also take decisions partly in line with the basis gravity model. More importantly, the family sub-sample is negatively impacted by inflation in both countries but the level of inequalities (as measured by the Gini coefficient) is of lower magnitudes than for other motives or not significant statistically. This suggests that the Roy model of migration could fit for some of the migration channels but not for all of them, notably the family motive. The first migrant would potentially chose the host country according to the differences in the distribution of inequalities and his or her personal characteristic. On the other hand, that is unlikely to be the case for the migrant coming thereafter to reunify. This is another reason for the model I display in the present paper not to be further refined with more individual heterogeneity which could raise effects similar to the Roy model.

	Log Number of Immigrants			
	(1) Education	(2) Family	(3) Occupation	(4) Other
(log)Geodesic distance	-0.916313***	-1.107158***	-1.079174***	-0.931464***
	(0.027)	(0.030)	(0.032)	(0.032)
ln(GDP/capita) in Source	0.459252***	0.427026***	0.384183***	0.236102***
	(0.027)	(0.029)	(0.031)	(0.030)
GINI in Source	0.000299	-0.004161	-0.012739***	-0.009666***
	(0.003)	(0.003)	(0.003)	(0.003)
Price Level in PPP in Source	0.763745***	0.001517	0.569306***	0.448875***
	(0.139)	(0.134)	(0.145)	(0.153)
Inflation in Source	-0.006950***	-0.010998***	-0.005329	-0.002265
	(0.003)	(0.003)	(0.003)	(0.004)
(log)Population in Source	0.625639***	0.614949***	0.677832***	0.517645***
	(0.013)	(0.013)	(0.013)	(0.015)
ln(GDP/capita) in Host	1.767258***	1.494525***	0.989013***	1.464581***
	(0.114)	(0.111)	(0.128)	(0.134)
GINI in Host	0.039239***	0.011658**	0.040682***	0.093944***
	(0.006)	(0.006)	(0.007)	(0.007)
Price Level in PPP in Host	0.013581	0.447260***	0.755981***	0.188103
	(0.122)	(0.128)	(0.140)	(0.147)
Inflation in Host	0.014132	-0.038030***	-0.014151	0.022880**
	(0.009)	(0.009)	(0.010)	(0.011)
(log)Population in Host	0.817419***	0.655148***	0.732375***	0.740127***
	(0.015)	(0.016)	(0.017)	(0.017)
Entry or integration restrictions	-0.050667	0.015516	0.339834***	0.195056***
	(0.048)	(0.057)	(0.061)	(0.063)
Exit restrictions	-0.015484	-1.133002***	0.108508	-0.043101
	(0.108)	(0.164)	(0.112)	(0.142)
Constant	-3.72e+01***	-2.82e+01***	-2.66e+01***	-3.04e+01***
	(1.172)	(1.219)	(1.299)	(1.373)
N	6.54e+03	7.09e+03	6.23e+03	5.73e+03
r2	0.579044	0.480251	0.501503	0.446295

Note: The table displays the estimation of Equation (25). Data about the number of migrants per year and per migration motives are taken from Eurostat, over the years 2008-2016. GDP per capita, Gini coefficients, inflation rate and price levels are from WDI. Geodesic distances are from Cepii. Exit, entry or integration restrictions are from DEMIG.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Immigration in Europe from RoW (2008-2016) - OLS

The second set of regressions is very similar, the only difference being that corridor fixed effects are included, β_{ij} and λ_t.

$$immigrants_{ijt} = \alpha + \beta_{ij} + \gamma X_{it} + \delta Y_{jt} + \epsilon_{ijt} \tag{26}$$

Adding corridor fixed effects logically absorbs a large share of the variance. The Gini coefficient in the host country is positively related to immigration (contrary to the OLS) for the family motive of migration while it is negative for the other motives. In a Roy-Borjas setting, this would imply the migrants for education or for employment to seek for a more equal country than the migrants for family motives (or the more equal country to need students and workers more than the less equal country). A surprising result concerns the legal restrictions (voted the year before, at $t-1$). It seems that the motives of migrations have very different results. Tighter entry restrictions seems positively related to the flow of immigrants and tighter exit restriction corresponds to a lower flow of immigrants.

	Log Number of Immigrants			
	(1) Education	(2) Family	(3) Occupation	(4) Other
ln(GDP/capita) in Source	-0.907578***	-0.753113***	-1.312093***	-0.942058***
	(0.220)	(0.245)	(0.241)	(0.301)
GINI in Source	0.019525***	0.022709***	0.035410***	0.026237***
	(0.007)	(0.008)	(0.009)	(0.010)
Price Level in PPP in Source	0.833378***	0.178985	-0.119909	0.186671
	(0.278)	(0.278)	(0.268)	(0.352)
Inflation in Source	0.000626	0.000170	-0.000014	-0.000362
	(0.002)	(0.002)	(0.002)	(0.002)
(log)Population in Source	-0.351294	-0.752336	-0.148430	0.354173
	(0.494)	(0.487)	(0.564)	(0.615)
ln(GDP/capita) in Host	2.369601***	0.418224*	2.437640***	0.611961*
	(0.266)	(0.222)	(0.319)	(0.330)
GINI in Host	-0.040588***	0.035598***	-0.084687***	-0.013293
	(0.011)	(0.010)	(0.013)	(0.016)
Price Level in PPP in Host	0.003783	2.526546***	0.123243	-0.227407
	(0.282)	(0.405)	(0.301)	(0.385)
Inflation in Host	-0.015249*	-0.006697	-0.003876	-0.026437**
	(0.009)	(0.008)	(0.011)	(0.012)
(log)Population in Host	0.177151	0.427274	-1.363993	-1.12e+01***
	(1.024)	(0.907)	(1.048)	(1.210)
Entry or integration restrictions	-0.047959*	0.110814***	0.158635***	0.037746
	(0.027)	(0.027)	(0.036)	(0.040)
Exit restrictions	-0.149266***	-0.275273***	-0.075190	-0.046079
	(0.055)	(0.064)	(0.051)	(0.091)
Constant	-1.02e+01	7.015469	15.515556	1.82e+02***
	(19.065)	(17.128)	(20.157)	(22.835)
N	5.58e+03	6.12e+03	5.39e+03	4.84e+03
r2	0.941359	0.944343	0.939605	0.915528

Note: The table displays the estimation of Equation (26). Data about the number of migrants per year and per migration motives are taken from Eurostat, over the years 2008-2016. GDP per capita, Gini coefficients, inflation rate and price levels are from WDI. Geodesic distances are from Cepii. Exit, entry or integration restrictions are from DEMIG.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Immigration in Europe from RoW (2008-2016) - Fixed Effects

B Comparative statics

B.1 Consumption statics in case of host country reunification

The comparative statics of most partial derivatives of G and B functions are straightforward. From equation (12) one simply uses classic analysis.

$$\frac{d\tilde{c_1}}{dx} = \frac{G_\tau B_x - B_{\tilde{c_1}} G_x}{\Delta} \tag{27}$$

The signs of G_τ, $G_{\tilde{c_1}}$, B_τ, $B_{\tilde{c_1}}$ are important to determine. One can easily obtain $G_\tau > 0$ as long as $|\pi''(\tau)| < |\pi'(\tau)|$ or $\pi''(\tau) < 0$. $G_{\tilde{c_1}} > 0$ is also straightforward. The change of the budget balance according to consumption is also simply derived: $B_{\tilde{c_1}} < 0$. The other term B_τ requires some more analysis. The impact of the length of separation on the budget constraint B_τ is also positive. One can see this by computing the derivative and noticing that $B_\tau > 0$ for $\tau = T$ and that $B_{\tau\tau} > 0$ so that $B_\tau > 0$ for a duration of separation close to the household's lifetime.[29] Now the question deals with whether $B_\tau > 0$ also holds for smaller values of τ. Using a CRRA individual utility function, one can find that $B_\tau > 0$ holds for $\tau > 1$ if the cost of separation is not too confiscatory (here the cost of separation function would hold a shape in the form of $\pi(\tau) = (\frac{1}{1+\tau})^{1/10}$). Such a cost already implies a drop of almost 7% after one year being separated and over 10% after two years; a hypothetical separation all over the life would lead to a penalty of about a third. The data cannot provide results at a thinner scope than a year and therefore it sounds realistic to consider that a reunification that occurred within a year as a simultaneous migration rather than a sequential migration. To summarize, this leads to $G_\tau > 0$, $G_{\tilde{c_1}} > 0$, $B_{\tilde{c_1}} < 0$, $B_\tau > 0$ which logically implies $\Delta > 0$.

It is clear that $G_{\tilde{w_s}} > 0$, $G_{w_s} < 0$, $G_{\tilde{w}} = 0$, $G_{K_0} = 0$, $G_{K_1} < 0$, $G_{A_0} < 0$, $G_T < 0$, $B_{\tilde{w_s}} > 0 \; \forall \; \tau > 0$, $B_{w_s} > 0 \; \forall \; \tau < T$, $B_{\tilde{w}} > 0$, $B_{K_0} < 0$, $B_{K_1} < 0$, $B_{A_0} > 0$, $B_T < 0$.[30] The derivatives with respect to price levels are less

[29] A sufficient - but not necessary condition - for this implies that $\pi(\tau)$ is either linear or convex.

[30] This last result only stem for a household that uses the separated period of migration to eventually benefit from better consumption once reunified, which is implicitly the main characteristic of sequential migration

obvious, $B_{\tilde{p}}$ is unambiguously negative but B_p is positive only for $p\psi_p(.) > |\psi(.)|$ with $\psi_p(.)$ the derivative with respect to the home price level. This condition, for example, is met in the individual CRRA case where $\tilde{p}\theta > 1 \equiv p$ (if one fixes, without loss of generality, p as a numéraire), which is realistic in the present South to North migration. Lastly, $G_{\tilde{p}}$ and G_p can be shown to be negative and positive, respectively, using the same restrictions as for the computation of G_τ and $G_{\tilde{c_1}}$. One should simply add that ψ with ψ_p or $\psi_{\tilde{p}}$ and notice that $\psi_{\tilde{p}} < \psi < -\psi_p$ and, make an additional assumption in the CRRA frame: $\frac{\pi'(\tau)}{\pi(\tau)} < \frac{r\theta}{e^{r\tau}-1}$. With the functional form of the separation cost taken here the partial derivatives are satisfactory up to a certain duration. For example, above 8 eight years of separation, with $r = 0.05$, the sign of the derivatives is reverted, implying an unclear result of the impact of prices on the length of separation. However, eight years of separation is already an exceptional case, at least in the context of the MAFE data. It should be highlighted that those restrictions are not necessary. The use of CRRA is obviously more restrictive but also more convenient.

Once equipped with all the partial derivatives, it is intuitive to apply equation (27) to obtain the results displayed in Proposition 1.

B.2 Consumption statics in case of source country reunification

Comparative statics in case of source country reunification are derived through a very similar procedure so that it does not seem required to detail it, a parallel with the first case is sufficient.

C Calibration, additional graphs

(a) Depreciation rate (b) Interest rate

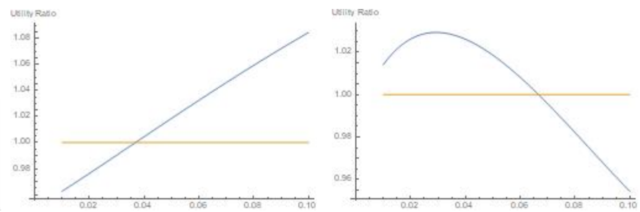


Figure 7: Objective Functions Ratio

(a) Share of first migrant in consumption (b) Inverse elasticity of intertemporal consumption substitution (c) Life expectancy

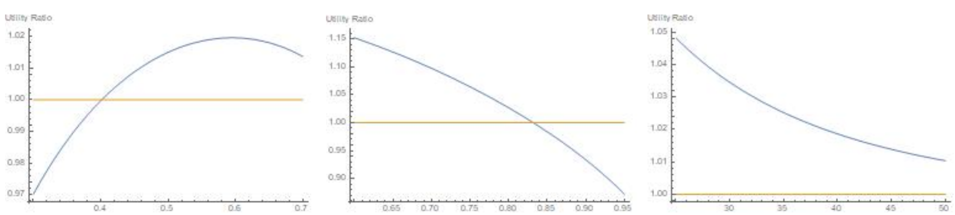


Figure 9: Objective Functions Ratio

D Time being separated

The richness of the MAFE data allows to estimate the number of years during which the couples were split. The shape of the distribution of τ is reassuring for the use of survival analysis where the dependent variable is usually following a similar path.

One can easily notice that the number of couples being separated decreases exponentially and that the source reunification usually happens quicker than the host reunification. Separation over long period, sometimes even exceeding a decade is not rare. If the only driver of family reunification in the host country were the legal constraint, then one should not expect a long period of separation. On the other hand, it seems to be the case here. The migrant must accumulate enough saving to afford the migration of the partner as well as prepare a setting so that the opportunity cost of the partner staying in the source country is fully offset (labor market integration and the cost of the separation as key drivers).

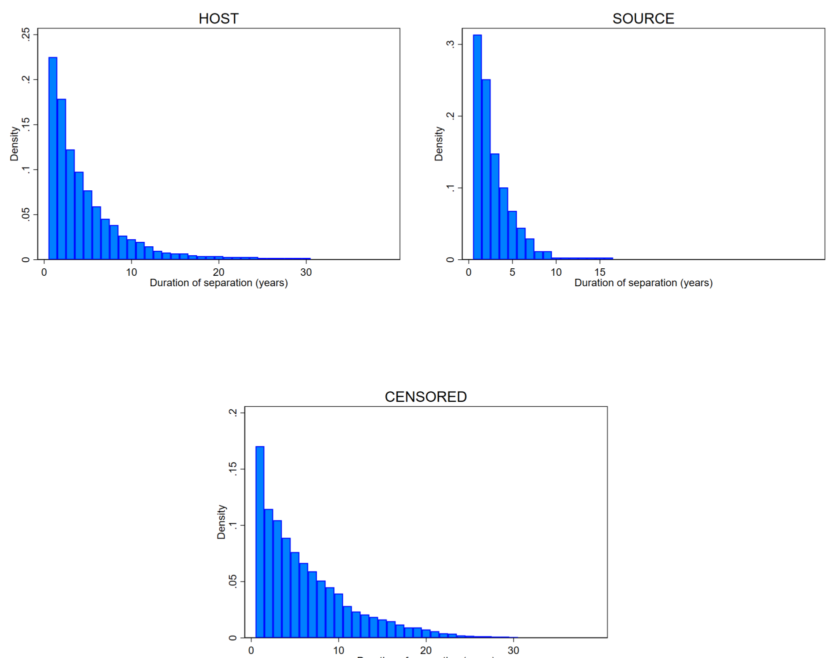


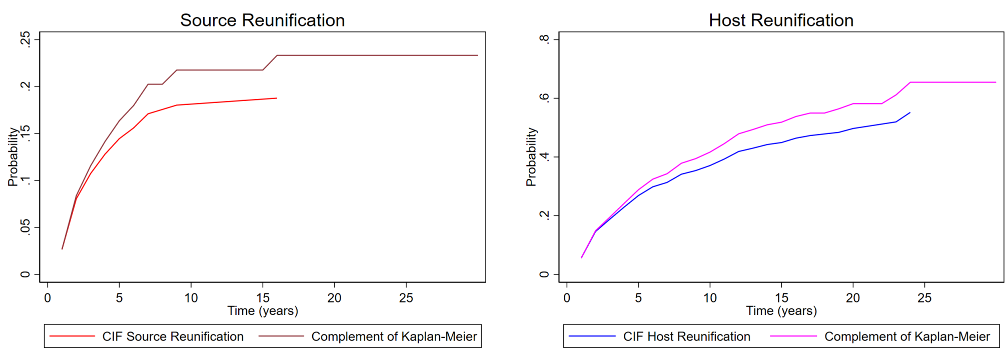
Figure 11: Time being separated: τ

E Competing risks

The use of classic tool for the competing risks survival analysis leads to biases. Following Gooley et al. (1999), one can see in the two graphs that, indeed, the usual non-parametric Kaplan-Meier estimation is bias. There is an upward bias (as explained by Austin et al. (2016)). It overestimates the reunifications in both cases.

Figure 12: CIF versus (complement of) Kaplan-Meier

(a) (b)



F Robustness checks

Flexible parametric survival models In order to check whether adding dimensions on the regression equations would have an impact, one can run a flexible parametric survival model. This introduces restricted cubic splines to gain flexibility. On the other hand, this implies to drop the non-parametric baseline function and instead use a Weibull distribution (see 12 for parametric models' results). The cause-specific log-cumulative is written as:

$$ln(H_l(t|\mathbf{x}_i)) = s_i(ln(t)|\gamma_i; m_{0i}) + \mathbf{x}_i\beta_x \tag{28}$$

with γs giving the baseline of the cumulative hazards and m_{0i} being the cause-specific number of knots to be included. The bridge from the cumulative to the hazards is not problematic though it implies to include the baseline. The coefficients remain similar to what what obtained in table (4).

	(1) REUNIFICATION IN SOURCE	(2) REUNIFICATION IN HOST
	b/se	b/se
Age at separation	0.016	-0.034***
	(0.013)	(0.011)
Gender of first migrant	0.254	-0.071
	(0.257)	(0.194)
Years of schooling	0.053***	0.078***
	(0.019)	(0.012)
ln(GDP/capita) in host	-0.335***	-0.054
	(0.107)	(0.101)
ln(GDP/capita) in source	0.235	-0.529***
	(0.197)	(0.151)
Price level in host	1.192	-0.859
	(0.771)	(0.531)
Price level in source	-2.579**	0.012
	(1.033)	(0.571)
ln(distance)	-0.523	-1.182***
	(0.328)	(0.283)
Colony	-0.178	0.996***
	(0.521)	(0.343)
Language	1.487***	-0.802**
	(0.532)	(0.357)
Exit restrictions	-0.244	-0.364
	(0.424)	(0.252)
Entry or integration restrictions	-0.008	0.441***
	(0.238)	(0.168)
restricted cubic spline 1	1.220***	1.240***
	(0.088)	(0.056)
restricted cubic spline 2	0.511***	0.347***
	(0.064)	(0.040)
restricted cubic spline 3	-0.055	-0.093***
	(0.043)	(0.027)
Constant	1.571	13.182***
	(3.692)	(2.856)
derivative of restricted cubic spline 1	1.220***	1.240***
	(0.088)	(0.056)
derivative of restricted cubic spline 2	0.511***	0.347***
	(0.064)	(0.040)
derivative of restricted cubic spline 3	-0.055	-0.093***
	(0.043)	(0.027)
N	4039	4039

Note: The table displays hazards ratios in Cox models for both types of reunification as in Equation (21). The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Flexible Parametric Survival Model

Shared Frailty A last refinement of the Cox model introduces shared frailty, for details see Gutierrez et al. (2002). This will take into account random effects among groups of migrants according to the pair of country that exist in the present paper. It should be highlighted that few returned migrants also went in another country, even though the vast majority went to the six European countries presented above. The model including shared frailty is written in the following way:

$$h_{lij}(t|\alpha_j) = \alpha_j h_{lij}(t) = \alpha_i h_l(t|\mathbf{x}_{ij}) \tag{29}$$

The subscript j refers to the pairs of countries group. In the shared frailty frame, individuals of different groups are assumed to be independent while they are not within groups. One can see that the model loses most of its significance, which makes sense as the variability of macro-variables are not large compared with the between variability. Therefore, this suggests that the differences are especially important between countries. Of course, with a better approximation of wages the results might be less striking. Nevertheless, this result is useful to have a broad estimation of the willingness of migrants to reunify in host country rather than in source country and to call for more micro-data to assess the choice of reunification.

	(1) REUNIFICATION IN SOURCE b/se	(2) REUNIFICATION IN HOST b/se
Age at separation	0.010	-0.013
	(0.013)	(0.011)
Gender of first migrant	0.327	0.190
	(0.267)	(0.219)
Years of schooling	0.049**	0.070***
	(0.021)	(0.015)
ln(GDP/capita) in host	-0.354***	0.070
	(0.120)	(0.113)
ln(GDP/capita) in source	0.062	-0.134
	(0.249)	(0.176)
Price level in host	0.928	-1.070
	(0.944)	(0.801)
Price level in source	-1.687	-0.095
	(1.323)	(0.765)
ln(distance)	0.379	-0.658*
	(0.919)	(0.387)
Colony	-0.341	-0.248
	(0.823)	(0.584)
Language	0.666	0.382
	(0.814)	(0.608)
N	3903.000	3903.000
N_sub	651.000	651.000
N_fail	104.000	227.000
chi2	19.103	30.475

Note: The table displays hazards ratios in Cox models for both types of reunification as in Equation (29). The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Cox model with shared frailty per pairs of countries

Different parametric Survival Models Table (12) simply displays the results of parametric models instead of Cox or Fine and Gray setting. The the baseline hazard is assumed to follow, respectively, a Weibull, an exponential, or a Gompertz distribution.

The results do not seem to be heavily affected by a change in the shape of the baseline. The only noticable difference is that the age at separation plays a significant role in two baseline hazard distribution (the Weibull and the Exponential). The impact seems to be that when the separation occurs later in the life the reunification will happen faster. Interestingly, the model predict a similar effect for both types of reunification will in reality it seems that the effects are opposite, depending on the type of reunification. For some more flexibility, and to stick with the most common model, I will simply use the Cox model as the preferred model.

	REUNIFICATION IN SOURCE			REUNIFICATION IN (HOST)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Weibull	Exponential	Gompertz	Weibull	Exponential	Gompertz
	b/se	b/se	b/se	b/se	b/se	b/se
Age at separation	0.027**	0.025**	0.020	-0.028**	-0.031***	-0.032***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.011)	(0.011)
Gender of first migrant	0.164	0.147	0.110	-0.216	-0.213	-0.203
	(0.278)	(0.267)	(0.251)	(0.249)	(0.224)	(0.219)
Years of schooling	0.063***	0.060***	0.048***	0.083***	0.078***	0.077***
	(0.019)	(0.019)	(0.018)	(0.013)	(0.012)	(0.012)
ln(GDP/capita) in host	-0.340***	-0.328***	-0.298***	-0.045	-0.019	-0.012
	(0.105)	(0.105)	(0.109)	(0.102)	(0.102)	(0.103)
ln(GDP/capita) in source	0.301	0.310	0.337*	-0.536***	-0.492***	-0.475***
	(0.209)	(0.203)	(0.192)	(0.159)	(0.149)	(0.147)
Price level in host	1.412*	1.400*	1.322*	-0.834	-0.861	-0.875*
	(0.732)	(0.727)	(0.719)	(0.539)	(0.527)	(0.527)
Price level in source	-3.043***	-2.953***	-2.683***	-0.169	-0.033	0.011
	(1.059)	(1.021)	(1.007)	(0.644)	(0.600)	(0.600)
ln(distance)	-0.631*	-0.600	-0.494	-1.283***	-1.202***	-1.167***
	(0.373)	(0.369)	(0.365)	(0.281)	(0.273)	(0.275)
Colony	-0.413	-0.407	-0.359	0.971**	0.906**	0.890**
	(0.531)	(0.521)	(0.509)	(0.453)	(0.432)	(0.429)
Language	1.669***	1.649***	1.589***	-0.813*	-0.761*	-0.746*
	(0.549)	(0.537)	(0.525)	(0.462)	(0.440)	(0.438)
Exit restrictions	-0.234	-0.214	-0.174	-0.371	-0.339	-0.330
	(0.413)	(0.410)	(0.412)	(0.238)	(0.240)	(0.241)
Entry or integration restrictions	0.017	0.012	-0.006	0.417**	0.425**	0.428**
	(0.223)	(0.222)	(0.224)	(0.165)	(0.166)	(0.166)
Constant	0.353	0.168	-0.577	12.482***	11.655***	11.291***
	(4.047)	(4.007)	(3.944)	(2.899)	(2.770)	(2.777)
ln_p	0.080			0.141***		
	(0.053)			(0.039)		
gamma			-0.076***			-0.014
			(0.022)			(0.014)
N	4039	4039	4039	4039	4039	4039
Number of surveyed	792	792	792	792	792	792
Number of failure	105	105	105	227	227	227
chi2	65.573	72.266	61.129	80.140	85.941	81.981

Note: The table displays hazards ratios in parametric models for both types of reunification as in Equation (21) but for which the baseline has been set to a specific distribution, here Weibull, Exponential and Gompertz. The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Survival Analysis with parametric hazards models

What if we only look at post-1990 since WDI not available before for lots of countries? For most of countries, the WDI database does not provide any information for the price level by 1990. Therefore, I simply put the last value available, which is obviously extremely restrictive. Fundamentally, this implies that 10% of the surveyed are lost. Then it is worthwhile checking whether the results could be driven by this fact. It appears, on the table (13), that they are not.

	(1) REUNIFICATION IN SOURCE b/se	(2) REUNIFICATION IN HOST b/se
Age at separation	0.018	-0.040***
	(0.015)	(0.013)
Gender of first migrant	0.203	-0.072
	(0.351)	(0.241)
Years of schooling	0.048**	0.089***
	(0.024)	(0.014)
ln(GDP/capita) in host	-0.258*	-0.082
	(0.152)	(0.180)
ln(GDP/capita) in source	0.681***	-0.555***
	(0.246)	(0.189)
Price level in host	0.976	-0.856
	(0.956)	(0.652)
Price level in source	-4.376***	0.058
	(1.409)	(0.734)
ln(distance)	-0.411	-1.215***
	(0.370)	(0.463)
Colony	-0.555	0.952
	(0.873)	(0.777)
Language	1.809**	-0.970
	(0.859)	(0.784)
Exit restrictions	-0.012	-0.197
	(0.596)	(0.314)
Entry or integration restrictions	-0.187	0.608***
	(0.292)	(0.203)
N	3111	3111
Number of surveyed	639	639
Number of failure	76	165
Pseudo R2	0.066	0.041
chi2	57.214	75.111

Note: The table displays hazards ratios in Cox models for both types of reunification as in Equation (21). The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Cox model with post 1990 observation only

Separate countries Another interesting check deals with whether one source country only explains everything. It appears that results barely change or, at least, signs remain unaffected.[31]

	REUNIFICATION IN SOURCE			REUNIFICATION IN (HOST)		
	(1)	(2)	(3)	(4)	(5)	(6)
	No DRC	No Ghana	No Senegal	No DRC	No Ghana	No Senegal
	b/se	b/se	b/se	b/se	b/se	b/se
Age at separation	0.016	0.010	0.025	-0.051***	-0.021	-0.026
	(0.014)	(0.019)	(0.016)	(0.013)	(0.013)	(0.016)
Gender of first migrant	0.379	0.060	-0.034	0.108	-0.660**	-0.100
	(0.284)	(0.477)	(0.319)	(0.238)	(0.315)	(0.252)
Years of schooling	0.050**	0.023	0.024	0.079***	0.073***	0.065***
	(0.021)	(0.025)	(0.031)	(0.013)	(0.014)	(0.025)
ln(GDP/capita) in host	-0.304**	-0.339*	-0.310**	0.059	-0.182	0.087
	(0.122)	(0.176)	(0.140)	(0.147)	(0.118)	(0.144)
ln(GDP/capita) in source	0.140	0.041	0.352	-0.581***	-0.616***	-0.354**
	(0.310)	(0.306)	(0.231)	(0.200)	(0.233)	(0.176)
Price level in host	1.128	0.657	1.088	-1.359*	-0.681	-0.841
	(0.884)	(1.132)	(0.990)	(0.721)	(0.666)	(0.802)
Price level in source	-1.368	-2.112	-2.992**	-0.446	0.002	0.679
	(1.560)	(1.481)	(1.312)	(0.793)	(0.848)	(0.855)
ln(distance)	0.031	-0.761	-0.611*	-1.397***	-1.436***	-0.719
	(0.611)	(0.658)	(0.351)	(0.366)	(0.494)	(0.642)
Colony	0.005	-0.222	-0.024	0.834	1.343	0.682
	(3.944)	(0.488)	(0.562)	(2.181)	(1.528)	(0.453)
Language	1.242	1.864***	1.036*	-0.570	-1.117	-0.683
	(3.943)	(0.559)	(0.610)	(2.177)	(1.530)	(0.464)
Exit restrictions	-0.336	0.612	-1.041	-0.705**	-0.248	0.070
	(0.462)	(0.512)	(0.659)	(0.359)	(0.286)	(0.307)
Entry or integration restrictions	0.042	-0.566	0.191	0.692***	0.374*	0.270
	(0.244)	(0.374)	(0.255)	(0.179)	(0.217)	(0.207)
N	3467	3031	1609	3467	3031	1609
Number of surveyed	638	551	399	638.000	551	399
Number of reunifiers	86	55	69	176.000	160	120
Pseudo R2	0.065	0.068	0.046	0.045	0.035	0.022
chi2	62.225	40.285	31.867	92.342	62.078	21.337

Note: The table displays hazards ratios in Cox models for both types of reunification as in Equation (21). The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Cox model without one source country each time

[31]There is one exception: gender level once Senegal has been dropped but this is not a key variable in the present study.

Post 23 years old people only Table (15) provides the same results as above but it drops the couples whose separation started before the age of 24. This is likely to drop those who might have migrated for educational motives as well, in which case the causality might be reversed. Here also, results are barely modified.

	(1) REUNIFICATION IN SOURCE	(2) REUNIFICATION IN HOST
	b/se	b/se
Age at separation	0.013	-0.036**
	(0.016)	(0.016)
Gender of first migrant	0.362	0.025
	(0.272)	(0.236)
Years of schooling	0.055***	0.077***
	(0.020)	(0.015)
ln(GDP/capita) in host	-0.422***	-0.083
	(0.117)	(0.126)
ln(GDP/capita) in source	0.382*	-0.508***
	(0.197)	(0.184)
Price level in host	1.609**	-0.406
	(0.801)	(0.601)
Price level in source	-3.467***	1.042
	(1.191)	(0.756)
ln(distance)	-0.548	-0.907**
	(0.360)	(0.417)
Colony	-0.533	0.578
	(0.612)	(0.832)
Language	1.735***	-0.689
	(0.624)	(0.842)
Exit restrictions	-0.103	-0.436
	(0.508)	(0.277)
Entry or integration restrictions	-0.181	0.229
	(0.247)	(0.201)
N	2966	2966
Number of surveyed	622	622
Number of reunifiers	89	155
Pseudo R2	0.071	0.033
chi2	71.904	64.099

Note: The table displays hazards ratios in Cox models for both types of reunification as in Equation (21). The duration of separation in years, the age at separation, the gender of the first migrant and the years of schooling of the first migrant are from the MAFE. GDP per capita and price levels are from WDI. Geodesic distances, indicator variables about colonial past and common language are from Cepii. Exit, entry or integration restrictions are from DEMIG. The coefficients displayed are the hazards and are inversely related to the duration of separation.
Standard errors are computed using a bootstrap with 1000 replicates and displayed in the parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Cox model without less than 23 individuals when separation occurred