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Brexit and Multilingualism in the European Union

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Brexit and Multilingualism in the European Union*

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Abstract

The EU spends more than one billion euros per year ensuring translation and interpretation of 24 languages to preserve multilingualism. We examine how this budget should be fairly allocated, taking into account linguistic and economic realities of each member country. Our analysis tries to estimate the *value* of keeping English as a procedural language (in fact, almost a *lingua franca*) in the post-Brexit EU, where, today, just about one percent of the population speaks it as native language.

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1 Introduction

Economists and social scientists alike have long been concerned with studying the impact of language on economic outcomes such as growth (Easterly and Levine, 1997, growth in African countries), public policies (Alesina, Bakir and Easterly, 1999, public goods), as well as conflicts and wars (Collier and Hoeffler, 1998 and Laitin, 2000 on language and violence).[1] Special emphasis has been given to the case of multilingual societies, which provide extraordinary challenges with crucial economic implications.

Multilingualism is fortunately less hectic in the European Union (EU). On the contrary, it has always been one of its stronger pillars. Back in 1958, at the time in which the seed of the EU (the so-called Common Market) was planted, Dutch, French, German and Italian became official languages of this new union. 1973 was the time for English and Danish; 1981 for Greek; 1986 for Portuguese and Spanish and 1995 for Finnish and Swedish. In 2007, nine more languages joined the pool of official languages: Estonian, Czech, Hungarian, Latvian, Lithuanian, Maltese, Polish, Slovak and Slovenian. 2007 was the turn of Bulgarian, Irish and Romanian. Croatian was the last to become an official language in 2013.[2] This sequence of events proves that, starting in the very beginning, language services (mainly interpretation and translation) were considered essential to guarantee the cultural and linguistic diversity of the EU.[3] Among other things, the EU ensures that European citizens have access to EU laws, regulations and key political documents in a language spoken in their country; that members of the European Parliament have the right to use their native language when addressing the European Parliament; that EU summits and meetings of the European Council can be interpreted into all official EU languages;[4] and last but not least, that citizens have the possibility to address the Commission and get a reply in their native language, as long as it is an official language in the EU.

Although there exists a very small number of documents concerned with accounting details,

[1] For a recent survey, see Ginsburgh and Weber (2020).

[2] Among these 'official' languages, three are more important: English, French and German. Almost all documents are written in these 'procedural' (also called working) languages, and then translated to the other official languages.

[3] One of the first articles (no 158/1) of its constitution was devoted to the rule that governs the functioning of languages in the union.

[4] Note that in most cases, only English, French and German are used and translated, but attendants have the possibility to request interpretations from and into their native language(s).

the EU admits to devote more than one billion euros per year to achieve the goals listed above.[5] How much should each EU member contribute (implicitly or explicitly) to cover the cost of these services? Answering this question could lead to address a crucial, but largely ignored issue: The status (and role) of English after Brexit, once the UK will obviously stop contributing to the EU budget, though English remains a working and official language.

There are efficiency conditions to keep English as an official language in the EU and, though there is no legislation on the issue, it could even become a *lingua franca*.[6] But one can wonder whether it would be fair to let the British passively benefit from this bonanza. Even long before Brexit, it could safely be argued that the UK massively gained from the status of English worldwide. From now on, post-Brexit EU countries may have to pay for it, while the UK will benefit from it.[7] It is thus important to assess the *value* of using English, as well as to determine who, within the EU, will (at least, implicitly) have to pay for it. In other words, we argue that the value of keeping English (almost as a *lingua franca*) could have been part of the Brexit divorce bill.

To address this question, we take into account a variety of relevant characteristics of each EU member, including their official languages. These characteristics range from some (admittedly, scarce and incomplete) documentation on the use of languages (translation and interpretation) in the EU administration, to other linguistic aspects (such as linguistic disenfranchisement of EU citizens) and economic conditions (GDPs).

More precisely, to assess the contribution of each official language to the EU language budget, we have selected a series of indicators that are measured at the level of each member country:

1. The costs of using various languages by the EU administration,

2. The degree of non-knowledge of procedural languages (English, German and French) in

[5]Somewhat surprisingly, there is even uncertainty about this precise amount. See, for instance, https://ec.europa.eu/info/strategy/eu-budget/how-it-works/fact-check. Last accessed, October, 2021.

[6]See, for instance, Ginsburgh, Moreno-Ternero and Weber (2017) or Ginsburgh and Moreno-Ternero (2018, 2019).

[7]At the time he was chairman of the British Council, Lord Kinnock suggested that "the English language teaching sector directly earns 1.3 billions pounds for the UK as invisible exports and our education related exports earn up to 10 billion pounds a year." See Graddol (2006). Note that Grin (2005) estimates the amount at some 17 to 18 billion euros.

each member country,

3. The economic size (GDP) of each member country, and

4. A weighted index of the previous three indicators.

Consider first how to share the cost of the 2.2 million documents written in, or translated into, any official language within the EU. Ideally, we would need observations on a_{ij}, the number of pages written in language i translated into language j, for each pair of languages $i, j \in L$, where L is the number of languages. Unfortunately, only marginal totals $\sum_{l\in L} a_{il}$ and $\sum_{l\in L} a_{li}$ are available. Recently, Bergantiños and Moreno-Ternero (2020) introduced a method to analyze the revenue sharing from collective rights, which can be applied to our situation. The idea is to consider each translated document as a *joint venture* of the two languages in question. Several sharing rules can be used in this context. Each of these is supported by strong normative grounds. In our setting, they all suggest (to various degrees) a strong burden on the three procedural languages (English, French, and German, EFG in what follows), essentially spoken in the UK, Ireland and Malta, Germany, Austria and Luxembourg, and France, part of Belgium and Luxembourg, respectively.

The second approach, which happens to be polar to the first and, thus, favorable to languages EFG, aims at reflecting the lack of effort of each other country to promote multilingualism and learn at least one of the EFG languages; it will lead us to consider how many citizens in each country are disenfranchised with respect to EFG. To wit, we take from surveys ran in each EU country, the number of citizens who do not speak *any* of the EFG languages. Compare the following cases: If all Danes spoke one or the languages in EFG, Denmark would not be disenfranchised and it would be useless to translate into Danish. Consider now a country in which no citizen speaks any of the EFG languages. For them translation is needed and bears a cost that is proportional to their total disenfranchisement. If all citizens know one of the three languages, *accountability*, which is one of the two pillars of modern theories of equality of opportunity (Roemer, 1998), would require that the corresponding budget should not be borne by that country, as it made the effort to have its population speak one of the three important European languages.

Finally, combining linguistic aspects and economic dimensions, summarized by GDPs (which

are standard in the EU to deal with budget sharing),[8] leads to a multidimensional index that will give us the basis to share the burden of multilingualism. Constructing multidimensional indices is a fairly common practice. Most of them use linear transformations of the indicators and aggregate them using an (un)weighted average across the indicators (Decancq and Lugo, 2013). John Rawls (1971) suggested an index based on primary goods. Amartya Sen (1980) was more favorable to an index of 'functionings' as a possible measure of a person's welfare. The UNDP's human development indicator developed by Anand and Sen (1994) is an index composed of GDP, literacy rate, and infant mortality rate. Somewhat closer to what we do, Kollias (2008) designed a burden sharing index for the EU common defence policy, averaging populations and GDPs in each member country. Olson and Zeckhauser (1966), Weber and Wiesmeth (1991) and Weber, Weber and Wiesmeth (2020) followed a similar approach for the related problem of sharing the burden of NATO.[9]

The paper is organized as follows. Section 2 presents the method to deal with the matrix of bilateral translations. Section 3 shifts to measure disenfranchisement to estimate the accountability of countries with respect to multilingualism. Section 4 accommodates these dimensions with the economic dimension, into an index meant to drive the sharing process. Section 5 is devoted to the consequences of Brexit regarding multilingualism in the EU, and Section 6 concludes.

2 Translation (and Interpretation) in the EU

2.1 Facts and Data

Translation. On 1 January 2019, the translation service of the European Commission involved 2,241 staff members (68 percent of whom are translators, language technology experts, quality experts, terminologists and revisers, the others being support staff).[10] With the exception of 30 people located in EU member countries, most of them work in Brussels (45 percent) or

[8] A very obvious regression shows that GDPs are strongly correlated with contributions to the EU budget.

[9] Moreno-Ternero and Roemer (2006) provide normative foundations for some of these indices. See also Moreno-Ternero and Roemer (2012) or Zambrano (2014), among others.

[10] Most of the data we report in this section are described in *Translation in figures 2019* available at https://op.europa.eu/en/publication-detail/-/publication/62f8069c-67d4-11e9-9f05-01aa75ed71a1/language-en. Accessed on February 28, 2020.

Luxembourg (54 percent). Half of their work consists in translating EU law-making. The other half is devoted to external communication, web content, other official documents, incoming correspondence, and communication with EU institutions, and national parliaments (8 percent). The administration reports that they translate approximately 2.2 million pages a year, which cost 325 million eurosr.

The breakdown of these 2.2 million pages is reported in columns (2) and (3) of Table 1. As can be seen, the overwhelming majority of documents (some 86 percent) are written in English. French and German follow with 3.3 and 1.7 percent only.

Interpretation. The European Parliament uses approximately 275 staff interpreters working in 24 interpreting booths, one for each official language. In the vocabulary of graph theory, this implies a tripartite graph configuration with one of the EFG languages acting as bridge node, between an official language (in which the speaker is giving his speech, or making his remarks) as source node, and the remaining official languages as destination nodes. Again, English is the leading language used in the plenary sessions of the Parliament in year 2018 (129.2 hours). German (76.3), French (38.1), Italian (36.5), Spanish (22.1) and Polish (21.0) follow.[11] There is no information concerning other official languages. Interpretation is also needed in many (small or large) meetings, and these are probably difficult to count.

Unfortunately, to the best of our knowledge, no complete breakdown of interpretation costs is published. That is the reason for which our empirical analysis is based on translation only.

2.2 An Intuitive Sharing Model

Let L describe a finite set of languages. Its cardinality is denoted by ℓ. For each pair of languages $i, j \in L$, we denote by a_{ij} the number of pages translated from language i into language j. We use the notational convention that $a_{ii} = 0$, for each $i \in L$. Let $A \in \mathcal{A}_{\ell \times \ell}$ denote the resulting matrix of translations generated within the whole set of languages L. We assume that each translated page costs the same. Without loss of generality, let that cost be 1.[12]

[11] Partial data on hours spoken during plenary sessions in the European Parliament can be found in Aamna Mohdin, Even after Brexit, English will remain the language that holds the EU together, *The Guardian*, May 5, 2018.

[12] This is probably not the case (English may be more difficult to translate to Hungarian than to Danish), but as we have no detailed data, we follow this assumption.

The translation *problem* can then be formalized as a matrix $A \in \mathcal{A}_{\ell\times\ell}$ the terms of which are a_{ij}, the number of pages translated from language i to language j, $i \neq j$.[13] The family of all the problems is denoted by $\mathcal{P}$.[14]

For each $i \in L$, let f_i and t_i respectively denote the total number of pages translated from i, and the number of pages translated to i; α_i is the sum of both numbers. That is,

$$\alpha_i = \sum_{j\in L}(a_{ij} + a_{ji}) = \sum_{j\in L} a_{ij} + \sum_{j\in L} a_{ji} = f_i + t_i.$$

We sometimes refer to α_i (the total number of translated pages for language i) as the *burden* of language i.

For each $A \in \mathcal{A}_{\ell\times\ell}$, let $||A||$ denote the total number of pages translated:

$$||A|| = \sum_{i,j\in L} a_{ij} = \sum_{i\in L} f_i = \sum_{i\in L} t_i = \frac{1}{2}\sum_{i\in L} \alpha_i.$$

A *sharing rule* R is a mapping that associates with each problem an allocation indicating the amount each language covers from the total burden generated by translating. That is, $R : \mathcal{P} \to \mathbb{R}^\ell$ is such that, for each $A \in \mathcal{P}$,

$$\sum_{i\in L} R_i\,(A) = ||A||.$$

We then consider three basic axioms for rules. The first one is a minimal requirement of *impartiality*, a basic requirement of justice (e.g., Moreno-Ternero and Roemer, 2006). It says that if two languages have equal total number of translated pages, then they should face an equal burden.

Symmetry: For each $A \in \mathcal{P}$, and each pair $i, j \in L$, such that $\alpha_i = \alpha_j$,

$$R_i(A) = R_j(A).$$

The second axiom is a *robustness* axiom stating that revenues should be additive on A. It is

[13] The same method can be used for interpretation. The number of hours would replace the number of pages.

[14] Formally speaking, the model is identical to the one introduced by Bergantiños and Moreno-Ternero (2020) to share the revenues from broadcasting sport leagues. In that case, a_{ij} refers to the number of viewers watching the game teams i and j playing at i's stadium, and the concern is sharing revenues. In our case, the concern is sharing costs.

an axiom with long tradition in axiomatic work, which can be traced back to Shapley (1953).[15] Formally,

Additivity: For each pair A and $A' \in \mathcal{P}$,

$$R\left(A + A'\right) = R(A) + R\left(A'\right).$$

The third axiom says that each language should face, at most, a burden equal to its total number of translated pages. It therefore formalizes a natural upper bound, akin to the standard requirement of claims boundedness for the problem of adjudicating conflicting claims (e.g., O'Neill, 1982; Thomson, 2019).

Maximum burden: For each $A \in \mathcal{P}$ and each $i \in L$,

$$R_i(A) \leq \alpha_i.$$

Theorem 1 in Bergantiños and Moreno-Ternero (2021a) states that the combination of the three previous axioms characterizes a family of *compromise* rules, introduced next. This is remarkable as the three axioms are intuitive and basic and none of them seems to convey strong implications individually.

The family of *compromise* rules is made from the convex combinations of two focal (and somewhat polar) rules. The first is the so-called *equal-split* rule. It splits equally the burden of each written document between both languages involved in the translation (either from or into):

Equal-split rule, ES. For each $A \in \mathcal{P}$, and each $i \in L$,

$$ES_i\left(A\right) = \frac{\alpha_i}{2}.$$

Note that the equal-split rule can also be rationalized as the proportional solution to a problem of adjudicating conflicting claims. To wit, suppose each country pays for the marginal cost α_i of having its language in the EU: (if language i were not present, the costs would be reduced by that amount). As the sum of all marginal costs is higher than the total cost

[15] This requirement precludes the allocation of the amount a_{ij} to depend on any other information contained in the matrix A. This can be seen as a strong requirement (it precludes externalities). But, at the same time, this requirement can be seen as a form of simplicity. Furthermore, it is not a disruptive axiom in our model as many rules satisfy it.

$||A||$, the surplus is then distributed proportionally to the contributions α_i, resulting in a net contribution of $\sum_i \alpha_i/2 = ||A||$.

The other focal rule, *concede-and-divide*, takes into account the relative importance of each language.[16] More precisely, the rule subtracts from each α_i a constant amount for each of the other $\ell - 1$ languages (the average of pages translated not involving language i). Formally, this rule can be expressed as:

Concede-and-divide rule, CD. For each $A \in \mathcal{P}$, and each $i \in L$,

$$CD_i(A) = \alpha_i - (\ell - 1)\frac{\sum_{j,k \in L \setminus \{i\}} (a_{jk} + a_{kj})}{(\ell - 2)(\ell - 1)} = \frac{(\ell - 1)\,\alpha_i - ||A||}{\ell - 2}.$$

We are now ready to introduce the family of rules compromising between the previous two.

Compromise rules, $\left\{C^\lambda\right\}_{\lambda \in [0,1]}$. For each $\lambda \in [0,1]$, each $A \in \mathcal{P}$, and each $i \in L$,

$$C_i^\lambda(A) = \lambda ES_i(A) + (1 - \lambda) CD_i(A).$$

It is obvious to check that when $\lambda = 0$ then C^λ coincides with *concede-and-divide*, whereas when $\lambda = 1$ then C^λ coincides with the *equal-split* rule. That is, $C^0 \equiv CD$ and $C^1 \equiv ES$.

Straightforward algebraic computations allow us to show that, for each $A \in \mathcal{P}$, each $i \in \ell$, and each $\lambda \in [0,1]$,

$$C_i^\lambda(A) = \frac{\alpha_i}{2} + \frac{\ell(1 - \lambda)}{2\,(\ell - 2)}\,(\alpha_i - \overline{\alpha})\,, \tag{1}$$

where

$$\overline{\alpha} = \frac{\sum_{i \in L} \alpha_i}{\ell}.$$

Instead of the upper bound axiom of *maximum burden*, one might want to consider a dual lower bound instead. *Non-negativity* would be the natural one. But it can actually be shown that all compromise rules presented above violate that lower bound, except for the corner case of the equal-split rule. In other words, if one wants to impose non-negativity, together with the three axioms we consider, then only one rule survives: the equal-split rule. Now, if one dismisses the upper bound (but keeps non-negativity, additivity and symmetry) then another family of compromise rules arises (e.g. Bergantinos and Moreno-Ternero, 2021b). But, in this case, they compromise between the equal-split rule and the so-called *uniform* rule (instead

[16] The term was coined by Thomson (2003), who used it to describe the intuitive solution of the so-called (and related) contested garment problem that is originally described in the *Talmud*.

of concede-and-divide), which allocates the overall burden ($||A||$) equally among the existing languages (thus ignoring the individual burdens α_i).

To conclude, note that compromise rules are minimalistic from an informational viewpoint. That is, even if the rules are defined over problems, they only require to know the vector $(\alpha_i)_{i\in L}$ rather than the whole matrix A. We stress that this is not a prior of our model, but a consequence of our axiomatic analysis. In other words, our axioms are characterizing rules that are minimalistic (from an informational viewpoint) that do not require to know the value of all entries in the matrix. This will become crucial for our problem, given the available data. More precisely, we do not have data on the number of pages written in language i translated into language j; only marginal totals are available. Now, one could think of plausible alternative axioms leading to alternative rules that make use of all the matrix entries. If we would had characterized some of those (sharing) rules, we would need better data to apply them, or at least resort to some of the classical methods, such as the biproportional fitting procedure (e.g., Deming and Stephan, 1940), to estimate them from what we have.

2.3 Results

Data and results of the computations are displayed in Table 1. Column (1) indicates that the official language of some countries, or parts of countries, is the same as the native language of a larger country. For instance 'See Germany' means that Austria's language (German) is included in Germany.[17] Columns (2) and (3) contain the basic data (total translations from, and total translations to). Columns (4) to (6) provide the solutions of the three rules defined in Section 2.2, in absolute value (pages), while columns (7) to (9) display relative values (number of pages divided by the total in each column).[18]

[Insert Table 1 about here]

As expected, the *equal-split* rule is more favorable to dominating languages, while *concede-and-divide* is the most unequal: It would make English cover almost 95 percent of the burden,

[17] The reason will become more obvious in what follows.

[18] Note that these columns contain an amount for each language, not country. To recover the country allocation, we suggest to split the amount for the language in proportion of populations: some 90 percent would be covered by Germany and 10 percent by Austria (and a tiny percentage for Luxembourg, that we will ignore in what follows).

whereas the *equal-split* rule roughly halves this number. Still, English 'counts' for half of the budget, while some languages (and countries) would get subsidized (negative signs in columns (8) and (9)). Though these subsidies are rather small, with the exception of Irish and Maltese to some extent, two languages that became official quite recently. This may look controversial, as English is largely dominant in both countries.

Note that the *concede-and-divide* outcome is roughly proportional to the documents that each language generates and must be translated into other languages. If we leave out EFG languages, Table 1 shows that all documents are translated, so the column marginals of A are all very similar (roughly 90 million). However, the row marginals do vary greatly, and these values seem proportional to the values of the *concede-and-divide* outcome, which means that *concede-and-divide* suggests that the sharing rule should be somewhat proportional to the documents that each language generates. Now, if the variation in row marginals is related to the legislative activity of the different countries, this might be controversial. Some countries, for reasons unrelated to the languages, generate more legislative proposals than others. *Concede-and-divide* would then penalize such legislative activity, hence becoming a sort of tax on legislative proposals.

We stress that the previous rules do not distinguish between translations 'to' and translations 'from'. They are *impartial* in that respect. One may argue that the vast majority of translations are 'from' English, rather than 'to' English and that this would motivate to shift more of the burden on the receiving language. *Asymmetric* versions of the rules introduced above could be considered. Instead, we convey that view with a different approach taken in Section 3.

To conclude with this section, we acknowledge that our axiomatic analysis is silent regarding the specific rule to choose within the family we provide (or, equivalently, the choice of the parameter λ). One could take, for instance, a decentralized approach to deal with this issue, by means of simple majority voting, letting each country vote for a rule within the family. As mentioned above, one should normally not expect a majority voting equilibrium. Surprisingly, we can get it in our setting, thanks to the fact that compromise rules satisfy the so-called *single-crossing* property (e.g., Gans and Smart, 1996).[19] It turns out that corner solutions arise overwhelmingly. More precisely, if the distribution of individual burdens (α_i) is skewed

[19] A formal proof is in Bergantiños and Moreno-Ternero (2021a).

to the right (i.e., the median burden is above the mean burden), then the *equal-split* allocation (the most equal allocation within the family) is the majority winner, whereas if it is skewed to the left (i.e., the median burden is below the mean burden), then the *concede-and-divide* allocation (the most unequal allocation within the family) is the majority winner. If it is not skewed (i.e., the median burden is equal the mean burden), then any *compromise* allocation can be a majority winner.

The so-called Penrose Law (e.g., Penrose, 1946) is a well-known method to generate an equal voting power for citizens of all countries (with possibly heterogeneous population sizes) involved in a global assembly. One might consider for each language its *weighted burden*; namely, $\widehat{\alpha}_i = \sqrt{n_i}\alpha_i$, where n_i denotes the population speaking language i. Then, the previous discussion would also hold for the distribution of *weighted burdens*. To wit, if the distribution of weighted burdens is skewed to the right, then the *equal-split* allocation is the majority winner, whereas if it is skewed to the left then the *concede-and-divide* allocation is the majority winner. If it is not skewed, then any *compromise* allocation can be a majority winner.

Finally, one might consider a plausible way to modify the *compromise* rules, according to some (country-specific) influence parameters. More precisely, for each $A \in \mathcal{P}$ and each $\lambda \in [0,1]$, we could construct the (sharing) rule that assigns to each $i \in L$, the amount

$$\widehat{C}_i^{\lambda}(A) = C_i^{\lambda}(A) + \gamma_i - \bar{\gamma}.$$

If we let countries vote for a rule within the new family $\{\widehat{C}^{\lambda}\}_{\lambda\in[0,1]}$, then we can also guarantee that there exists a majority voting equilibrium (an analogous proof to the one mentioned above would be valid to show that the rules within this new family satisfy the single-crossing property too). Furthermore, the equilibrium would, in general, be a corner solution too (unless the median burden coincides with the mean burden). The same comment made for modified burdens above (taking into account Penrose weighting) could also be made here.

3 Taking Disenfranchisement into Account

Although the analysis in the previous section leads to a very large variety of solutions, they may be too severe for widely used languages, especially, for English. We now take another approach, referring to the concept of *linguistic disenfranchisement*, that can be considered to be the fraction of each country's people who do not speak *any* of the EFG languages. In a

sense, we take the view that as long as everyone speaks one of the three procedural languages, the whole discussion on bilateral translations becomes irrelevant.

Table 2 shows populations in column (1), and disenfranchisement rates of English, German and French in columns (2) to (4). The data are derived from a survey (Special Eurobarometer, 2006) supported by the European Commission. A couple of examples follow. Austria has a disenfranchisement rate of 0, since all its citizens speak German, one of the three procedural languages,[20] and so does obviously the UK (and a large fraction of the Irish people) as well as France (and French-speaking Belgians). In other cases, say Luxembourg, the large majority of people speak either French or German, and some speak both; this also drives their observed disenfranchisement rate to 0. Finally, 84 percent of Bulgarians do not speak English, but may speak one or both other languages (6 percent speak German, and 4 percent French). These numbers are cumulated in column (5), after having eliminated double and triple counts (a Bulgarian who speaks both German and French will not be counted twice, or even three times if he speaks all three languages). Note that these rates are computed for the year 2007,[21] and may look outdated. We, nevertheless, assume that the relative values of these rates did not change (or hardly did so) between 2007 and 2018, and apply them on 2018 populations. The population that is disenfranchised appears in columns (6) while column (7) shows the percentage of the total number of people (186.4 million) who are disenfranchised in the EU.

[Insert Table 2 about here]

In some countries, there are large differences between disenfranchisement rates (in column 5) and disenfranchised population in percentage terms (in column 7). Portugal and Romania have the same disenfranchisement rate (81 percent in column 5), and seem to have the same 'weight,' but Portugal has a much smaller population than Romania.

Obviously, the UK, Germany and France do not have to contribute, and this is very different from the results discussed in Section 2 where English would, in the best case, have to contribute some 50 percent to the budget.

To conclude with this section, we stress that we have relied on data coming from the Special Eurobarometer supported by the European Commission. One might argue that data on how

[20] In each country, there are some foreigners who speak none of the EFG languages, say Syrians during their first or second year after immigration. We drop these numbers which hardly represent one percent of the population.

[21] See Fidrmuc, Ginsburgh and Weber (2007).

many people speak one of the procedural languages in each country might not be entirely objective and easily verifiable. But we believe that the Special Eurobarometer takes us as close as possible one could hope for down that road.

An additional problem might arise with the choice itself of procedural languages in the EU. Countries like Italy and Spain might find it unfair that their languages are not procedural in the EU and that instead of compensating them, they are penalized for that. Nevertheless, we stress that, in this section, we took a positive rather than normative approach. It is a fact that English, French and German have enjoyed a special status since the beginning. And, as such, it seems natural to argue whether incoming countries in the EU made an effort or not to acquire knowledge of them. An alternative approach would be to consider enlarging the set of procedural languages. This has been partly addressed elsewhere (e.g., Firdmuc et al., 2007).

4 Compromising

In Sections 2 and 3, alternative budget sharing processes are suggested. Each of them favored some (and, sometimes, different) countries. As each one can be criticized for targeting a specific dimension, and thus dismissing important aspects, we now 'compromise' among them, moving from a single indicator, to a multidimensional index.

As mentioned in the introduction, constructing multidimensional indices is a simple and common practice. Here, we follow the standard approach considering a simple average of the indicators (which is also normatively grounded). The consequence of considering percentages rather than total amounts, is that the index will also yield percentages, which can directly be used to share the total burden of translation and interpretation.

Given the uncertainty of the budget devoted to languages, our index points to the share each country should contribute.

Before going to the final calculations, and as Table 1 is constructed on the basis of languages, while Table 2 is based on countries, we have to reconstruct slightly the table that shows the shares each country should be 'charged.' The results are shown in Table 3 where each language is associated to a unique country.[22]

[22]We 'transfer' languages of some countries to others to be able to have the same dimensions as in Tables 1 and 2. As already mentioned earlier, Austria is added to Germany, Flemish-speaking Belgium to the Netherlands, French-speaking Belgians to France, Greek-speaking Cypriots to Greece, English-speaking Irish to the UK, half

[Insert Table 3 about here]

Index I (Table 3, column 4), is the average between the sharing proposed in Sections 2 and 3: (i) translations in the EU's administration (Table 1); (ii) disenfranchisement (Table 2). Index I thus shows that the largest contribution falls on English (that is essentially the UK), with some 35 percent (to be shared with Ireland and Malta), Italian (12.1 percent), Spanish (11.2 percent) and Polish (8.5 percent). It is interesting, but not surprising, that the two other procedural languages, German (1.6 percent) and French (2.6 percent) would have to pay very little. They are indeed far from having the power of English in the EU administration, which uses a very large number of translations from English (1.9 million pages out of a total of 2.2 million), and the disenfranchisement rates of both procedural languages are of course equal to 0. This should also be so for the UK, but it weighs over 70 percent in the translations dimension. Italians, Spaniards and Poles have, unfortunately, not made much effort to learn EFG language, which makes their disenfranchisement rates with respect to EFG rather large.

This looks nevertheless quite unfair. Therefore we also constructed Index II (Table 3, column (7)) which also includes GDP as a new dimension, with equal weights to the other two. More precisely, Index II is obtained taking the averages of columns (2), (3) and (6) . This makes English a little 'cheaper,' decreases slightly the burdens of Italian, Polish and Spanish, but increases those of French and German, which seems reasonable.

If we assume that the budget is actually one billion (and, we reiterate, there is some uncertainty about that), we can easily calculate the *cost*, the *price*, or the *value* of each of the 24 official EU languages.

5 And along came Brexit...

On 23 June 2016, the so-called *United Kingdom European Union membership referendum* took place. The result, that very few observers had predicted, was legally non-binding, but, at the time, the government promised to implement it, initiating the official withdrawal process of the

of Luxembourg to France, the other half to Germany, and finally English-speaking Maltese to the UK. Note that some five percent (300.000 citizens) of Finns speak Swedish, but seventy percent of them speak or understand Finnish. We, therefore, ignored this distinction and left Swedish-speaking Finns in Finland. This makes each language associated to a unique country. Going back to countries is easy though, as we can share the burden of each language spoken in several countries proportionally to their populations.

UK from the EU (although, as of today, it has not been materialized in monetary amounts). In the aftermath of this shocking result, reactions came from the whole political spectrum. In one of them, Danuta Hubner, the head of the European Parliament's Constitutional Affairs Committee, warned that English would lose its status of official language in the EU. Here is what she said: "We have a regulation [...] where every EU country has the right to notify one official language. The Irish have notified Gaelic, and the Maltese have notified Maltese, so you have only the UK notifying English [...] If we don't have the UK, we don't have English."[23]

The very next day, the Commission's representation in Ireland released an official statement claiming that it is up to the Council of Ministers to vote *unanimously* on changes of EU's language regime. In other words, any change to the EU's language regime is subject to a unanimous vote of the Council, including Ireland. This implies that Ireland would obviously vote against deleting English from the list of official languages and Malta, which is in a similar situation but much smaller than Ireland, would probably cast a similar (negative) vote.

One might argue, in line with Ireland's position, that Finland (which has Swedish as an official language) could also claim Swedish to remain an official language, had Sweden decided to secede. It is a matter of speculation whether Swedish would receive this special treatment of English. Likewise, now that the term *Polexit* has even been coined amid concerns fueled in the Fall of 2021 that Poland might leave the EU too, it is a matter of speculation whether Polish would receive the same treatment of English.

It is also questionable whether such a special treatment could or should be given to a language, because a small country such as Ireland (and perhaps Malta, which is even smaller) sets the result of a vote. Catalan, for instance, is an official language in Spain, but not in the EU, and the population of Catalonia is larger than the population of Ireland.[24] Somewhat related, the number of Russian native speakers in the EU is similar that of Catalan speakers and Russian is not considered an official language in the EU either.

One can also argue that when a new country (with a non-EU language) enters the EU, its language is automatically accepted. In fact, there is a formal vote which has always been unanimous. Why should it be that, when a country leaves the EU, its language does not

[23]See for example https://www.politico.eu/article/english-will-not-be-an-official-eu-language-after-brexit-senior-mep/

[24]To be fair, not all Spanish citizens living in Catalonia speak Catalan, but Catalan is certainly spoken by more citizens than Maltese in Malta, or the share of the Swedish-speaking population in Finland.

automatically follow, and exits with its owner?

On the other hand, there are, of course, strong arguments to favour English. It is, by far, the language that disenfranchises the smallest number of EU citizens, and it probably is the most spoken language in the world, with the exception of Chinese and Arabic if one puts all their local dialects in the same basket. The EU (and all of us) obviously need a common language, whichever it is, official or not, but spoken by as many Europeans as possible. Ginsburgh and Moreno-Ternero (2018) suggest that this could be a further step, and argue that, for efficiency reasons, English could become the *lingua franca* in the EU, without any necessity to vote, though obviously, France and Germany would be very unhappy. Note that such a situation had already been predicted in 1873 by the Swiss scientist De Candolle (1987). Here is what he writes, after having described the role of Latin, followed by French, and to some extent by German as a scientific language, in the 19th and first part of the 20th centuries:

> A language can become dominant if and only if it satisfies the following characteristics: (i) have enough words or Germanic and Latin forms to be accessible both to the speakers of both Germanic and Romance languages, and (ii) be spoken by a considerable majority of civilized people.[25] It would also be important that this language should grammatically be simple enough as well sharing some conciseness and clarity. English is the only language that, could, in 100 or 150 years offer such conditions. The future preponderance of the Anglo-American language is so obvious that it will be imposed by the populations of both hemispheres.

However, would it be fair to let the British people passively benefit from this (and cash, as Lord Kinnock mentioned, billions of pounds[26]) without compensating its neighbors living in Continental Europe? English became much stronger and more spoken in the EU (and within the European Commission) during the last years, largely dethroning French and German. It was far from being so until 1973, the year in which the UK became member of the EU. Brexit might probably let other EU countries "take responsibility" for translations and interpretations from and to English.

Based on our analysis in the previous sections, English (an official language in the UK, Ireland and Malta) would have to contribute at least 291 million euros per year (almost a

[25] In the time he wrote this, Arabic and Chinese were not at the point at which they are nowadays.

[26] See the Introduction for some details.

third of the one billion yearly budget for multilingualism). Subtracting the Maltese and Irish population would lower the amount to some 268 million euros. It would have been reasonable to add such an amount to the UK-UE divorce bill, though, in the long run, the linguistic landscape within the EU might change, and the use of French and German would be obvious choices at the expense of English. These 268 million could be used, for instance, to increase the Erasmus budget and send EU students to the UK or to Ireland to learn English (and vice-versa). In these unsettling times, fostering cohesion between the EU and the UK would be more than welcome.

6 Conclusions

In this paper, we explore how to share the burden of multilingualism in the EU. We acknowledge that this is purely a 'theoretical exercise', as the language budget is not set by country but is taken from the total EU budget to which each country contributes. We, nevertheless, believe that this is an interesting exercise, especially in the aftermath of Brexit, as English became the mother tongue of only one per cent of the EU population, while being the one that weighs the most in the language budget. The language debate in the post-Brexit world has yet to take place, as the Brexit break-up brought more urgent issues to public attention and debate. We, nevertheless, believe that the time of careful examination of linguistic issues will come and it is prudent for the academic community to lay down the terms of future debate.

We consider three alternative approaches in our analysis:

The first one uses a stylized model of allocating revenues from collective rights to share the costs of translation (data on interpretation are unfortunately not sufficient). This approach is worrisome for procedural languages, especially English, which would have to support at least half of the burden.

The second approach uses the notion of linguistic disenfranchisement to implement the principle of accountability. Contrary to the first approach, procedural languages would now be treated in a better way.

The third approach introduces an economic dimension, constructing a multidimensional index involving the previous two dimensions too. This approach is reminiscent of Greenberg (1956) and Desmet, Ortuño-Ortin and Weber (2009) papers, who also consider linguistic infor-

mation to 'augment' existing diversity and polarizarion indices.

We believe that the allocation derived from this index is a very natural proposal to solve our problem as it balances linguistic and economic aspects of EU's member states, as well as capturing the principle of accountability, a cornerstone for the modern theory of fair allocation. Modifying the index to give a higher weight to the economic dimension would have, as main effect, a reduction of the burden of English, while increasing the one of French and, especially, German. Anyhow, English would still face a larger share of the burden than the other two languages together.

Some *caveats* on the grounds of fairness should be mentioned though, with respect to the allocation derived from our indices. On the one hand, six languages (three procedural languages, plus Italian, Polish and Spanish) out of 24, would have to support some 66 percent of the burden. This is not unreasonable, as they are the largest countries, with the largest populations in the EU. This group happens to be the same as the one that results from the analysis in Fidrmuc et al. (2007), who try to determine the optimal number of official languages in the EU.

We also acknowledge that, while 1 billion is quite a large number in absolute terms, it might not mean much in perspective (as share of the EU budget). The proposal for the 2020 budget actually represents around 2% of all EU public spending, with appropriations of EUR $168,3$ billion ($+1,3\%$ compared to the 2019 budget) proposed in commitments, and EUR $153,6$ billion ($+3,5\%$) in payments, corresponding to $0,99\%$ and $0,90\%$ of EU gross national income respectively.[27] This might question the relevance of a multidimensional index to share the budget for multilingualism (as opposed to, say, military budgets where the relevance seems more obvious). We nevertheless believe that the proposed weighting of budget shares could in practice be implemented.

More generally, one could consider an extension of our model, encompassing economic and strategic considerations. To wit, we may introduce an economic model with an endogenous choice of translation pages, and, for a given sharing rule, derive an equilibrium number of translated pages. Then, one may look for the compromise rule that provides the best fit with the existing data. This is left for future research.

To conclude, we believe that our analysis is relevant, given the crucial juncture the EU is

[27] $https://ec.europa.eu/info/sites/info/files/about_the_european_commission/eu_budget/draft-budget-2020-wd-13-web-1.4_soe.pdf$. Accessed March, 2021.

facing in the aftermath of Brexit. The COVID-19 pandemic is shaking almost all pillars of civilization worldwide, with a special strength in Europe, as well as in the UK, and postpones many crucial issues (including the full-fledged implementation of Brexit). One can hope that attention will gradually shift back to them. When this happens, we will have to seriously address, among other things, the EU-UK divorce bill.

There are certainly efficiency arguments that suggest that the EU will not only keep English as an official language in the future, but also as a de facto *lingua franca*. But that would exacerbate benefits for the UK, which should compensate the EU by chipping in, to face the burden of multilingualism in post-Brexit EU.

References

Alesina, Alberto, Reza Baqir, and William Easterly (1999). Public goods and ethnic divisions. *Quarterly Journal of Economics* 114, 1243-1284.

Anand, Sudhir and Amartya Sen (1994). Human development index: methodology and measurement. Human Development Report Office Occasional Paper 12, UNDP.

Bergantiños, Gustavo and Juan Moreno-Ternero (2020). Sharing the revenues from broadcasting sport events. *Management Science* 66, 2417-2431.

Bergantiños, Gustavo and Juan Moreno-Ternero (2021a). Compromising to share the revenues from broadcasting sports leagues. *Journal of Economic Behavior and Organization* 183, 57-74.

Bergantiños, Gustavo and Juan Moreno-Ternero (2021b). On the axiomatic approach to sharing the revenues from broadcasting sports leagues. *Social Choice and Welfare*. Forthcoming. https://doi.org/10.1007/s00355-021-01360-9

Collier, Paul and Anke Hoeffler (1998). On economic causes of civil war. *Oxford Economic Papers* 50, 563-573

De Candolle, Alphonse (1987, [1873]). *Histoire des sciences et des savants depuis deux siècles*. Paris : Odile Jacob.

Decancq, Koen and Maria Ana Lugo (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews* 32, 7-34.

Deming, W. Edwards and Frederick F. Stephan (1940). On a least squares adjustment of a sampled frequency table when the expected marginal totals are known. *The Annals of Mathematical Statistics* 11, 427-444.

Desmet, Klaus, Ignacio Ortuño-Ortin, and Shlomo Weber (2009). Linguistic diversity and redistribution. *Journal of the European Economic Association* 7, 1291-1318.

Easterly, William and Ross Levine (1997). Africa's growth tragedy: Policies and ethnic divisions. *Quarterly Journal of Economics* 112, 1203-1250.

Fidrmuc, Jan, Victor Ginsburgh and Shlomo Weber (2007). Ever closer union or Babylonian discord? The official-language problem in the European Union. CEPR Discussion Paper 6367.

Gans, Joshua S., and Michael Smart (1996). Majority voting with single-crossing preferences. *Journal of Public Economics* 59, 219-237.

Ginsburgh, Victor and Juan Moreno-Ternero (2018). Compensation schemes for learning a lingua franca in the European Union. *The World Economy* 41, 1775-1789.

Ginsburgh, Victor and Juan Moreno-Ternero (2019). A lingua franca in the post-Brexit EU. *Cuadernos Económicos del ICE* 98, 9-23.

Ginsburgh, Victor, Juan Moreno-Ternero, and Shlomo Weber (2017). Ranking languages in the European Union: Before and after Brexit. *European Economic Review 93*, 139-151.

Ginsburgh, Victor and Shlomo Weber (2020). The economics of language. *Journal of Economic Literature* 58, 348-404.

Graddol, David (2006). *English Next: Why Global English May Mean the End of English as a Foreign Language*. London: British Council.

Greenberg, Joseph (1956). The measurement of linguistic diversity. *Language* 32, 109-115.

Grin, François (2005). L'enseignement des langues étrangères comme politique publique. Paris: Haut Conseil de l'Evaluation de l'Ecole.

Kollias, Christos (2008). A preliminary investigation of the burden sharing aspects of a European Union common defence policy, *Defence and Peace Economics* 19, 253-263.

Laitin, David (2000). Language confict and violence: The straw that strengthened the camel's back. In Paul Stern, and Daniel Druckman, editors, *International Conflict Resolution After the Cold War.* National Academy of Sciences Press.

Moreno-Ternero, Juan and John Roemer (2006). Impartiality, priority and solidarity in the theory of justice. *Econometrica* 74, 1419-1427.

Moreno-Ternero, Juan and John Roemer (2012). A common ground for resource and welfare egalitarianism. *Games and Economic Behavior* 75, 832-841.

Olson, Mancur and Richard Zeckhauser (1966). An economic theory of alliances. *Review of Economics and Statistics* 48, 266-279.

O'Neill, Barry (1982). A problem of rights arbitration from the Talmud. *Mathematical Social Sciences* 2, 345-371.

Penrose, Lionel S. (1946). The elementary statistics of majority voting. *Journal of the Royal Statistical Society* 109, 53-57.

Rawls, John (1971). *A Theory of Justice*. Cambridge, MA: Harvard University Press.

Roemer, John (1998). *Equality of Opportunity.* Cambridge, MA: Harvard University Press.

Sen, Amartya (1980). Equality of what? In Sterling McMurrin, editor. *The Tanner Lectures on Human Values*. UT, Salt Lake City: University of Utah Press.

Shapley, Lloyd (1953). A value for n-person games, in Contributions to the Theory of Games II (Annals of Mathematics Studies 28), ed. by H.W. Kuhn and A.W. Tucker, Princeton: Princeton University Press, 307-317.

Special Eurobarometer 243 (2006). Europeans and their languages.

Thomson, William (2003). Axiomatic and game-theoretic analysis of bankruptcy and taxation problems: A survey. *Mathematical Social Sciences* 45, 249-297.

Thomson, William (2019). *How to Divide When There Isn't Enough: From Aristotle, the Talmud, and Maimonides to the Axiomatics of Resource Allocation*, Econometric Society Monograph. Cambridge, MA: Cambridge University Press.

Weber, Shlomo and Hans Wiesmeth (1991). Economic models of NATO. *Journal of Public Economics* 46, 181-197.

Weber, Shlomo, Yuval Weber and Hans Wiesmeth (2020). Hierarchy of Membership and Burden Sharing in a Military Alliance. *Defence and Peace Economics*. Forthcoming.

Zambrano, Eduardo (2014). An axiomatization of the human development index. *Social Choice and Welfare* 42, 853-872.

Appendix. Countries with more than one official language

Belgium

• Date of accession to the EU (Common Market at the time): 1958. Official languages in the country: Flemish (assimilated to Dutch), French and German. Official language in the EU: As The Netherlands, France and Germany were also among the founding member states, the three Belgian official languages were *ipso facto* Common Market official languages and the entry of Belgium added no new language.

• Belgium is separated into two parts: the Flemish-speaking provinces of Antwerpen, Limburg, Oost-Vlaanderen, Vlaams Brabant and West Vlaanderen plus 50 percent of Brussels for GDP, but only 10 percent of its inhabitants speak Dutch (Flanders in what follows) and the French-speaking (Walloons usually speak French) provinces of Brabant Wallon, Hainaut, Liège Luxembourg and Namur plus 50 percent of Brussels for GDP but 90 percent for its language (Wallonia). The German-speaking population of Eastern Belgium is included in Wallonia (note there are only 77,000 German speakers and most of them also speak French).

• Total population: 11.4 million. Total GDP: 458.28 billion.

• Sharing languages of populations: The population of 11.4 million is separated as follows: Flanders: 6.7 million that is 6.6 million living in the Flemish provinces (see above) plus 10 percent of the 1.2 million living in Brussels; Wallonia: 4.7 million of which 3.6 live in the French-speaking provinces (see above), plus 90 percent of the 1.2 million living in Brussels. Belgian censuses do not include questions on languages. The 90 percent is borrowed from a recent paper issued by a serious local newspaper (Pauline Deglume, Bruxelles à 91.8 pour cent francophone selon les déclarations fiscales, *L'Echo*, January 29, 2020) which reports on the languages (Flemish or French) used by inhabitants of Brussels in their income tax returns. Source: $www.statistica.com/statistics/517196/population-of-belgium-by-region.$

• Sharing GDPs by language: Belgian total GDP of 458.3 billion is shared as follows: Flanders: Euros 311.6 billion, that is the GDP of the provinces cited earlier plus 50 percent of the GDP of the Brussels region; Wallonia: 146.7 billion that is the provinces cited earlier and 50 percent of the Brussels region. Source: $https://ec.europa.eu/eurostat/news/themes-in-the-spotlight/regional-gdp.$

• disenfranchisement: Flemish-speaking population: 17 percent. Source: Ginsburgh, Victor and Shlomo Weber (2007), La connaissance des langues en Belgique, Reflets et Perspectives

de la Vie Economique 47, 33-43; French and German-speaking populations: 0 percent. For disenfranchisement data, see Fidrmuc, Ginsburgh and Weber (2007).

Ireland (Republic of)

• Date of accession to the EU: 1973. Official languages in the country: English and Irish (also often called Gaelic). Official language in the EU: Irish.

• Total population: 4.8 million. Total GDP: 320.16 billion.

• Ireland is separated into two parts: English speakers: 99 percent of the population; Irish: 36 percent also speak Irish. Source: $https://en.wikipedia.org/wiki/Irish-language$.

• Sharing languages of populations: 99 percent of Irish citizens speak English and 36 percent speak Irish, thus we assume that 1 percent of the population speaks Irish only. See previous paragraph.

• Sharing GDPs by language: We make the assumption that 36 percent, that is 115.3 = billion is produced by Irish speaking citizens, and 64 percent, that is 204.9 billion by English-speaking citizens.

• disenfranchisement: One percent only of the population does not speak English.

• Linguistic disenfranchisement: 0 for those who speak English; 1 percent speak only Irish.

Luxembourg

• Date of accession to the EU: 1958. Official languages in the country: Luxembourgish, French and German. Official language in the EU: In 1958, Luxembourg waved its rights to add Luxembourgish to the list of languages as French and German were already official languages in the Common Market. However, recently Luxembourg asked the EU to accept Luxembourgish as an official language as well (Source: $https://www.euractiv.com/section/languages-culture/news/luxembourgish-makes-comeback-bid-for-eu-approval/$)

• Total population: 0.6 million.

• Total GDP: 59.2 billion.

• Sharing languages of populations: The whole population knows either E, or G, or F, and many speak at least two of those three languages.

• Sharing GDPs by language: The whole GDP is produced by .

• Empirical disenfranchisement: 0 percent.

• Linguistic disenfrachisement: 0 with respect to .

Malta

• Date of accession to the EU: 2004. Official languages in the country: English and Maltese. Official language in the EU: Maltese. However, at the time Malta became a member of the EU, and given that a large majority of Maltese citizens know English, the country temporarily waved its rights to have Maltese translated and interpreted. The Council set a transitional period of three years starting May 1, 2004, during which the institutions were not constrained to draft or translate acts in Maltese. It was agreed that the Council could extend this transitional period by an additional year, but decided not to. All new acts of the institutions were required to be adopted and published in Maltese starting with documents issued as early as April, 30 2007. Source: $https://en.wikipedia.org/wiki/Languages_of_the_European_Union$. The EU recently issued guidelines for contractors translating into Maltese. Source: $https://ec.europa.eu/info/resources-partners/translation-and-drafting-resources/guidelines-translation-contractors/guidelines-contractors-translating-maltese$.

• Total population: 0.5 million.

• Total GDP: 12.7 billion.

• Sharing languages of populations: 98 percent speak Maltese, 88 percent can speak English. Source: Eurobarometer 386, 2012.

• Sharing GDPs by language. We make the assumption that GDPs are proportional to languages spoken (see below). Thus 11.2 (= 0.88 percent out of 12.75 billion) is produced by English speakers and 1.53 (= 0.12 percent of 12.75 billion) is produced by those who also speak English.

• Empirical disenfranchisement: 12 percent at most.

• Theoretical disenfranchisement: 0 with respect to for 88 percent of the population; 1000 for those 12 percent who speak only Maltese which is not an Indo-European (and perhaps also Italian, or French).

Table 1 Translations. Results of Sharing Rules

Countries	See country for language (1)	Translations (1,000 pages) from (2)	to (3)	Absolute values Equal split (4)	Concede & divide (5)	Comprom-ise (6)	Relative values (%) Equal split (7)	Concede & divide (8)	Comprom-ise (9)
Austria	See Germany								
Belgium Dutch	See Netherlands								
Belgium French	See France								
Bulgaria		14,0	87,3	50,7	3,6	27,1	2,3	0,2	1,2
Croatia		7,4	87,5	47,5	-3,1	22,2	2,1	-0,1	1,0
Cyprus	See Greece			0,0	0,0	0,0			
Czechia		7,9	88,1	48,0	-2,1	22,9	2,1	-0,1	1,0
Denmark		5,7	87,5	46,6	-4,9	20,8	2,1	-0,2	0,9
Estonia		2,9	86,1	44,5	-9,4	17,6	2,0	-0,4	0,8
Finland		4,3	86,7	45,5	-7,2	19,1	2,0	-0,3	0,9
France (F)		74,7	144,5	109,6	126,8	118,2	4,9	5,6	5,3
Germany (G)		38,5	118,5	78,5	61,8	70,2	3,5	2,7	3,1
Greece		21,0	90,1	55,5	13,8	34,6	2,5	0,6	1,5
Hungary		11,3	88,1	49,7	1,5	25,6	2,2	0,1	1,1
Ireland English	See UK								
Ireland Irish		0,0	19,2	9,6	-82,3	-36,4	0,4	-3,7	-1,6
Italy		20,1	96,0	58,1	19,0	38,5	2,6	0,8	1,7
Latvia		3,6	86,3	45,0	-8,4	18,3	2,0	-0,4	0,8
Lithuania		6,2	85,8	46,0	-6,3	19,9	2,0	-0,3	0,9
Luxembourg GF	See F. And G.								
Malta English	See UK								
Malta Maltese		0,2	85,0	42,6	-13,2	14,7	1,9	-0,6	0,7
Netherlands		9,3	92,3	50,8	3,9	27,3	2,3	0,2	1,2
Poland		22,5	90,5	56,5	15,7	36,1	2,5	0,7	1,6
Portugal		6,1	92,1	49,1	0,3	24,7	2,2	0,0	1,1
Romania		12,9	89,0	50,9	4,1	27,5	2,3	0,2	1,2
Slovakia		6,5	85,5	46,0	-6,2	19,9	2,0	-0,3	0,9
Slovenia		6,0	85,8	45,9	-6,4	19,8	2,0	-0,3	0,9
Spain		29,1	98,3	63,7	30,8	47,3	2,8	1,4	2,1
Sweden		5,4	88,0	46,7	-4,7	21,0	2,1	-0,2	0,9
UK		1937,0	193,8	1065,4	2125,3	1595,3	47,3	94,4	70,8
Total		2252.6	2252	2252,4	2252,4	2252,4	100,0	100,0	100,0

Column (1) refers to the language of another country which similar the mother tongue. Sources: Translations in Figures, 2009 https://op.europa.eu/en/publication-detail/-/publication/62f8069c-67d4-11e9-9f05-01aa75ed71a1

Other columns result from our calculations. See text.

Table 2. Disenfranchisement

Countries	Population (in millions) (1)	Obserevd rates of disenfranchisement (%) English (2)	French (3)	German (4)	E, F & G (5)	Disenfr. pop. (millions) (6)	Disenfr. pop. (% of total) (7)
Austria	8,8	55	94	0	0	0,0	0,0
Belgium Dutch	6,7	na	na	na	16*	1,1	0,6
Belgium French	4,6	80	0	95	0	0,0	0,0
Bulgaria	7,1	84	96	94	79	5,6	3,0
Croatia	4,1	71	99	85	62	2,5	1,4
Cyprus	0,9	49	95	98	49	0,4	0,2
Czechia	10,6	84	98	81	69	7,3	3,9
Denmark	5,8	34	97	73	31	1,8	1,0
Estonia	1,3	75	100	92	70	0,9	0,5
Finland	5,5	69	99	95	67	3,7	2,0
France	67,0	80	0	95	0	0,0	0,0
Germany	82,8	62	92	0	0	0,0	0,0
Greece	10,7	68	95	94	63	6,7	3,6
Hungary	9,8	92	100	91	85	8,3	4,5
Ireland English	3,1	0	91	98	0	0,0	0,0
Ireland Irish	1,7					0,0	0,0
Italy	60,5	75	90	96	69	41,7	22,4
Latvia	1,9	85	100	97	83	1,6	0,8
Lithuania	2,8	86	99	96	82	2,3	1,2
Luxembourg	0,6	61	11	12	0	0,0	0,0
Malta English	0,4	0	91	98	0	0,0	0,0
Malta Maltese	0,1					0,0	0,0
Netherlands	17,1	23	81	43	18	3,1	1,7
Poland	38,0	82	99	90	76	28,9	15,5
Portugal	10,3	85	91	98	81	8,3	4,5
Romania	19,5	86	90	97	81	15,8	8,5
Slovakia	5,4	83	99	82	72	3,9	2,1
Slovenia	2,1	59	98	79	50	1,1	0,6
Spain	46,9	84	94	98	81	38,0	20,4
Sweden	10,1	33	97	88	33	3,3	1,8
UK	66,2	0	91	98	0	0,0	0,0
Total	512,4					186,4	100,0

Sources: Disenfrachisement rates: Fidrmuc, Ginsburgh and Weber (2007). Populations 2008 ec.europa.eu/eurostat/documents/2995521/9063738/3-10072018-BP-EN.pdf/ccdfc838-d909-4fd8-b3f9-db0d65ea457f
Other columns result from our calculations. See text.

Table 3. Results from Sharing Rules (%)

Countries	Language	See country for language (1)	Comprom-ise rule (2)	Disenfranch-chisement (3)	Index 1 ((2)+(3))/2 (4)	GDP (5)	GDP reordered (6)	Index 2 ((2)+(3)+(6))/3 (7)
Austria	German	See Germany				2,4		
Belgium Dutch	*Dutch*	See Netherlands				2,0		
Belgium French	*French*	See France				0,9		
Bulgaria	Bulgarian		1,2	3,0	2,1	0,4	0,4	1,5
Croatia	Croatian		1,0	1,4	1,2	0,3	0,3	0,9
Cyprus	Greek	See Greece				0,1		
Czechia	Czech		1,0	3,9	2,5	1,3	1,3	2,1
Denmark	Danish		0,9	1,0	0,9	1,9	1,9	1,3
Estonia	Estonian		0,8	0,5	0,6	0,2	0,2	0,5
Finland	Finnish		0,9	2,0	1,4	1,5	1,5	1,4
France (F)	French		5,3	0,0	2,6	14,8	15,9	7,1
Germany (G)	German		3,1	0,0	1,6	21,0	23,6	8,9
Greece	Greek		1,5	3,8	2,7	1,2	1,3	2,2
Hungary	Hungarian		1,1	4,5	2,8	0,8	0,9	2,2
Ireland English	*English*	See UK				1,3		
Ireland Irish	*Gaelic*		-1,6	0,0	-0,8	0,7	0,7	-0,3
Italy	Italian		1,7	22,4	12,1	11,1	11,1	11,7
Latvia	Latvian		0,8	0,8	0,8	0,2	0,2	0,6
Lithuania	Lithuanian		0,9	1,2	1,1	0,3	0,3	0,8
Luxembourg GF	*F and G.*	See F. And G.				0,4		
Malta English	*English*	See UK				0,1		
Malta Maltese	*Maltese*		0,7	0,0	0,3	0,0	0,0	0,2
Netherlands	Dutch		1,2	2,3	1,8	4,8	6,8	3,4
Poland	Polish		1,6	15,5	8,5	3,1	3,1	6,7
Portugal	Portuguese		1,1	4,5	2,8	1,3	1,3	2,3
Romania	Romanian		1,2	8,5	4,8	1,3	1,3	3,7
Slovakia	Slovak		0,9	2,1	1,5	0,6	0,6	1,2
Slovenia	Slovene		0,9	0,6	0,7	0,3	0,3	0,6
Spain	Spanish		2,1	20,4	11,2	7,6	7,6	10,0
Sweden	Swedish		0,9	1,8	1,4	2,9	2,9	1,9
UK	English		70,8	0,0	35,4	15,2	16,6	29,1
Total			100,0	100,1	100,0	100,0	100,0	100,0

Column (1) refers to the language of another country for the mother tongue.

Sources: Column (2), see Table 1; column (3) see Table 2.

Column 5: GDPs, see: https://en.wikipedia.org/wiki/List_of_sovereign_states_in_Europe_by_GDP_(nominal)

Other columns result from our calculations. See text.