Effectiveness of policy measures and language dynamics

TORSTEN TEMPLIN, BENGT-ARNE WICKSTRÖM, and MICHELE GAZZOLA

WORKING PAPER NO. 19-6

Updated: 2022-01-23

REAL

Research group “Economics, policy analysis, and language”
Effectiveness of policy measures and language dynamics*

TORSTEN TEMPLIN†, BENGT-ARNE WICKSTRÖM‡, and MICHELE GAZZOLA§

Updated: 2022-01-23

Abstract

The effect of a given language policy can be very different in the short, medium, and long run. In this chapter we illustrate this, looking at the effects of status and acquisition planning on inclusion by given mobility patterns. On the policy side the choice is between different status- and acquisition-planning measures, respectively. On the effect side this choice gives rise to different degrees of inclusion (in the form of bilingualism) by given linguistic environments (distribution of language use on the inhabitants) and costs. That is, in a mobility-inclusion trade-off, a higher level of inclusion can be reached for a given

---

*The essay has clearly benefited from a number of comments from the editor and from an external referee. We thank both.

Part of this work was carried out in the Research group “Economics and language” in Berlin, with which all three authors are associated. The group received funding from the European Union’s Seventh Framework Program (Project MIME – grant agreement 613344). This support is gratefully acknowledged.

This essay has been published as:


†Humboldt-Universität zu Berlin
Research group “Economics, policy analysis, and language” (REAL)
Email: templin@math.hu-berlin.de

‡Andrássy-Universität Budapest
Research group “Economics, policy analysis, and language” (REAL)
Email: bengt-arne.wickstroem@andrassyuni.hu

§Ulster University
Research group “Economics, policy analysis, and language” (REAL)
Email: m.gazzola@ulster.ac.uk
amount of mobility in the form of migration through a well-designed language policy. Different scenarios will require different policy measures in a cost-effectiveness analysis. This is illustrated in this essay.

The effects of status and acquisition planning are modeled in a dynamic setting, where language learning depends on compulsory measures as well as voluntary decisions of the individuals involved based on their individual cost-benefit calculations (or that of their parents). The effects on inclusion are simulated in different scenarios lasting 50 years (i.e. several generations) when language skills are transferred from one generation to the next. The scenarios include the migration of majority speakers into a region with a strong minority language in a given country (Spanish speakers migrating into the Basque countries) and migration of speakers of a “foreign” language into a country with enclaves of these foreign speakers (Spanish speakers in the USA).

**Keywords:** language policy, language dynamics, effectiveness analysis
1 INTRODUCTION

Language planning is the set of measures explicitly or implicitly adopted by the government to address a language issue of collective nature. Traditionally language planning is divided into two components, that is, corpus planning and status planning. While the former refers to direct interventions on a language, e.g. the choice of script system, the latter refers to interventions aimed at modifying its functions in society. Sometimes the term acquisition planning is used to denote language planning in education and adult language training. Status planning in practice consists of allocating (or removing) functions to a language in different areas of public intervention such as public administration, public signage, broadcasting, education, and the juridical system. In these areas the government intervenes and regulates the (rights to) provision of goods and services in one or more language (WICKSTRÖM, TEMPLIN, and GAZZOLA, 2018). Status planning is expected to modify the evolution of speakers’ practices and representations in order to strengthen (or to weaken) the usage and the knowledge of a language in a society. As “it is status planning, not corpus planning, that is the engine of all language planning success” (FISHMAN, 1991, p. 347), in this chapter we pay attention to status planning and its dynamic effects.

As Cooper notes, “language planning is directed ultimately towards non-linguistic ends” (COOPER, 1989, p. 35), for example, promoting nation building and political unity, supporting ethnic minorities and the social integration of migrants, and facilitating economic development, but also implementing imperial or colonial strategies. Status planning, therefore, can influence the well-being (or welfare) of individuals in very different ways. For example, it can expand the set of official languages of a regional government, whereby providing material and symbolic benefits for the speakers of a minority language (and this even if such speakers are fluent in the majority language). It can improve the set of skills of migrants (and therefore their human capital), thereby facilitating their integration in the society of the host country. Language planning can reduce tensions among linguistic communities in a multilingual state by making it possible to participate in democratic deliberation processes and to access public services in more than one language.  

In order to plan meaningful policy we must develop a sound understanding of the variables that affect language dynamics, that is, the evolution in the short and long term of language use by speakers in a given territory. Language shift, for example, is a type of language dynamics through which a language gradually loses functions, domains, and speakers in a society, increasing the importance of another language. Language policy aims at influencing language dynamics by acting on variables that can accelerate, reduce or reverse the spread or the decline of a language. In practice, this means to intervene on factors that influence individuals’ decisions as to which languages to learn, transmit and use. This can be carried out by policy measures that affect, on the one side, the real and perceived material and symbolic value that speakers attach to a language and, on the other side, the learning costs of the language in question. For example, giving official status to a minority language in the public administration is a policy that aims at increasing the utility of the language in society. This can affect the expected future benefits accruing to its speakers and their children, and therefore their language choices. Teaching the language at school or using it as a means of instruction will lower the learning costs of

1 Of course, the goal of some members of the majority can also be the suppression of the minority. Then language rights for a minority can lead to resentments in parts of the majority. For a discussion of the political economy of language right, see WICKSTRÖM (2020).
the individual.

This chapter examines the question of language dynamics from a quantitative point of view. It presents models that describe the likely evolution of two languages in a society given a certain set of demographic and contextual variables and parameters. Such variables and parameters can be influenced by language policy. The results of language policy are described in the short, medium and long run. In addition, its effects on individuals’ welfare are examined. The aggregate benefits and the costs of a language policy are evaluated as well.

The relationship between status planning and individuals’ welfare, of course, is complex and multidimensional. In the context of the MIME project we focus on one specific benefit, that is inclusion. Given a certain level of mobility of speakers of different languages in and out of a jurisdiction, language policy can influence the language repertoire of the people living in a jurisdiction. Inclusion is not a well-defined *terminus technicus*. The notion of inclusion is context-dependent and ultimately it is defined by the views and opinions of policy maker. In this chapter, we define inclusion as the degree to which the members of a community can communicate with each other. In practice, inclusion is then operationalized in terms of bilingualism, but no restriction is put on which type of societal bilingualism we are dealing with. Policy maker can push the speakers of the minority language to become bilingual in the majority language or the other way around. Symmetric bilingualism for all (i.e. everyone must speak the language of the other community) can be a perfectly legitimate policy goal. It is worth stressing that skills in the relevant languages spoken in a territory are a necessary but clearly not a sufficient condition for social integration.

Different types of language policy result in different levels of inclusion, and of course different levels of aggregate costs. Generally speaking, the higher the level of inclusion, the higher the costs of a language policy, because more resources are needed to implement status and acquisition planning. In this chapter, the trade-off between mobility and inclusion is studied in terms of cost-effectiveness analysis. Given a certain level of mobility, the policy maker can target different degrees of inclusion and different corresponding levels of costs in the short, medium and long run. In the medium and long run also feedback mechanisms become important and we focus on these making the analysis dynamic. The result of the chapter, therefore, is a comparative analysis of the cost-effectiveness of alternative scenarios. We study the relationship between effects and costs of language policy in situation of high and low mobility. In our analysis, for the sake of tractability, we assume that the degree of mobility can be high or low, and that it is an exogenous variable. It can be treated as endogenous if the level of mobility is set by the government through immigration policy. This will be further discussed in the conclusions, section 6.

2 MODELING LANGUAGE DYNAMICS

In their often cited paper, Abrams and Strogatz (2003) analyzed a situation in which two languages compete for monolingual speakers. The attractiveness of a language is determined by

---

2 In our modelling as well as in the cases we present, we start out with a situation of two languages being used in a certain jurisdiction, one a relative high-status majority language and the other one a relative low-status minority language. There is migrating into the jurisdiction. In one case the migrants belong to the low-status minority (United States of America) and in the other case to the high-status majority (Spanish Basque countries).
the number of its speakers as well as its “perceived status”. The authors developed a simple mathematical model that describes how the number of speakers of both languages change over time. They could fit their model to aggregated empirical data of endangered languages, but the model neglects bilinguals and always predicts the extinction of one of the two competing languages. The fairly accurate projections of the model as well as its obvious shortcomings motivated a variety of new research on language competition modeling. Later models considered monolingual as well as bilingual language repertoires and provide more realistic models of the transition process from one language to another. The role of bilinguals in language shift is crucial, since in practice individuals normally do not change from being monolingual in one language to being multilingual in the other language. Instead, it is more realistic to consider transitions from monolinguals in one language to bilinguals and – in a second step – from bilinguals to monolinguals in the other language. Another mode of transition is the inter-generational one. Parents who speak a minority language in a context dominated by a higher status majority language do not always successfully transmit the minority language to their children. This is the case for an autochthonous minority languages as well as the languages of recent migrants.

Intergenerational language transmission is the driving force in the language competition model proposed in Wickström (2005). Adults form families, have children and transmit languages to them. Family formation depends on the distribution of language repertoires in the population. Language transmission depends on the decision of parents. They gain utility from transmitting languages with a wide communication range as well as from the transmission of languages to which they are emotionally attached. In case of speakers of a small minority language, an autochthonous minority, say, there is a trade-off between the rather small communicational value of that language and the emotional attachment to it. It is assumed that the higher the status of the language, the higher the utility parents get from transmitting it. Parents choose the language repertoire that yields the highest utility. Minett and Wang (2008) also modeled intergenerational language transmission, using a single-parent model. A single-parental model is equivalent to the assumption that in every family both parents have identical language repertoires, see Wickström (2014). The model presented in Minett and Wang (2008) also features horizontal language transmission. That is, during their lifetime monolingual adults can learn a second language and therefore become bilingual. The incentive to learn a second language increases with the number of speakers of that language and its status. Fernando, Valijärvi, and Goldstein (2010) adapted the two-parent family transmission model of Wickström (2005). For language acquisition within the family, their focus is not on the parents’ decision, but on the child who is exposed to conversation in both languages at home as well as outside the home. A result of their model is that it is the amount of exposure to a language that determines whether or not the child will acquire that language successfully. Fernando, Valijärvi, and Goldstein (2010) also model language learning in formal education. Moreover, the authors argue for mod-

---

3 The relative rate of change of the number of speakers of the two languages is determined by the fractions of speakers of the two languages at any time – an endogenous variable – and by an ad hoc variable, the relative status of the languages. With a given distribution of the languages on the population, the higher the relative status of one of the languages in comparison to the other, the slower is the decline if the language is declining in use or the higher is the growth if the language is growing.


els “characterized by parameters that are measurable in the field” (p. 52) and therefore have more “predictive power” (p. 49). This measurability property is not shared by the previous papers. In Templin, Seidl, Wickström, and Feichtinger (2016), Templin (2019) and Templin (2020), we adapted and extended the above models. In Templin (2019) and Templin (2020), we added language education, adult language learning and mobility to the model in Wickström (2005). Following Fernando, Valijärvi, and Goldstein (2010), we suggested model parameters that can be estimated from empirical data. In the following, we give a brief discussion of the extended model.

3 KEY CONCEPTS AND TOOLS

We model the evolution of the linguistic composition of societies with two languages: a higher status majority language $H$, and a lower status minority language $L$. The linguistic composition of the society is defined as the distribution of language repertoires. It is determined by the number of $H$-monolinguals, $L$-monolinguals and bilinguals. We use the following notation:

- $N_H$: number of $H$-monolinguals; $X_H$ fraction of $H$-monolinguals in the total population
- $N_L$: number of $L$-monolinguals; $X_L$ fraction of $L$-monolinguals in the total population
- $N_B$: number of bilinguals; $X_B$ fraction of bilinguals in the total population
- $N = N_H + N_L + N_B$: total population, hence $X_H + X_L + X_B = 1$

We speak of monolingual and bilingual repertoires. Our language-dynamics model describes how $N_H$, $N_L$ and $N_B$ change over time. Time $t$ is measured in years. Based on the linguistic distribution at year $t$ as well on relevant information on the linguistic environment, the model produces an estimate of the composition in the following year $t+1$. In mathematical terms, this reads as

$$N_R(t + 1) = F(\text{environment parameters}; N_H(t), N_L(t), N_B(t)). \quad (3.1)$$

In the formula, $N_R$ is the number of people with language repertoire $R$. Repertoire $R$ could be monolingualism in $H$ or $L$, or bilingualism. The two interrelated ingredients of the model are the function $F$ and the choice and construction of the environment parameters.

3.1 DYNAMICS

The function $F$ expresses how the linguistic composition of the society changes over time. The easiest function one could think of here is the identity function. That means, everything stays as it currently is. Nothing ever changes. Except for some extreme cases, this is obviously wrong. We develop a function $F$ that models some central social processes essential to language dynamics. To obtain a realistic but manageable mathematical model, we take into account four key processes:

---

6 In these papers we provide a more extensive review of the literature on language competition models.

7 If for example, the minority language died out in the long run and only monolingual speakers of $H$ are left, the linguistic composition won’t change anymore.
• Population dynamics

• Intergenerational language transmission

• Language education

• Adult language learning

The population dynamics comprises births, deaths, as well as inward and outward migration. The first two can for our purposes be taken as exogenous and independent of language policy. Migration, on the other hand, can be influenced by public policy. The discrimination of a linguistic minority that constitutes the majority population in another country can lead to an increase in emigration of members of the minority to the country where their language is a majority language. Conversely, extensive minority rights can increase the immigration of other speakers of the minority language.

The intergenerational language transmission consists of several subprocesses. The first one is the family formation. It is reasonable to assume, ceteris paribus, that the transmission of a minority language is higher in families where both parents are speakers of the minority language. To what extent people from different language groups mix depends on a number of factors. Generally speaking the matching is a stochastic process. The frequency of different family types emerging from the random encounters depends on the linguistic and social environment, though. If the minority population is concentrated only in certain areas, mixed couples are less frequent in comparison to a situation where it is evenly distributed over the whole country. Similar effects can be expected if the minority and majority population are socially or religiously segregated. The characteristics of the linguistic environment and the strength of the social and ethnic identity of the speakers will determine whether a language is transmitted or not. For this process, status planning can be important. Parents might be more inclined to transmit a language with a high status. Hence, language policy regulating the status of the minority language will have an influence on the dynamics of language use.

Language education strongly depends on language policy, especially acquisition planning. The use of languages in school, both the language of instruction and the teaching of “second” languages have a strong influence of the main language adopted by native speakers of minority languages. Here, government policy plays one of the main rôles. Curricula in both public and private schools are generally determined by governments.

Finally, adult language learning is also at least partially influenced by language policy. The government can give direct (or indirect) support to adults taking language classes or itself offer such courses.

---

8 Generally they are different for different groups and might vary with income or other variables. For the sake of modeling, it is often opportune to assume the demographic characteristics to be constant and the same for all groups. That way one can more easily work with the speakers of the different groups as fractions of the total population instead of absolute numbers of speakers. In the cited literature this is generally the case.

9 Given that there are three types of language repertory, monolingual speakers of one of the two languages as well as bilinguals, twelve possible family types are possible. However, we assume that interchanging the types of the father and the mother in a family does not affect family behavior. Hence, there are six distinguishable family types with two parents in the model.
3.2 **LINGUISTIC ENVIRONMENT**

These four processes are affected by the linguistic environment and, at the same time, they shape it. This brings us to the second ingredient in the model, the parameter and variable values that make up the linguistic environment. The linguistic environment is a theoretical construct. “It subsumes in an extensive (but obviously not exhaustive) fashion all the relevant information about the status, in the broadest sense of the word, of the various languages present in a given polity at a certain time” (GRIN and VAILLANCOURT, 1997, p. 49). In our model, we consider six dimensions of the environment:

- Current linguistic composition
- Territorial concentration of the users of both languages
- Status of both languages
- Language education policy
- Adult language learning support
- Internal and external migration

The current linguistic composition of the population in society is an essential part of the linguistic environment and influences the population dynamics. It is also one of the important factors influencing the inter-generational transmission. It influences both the frequencies of the family types and their inclination to transmit the languages. The more widespread a language in a certain sense, the more useful it is in communication. In our model, it is an endogenous variable, but it is also strongly and directly influenced by language policy.

The territorial concentration tells us how close spatially the members of the minority live. The higher the concentration, the greater in general will be the inter-generational transmission in the areas where the minority lives. Urbanization is likely to reduce the concentration of the minority and reduce the transmission of the minority language between generations (see WICKSTRÖM, 2022). For our model, the concentration is assumed to be an exogenous parameter and it is approximated by a concentration index.\(^\text{10}\)

The relative status of both languages in society consists of the socioeconomic status of the speakers of the respective language as well as the official status of the language. The socioeconomic status of the speakers, of course, can only be defined in the context of the society analyzed, and the factors determining it can vary wildly from one society to another.\(^\text{11}\) The official status reflects the number of public domains, like public services or courtrooms, a language can be used in. It is assumed that the status influences the outcomes of the inter-generational transmission process, the language education process, and the adult learning process. Both status aspects, the socioeconomic and the official ones, are weighted to obtain a single status parameter for our model. The official status is as a rule directly determined by language policy. Since the socioeconomic status is strongly influenced by the official status, it is indirectly influenced by language policy.

\(^{10}\) The index of isolation, for a detailed discussion of this measure and others, see MORRILL (2016).

\(^{11}\) In some society, belonging to a traditional upper class can be important, in others, being rich is what matters. Of course, in many places these factors go hand-in-hand.
Acquisition planning, for instance which languages are taught in schools, is to a very large extent the result of language policy. This policy not only influences the status of the languages, but also has a strong impact on the linguistic skills of students and hence on the future linguistic composition. Also adult learning can be important. Locals as well as newcomers, can learn new languages to improve their human capital or to preserve their cultural heritage. Adults can also lose their skills in a language over time. This is often the case if a language is learned at school, but is never used thereafter. Especially important here is teaching the majority (or minority) language to newcomers. This can be directly influenced by the public sector and has a lot to say for the integration and inclusion of the newcomers and indirectly for cohesion in society.

Internal and external migration alter the population structure. Urbanization, for instance, like migration to and from abroad will influence population dynamics and inter-generational transmission. Internal migration of majority speakers into an area of speakers of the minority language or of minority speakers into areas dominated by the majority language are bound to weaken the minority language. Immigration from outside the country can consist of speakers of the minority language, of the majority language, or of a third language. The effect on the strength of the minority or majority language in the first two cases is obvious; in the third case the effects can go in both directions and here language policy in favor of the minority language can have a deciding influence. Finally, emigration can lead to a weakening of the minority language by reducing its demographic base.

3.3 Costs of different policy measures

For our purposes in this chapter, we will discuss two types of language planning measures, the costs structures of which are very different. The first one is status planning strictu sensu; the second is acquisition planning. The costs of language planning measures can be characterized according to two dimensions, that is, the number of beneficiaries and the geographical area of implementation. This is discussed in some detail in Wickström (2017) and Wickström, TEMPLIN, and Gazzola (2018).

Some typical status-planning measures, like using a minority language in public documents or providing radio and television programs in a minority language, will cause the same costs independent of the number of speakers or their geographical patterns of habitation. In our model we assume that the status planning is of this type. That is, the status of the minority language is a function of the budget used for status-planning. Assuming that the status influences the processes discussed in section 3.1, especially the inter-generational transmission, an increase in the status will affect each minority-language speaker in the same way, on average. That means the aggregated effect will depend on the size of the community. The costs necessary to produce a given effect, however, are independent of the size of the community.

The second type of language planning measure that we consider is acquisition planning. In our model, this form of planning causes costs that are more or less proportional both to the number of individuals being affected and to the size of their habitation area. An increase in the amount of acquisition planning per capita will also here produce an aggregated effect that will...

---

12 In reality, of course, there are many types of status planning that depend both on the area of application (street names in the minority language), the number of beneficiaries (right to receive answers to queries in public offices in the minority language), or both (right to receive social services at home in the minority language).

13 Of course, the question which status-planning measures should be chosen is a non-trivial optimization problem.
depend on the size of the community. In this case, however, also the costs will depend on the size of the community.

With a given budget the planner will have to choose a mix of status and acquisition measures to produce the highest possible effect on the minority community, for instance the number of bilingual speakers. This is a typical cost-effectiveness analysis; a given goal – the number of bilinguals – should be achieved at the lowest costs. From what has been said above about the structure of costs, it follows that an increase in the status will affect all concerned individuals, but the expenditure is independent of their number. By acquisition planning aimed at a certain number of individuals, on the other hand, the expenditures increase with their number. It then follows that if there is a trade-off between the positive effects of status and acquisition measures affecting a typical individual, one should put more stress on status planning in comparison to acquisition planning in the big community, since the per-person expenditure on status planning will be lower in the big community than in the small one.\footnote{For more detail, see WICKSTRÖM \citeyear{2021}.}

In a dynamic analysis with its feed-back mechanisms, the general conclusion could be slightly different, though, because the reciprocal feedback mechanisms between social status and an increase in the number of speakers are generated in a different manner than the more direct connection between the number of speakers and acquisition-planning measures; see also TEMPLIN \citeyear{2020} and WICKSTRÖM \citeyear{2013, 2016, 2021}.

4 DYNAMIC LANGUAGE POLICY ANALYSIS

Since language competition models provide projections of the future development of the linguistic composition, they can “be useful in the design and evaluation of language-preservation programs” (ABRAMS and STROGATZ, \citeyear{2003}, p. 900). In this section we, hence, first review a few relevant theoretical models before presenting the case studies.

4.1 SOME DYNAMIC MODELS

Different models help us analyzing language policies at different levels of abstraction. MINETT and WANG \citeyear{2008} analyzed the effects of a simple language revitalization policy. The authors “assume that a community can bring about a change in the value” of relevant model parameters whenever the number of speakers of the minority language falls below some threshold (MINETT and WANG, \citeyear{2008}, p. 29). They show that with such a policy in place, the minority language can be maintained. TEMPLIN, SEIDL, WICKSTRÖM, and FEICHTINGER \citeyear{2016} analyze the effects of investments in status planning on the survival of the minority language and show that it can be optimal – from the point of view of welfare economics – to invest into status planning.

\footnote{To find the optimal mix of status planning and acquisition planning in a static setting, one has to look at the marginal change in effectiveness of the same budget increase in the two types of planning activities and equate those marginal effects. In the dynamic analysis, the number of speakers of the different types and the status of the languages are so called “state” variables, that is their size (or level) reflect the whole accumulated history of language policy, whereas the acquisition planning has a direct influence and is a so called “flow” variable. The budgets for the two types of planning are “control” variables (also flow variables). The values of the latter are instantaneous and independent of history. Because of this there is no simple instantaneous trade-off between the effect on language use of status and acquisition planning. Only in a long-run steady state can one find easy expressions comparable to the marginal impacts in the static case.}
in order to keep the minority language alive. Fernando, Valijärvi, and Goldstein (2010) emphasized that more abstract or theoretical models limit the analysis to theoretical language policies. If a model is to be able to allow for the analysis of more specific and realistic policies, it should build on measurable parameters. The model parameters in Templin (2019) and Templin (2020) are designed in such a way that they can be obtained from empirical quantitative data on the languages in question. The collection of parameters reflects the characteristics of its linguistic environment. For some countries and regions, the required data are collected in censuses and language related quantitative studies. For many countries, though, sufficient data are not available. Only few censuses, for example, ask for the full linguistic repertoire of individuals. Instead, they only ask for the mother tongue or first language. Without a sufficiently clear picture of the linguistic environment, projections of the future development of the linguistic composition are practically worthless.\footnote{This yields an argument for collecting more information on languages in quantitative surveys. To evaluate language policies, one has to know what kind of environment they are operating in.}

Of course, there are concrete language-planning measures that directly affect the parameters that influence language dynamics, that is, the linguistic environment. Policies can range from increasing the number of languages on bank notes or street signs, introducing different language education programs, supporting language courses for newcomers or putting up a new television program in a minority language. They can also consist of the support to the symbolic status of a language, as in Templin, Seidl, Wickström, and Feichtinger (2016). It is important to note that most policy measures can not be modeled directly because this would not only make the formal analysis intractable but also blur the essential structure of the dynamic analysis. There are, hence, neither street signs nor teacher-training curricula explicitly used in the models, although they are implicitly present as inputs in the status or acquisition planning variables. What the model considers is the effects of language policies on the linguistic environment. Adding the minority language to previously monolingual street signs, for example, can increase the status of the minority language, but this result can also be achieved by other measures, e.g., direct promotion of the minority language via a public information campaign. For our analysis, what matters is the fact that a measure has a positive impact on the status of the language. An education policy can alter the linguistic outcomes of education. Consequently, we model language policies as a change in corresponding model parameters. If parameters are estimated carefully from empirical data, the model enables us to derive projections of the future development of the linguistic composition for different policy options. One policy option being leaving everything at the status quo. This way, we can compare the effects and costs of different policy options.

\subsection*{4.2 Case Studies}

In Templin (2019) and Templin (2020), we applied the model to two contexts, for which all relevant data are publically available.\footnote{For both contexts, all model parameters could be estimated from Census data and quantitative surveys on language issues.} We modeled English (H) and Spanish (L) in the United States in Templin (2019), and Spanish (H) and Basque (L) in Basque Autonomous Community (BAC) in northern Spain in Templin (2020). We show that the model informed by empirical data is able to reproduce observed developments of the linguistic composition in the US and in the BAC. In other words it is fitted to existing data and therefore can be used to make forecasts.
In this section, we analyze the effects of status planning and language acquisition policies and mobility patterns (or migration policies) on inclusion. We consider the two language competition situations studied in Templin (2019) and Templin (2020).

- **Situation 1.** English and Spanish in the United States
  - In the United States, English is the dominant majority language. Being spoken by about 35 million people, Spanish is by far the largest minority language in the US.\[^{18}\] It owes its vitality and spread to a large extent to the continuous influx of new people from Spanish speaking countries, cf. García and Mason (2009) or Carreira (2013).
  - *De jure*, the US do not have an official national language. Nonetheless, English is the *de facto* official language in US government and administration.\[^{19}\] Moreover, in the US Spanish speakers generally have a lower socio-economic status than many English speakers. For the situation and history of Spanish speakers in the USA. See, for instance, Sáenz and Morales (2015).
  - English is the dominant language in education. As a result, US born children of migrants are mostly bilingual or even monolingual in English. Over following generations, English becomes the dominant language among the descendants of Spanish speaking migrants. See Sáenz and Morales (2015).

- **Situation 2.** Spanish and Basque in the Basque Autonomous Community.
  - Basque is a minority language within the BAC, Where it is spoken by approximately one third of the population. The majority language is Spanish.
  - On the territory of the BAC, both languages have an official status, i.e. citizens have the right to use both languages in official communications. Moreover, the Spanish Constitution (1978) states that all Spanish citizens have a responsibility to know Spanish, cf. Zalvide and Cenoz (2008).
  - The vast majority of Speakers of Basque also speak Spanish. They are bilinguals.
  - The theoretical goal of the Basque education system is that all students should learn Spanish and Basque. There are predominantly Spanish-speaking, bilingual and predominantly Basque-speaking schools. Especially the Spanish dominated schools often do not achieve the theoretical goal. Nonetheless, the BAC is a positive exception in terms of successful minority language revitalization. And education in the minority language is central for the vitality of Basque.
  - Most of the newcomers to the BAC are speakers of the majority language Spanish. They come, for example, from Castilian-speaking regions of Spain and South America. Basque speaking newcomers are from Navarra in Spain or from the Northern Basque Country in France.

\[^{18}\] The census data being somewhat unreliable, the estimates vary considerably. Instituto Cervantes, for instance, estimates the number of native Spanish speakers in the USA in 2018 to be more than 42 million; see Instituto Cervantes (2018).

\[^{19}\] Spanish has an official status only in Puerto Rico, but has a “special” status in New Mexico. For an overview of the legal status of various languages in the USA, see Faingold (2013).
5 RESULTS AND DISCUSSION

5.1 SITUATION 1: STATUS PLANNING

In Situation 1, we are dealing with a context with a high status majority language and a low status minority language. Newcomers speak the minority language. Some of them are bilingual. We investigate the effects of increasing the status $S$ of the minority language. The status $S$ reflects the socio-economic standing of speakers of the minority language as well as the status of the language in public domains. We investigate the effect of a status planning policy that increases the status $S$ of the minority language on the development of the linguistic composition. We consider three cases for migration: no migration, low migration and high migration. For each migration scenario, we investigate the case of a low status $S$ (no policy) and the case of a high status $S$ (status planning policy). This yields six scenarios. The development of the

<table>
<thead>
<tr>
<th>low status, no migration</th>
<th>high status, no migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t = 0$</td>
<td>$t = 10$</td>
</tr>
<tr>
<td>$N$</td>
<td>264</td>
</tr>
<tr>
<td>$X_H$</td>
<td>0.866</td>
</tr>
<tr>
<td>$X_L$</td>
<td>0.061</td>
</tr>
<tr>
<td>$X_B$</td>
<td>0.073</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>low status, low migration</th>
<th>high status, low migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t = 0$</td>
<td>$t = 10$</td>
</tr>
<tr>
<td>$N$</td>
<td>264</td>
</tr>
<tr>
<td>$X_H$</td>
<td>0.866</td>
</tr>
<tr>
<td>$X_L$</td>
<td>0.061</td>
</tr>
<tr>
<td>$X_B$</td>
<td>0.073</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>low status, high migration</th>
<th>high status, high migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t = 0$</td>
<td>$t = 10$</td>
</tr>
<tr>
<td>$N$</td>
<td>264</td>
</tr>
<tr>
<td>$X_H$</td>
<td>0.866</td>
</tr>
<tr>
<td>$X_L$</td>
<td>0.061</td>
</tr>
<tr>
<td>$X_B$</td>
<td>0.073</td>
</tr>
</tbody>
</table>

Table 5.1 Development of the linguistic environment in Situation 1. For years 0, 10, 25 and 50 the population size $N$ is given (in millions) as well as the fractions of $H$ monolinguals ($X_H$), the fraction of $L$ monolinguals ($X_L$) and the fraction of bilinguals ($X_B$).

The status of the language is not very easily defined as an objectively measured variable. It is basically indirectly defined as the effect status-planning measures have on linguistic behavior. See also the discussion in Wickström (2005) and Templin, Seidl, Wickström, and Feichtinger (2016) as well as the discussion in section 3.2.

In all three cases, migration is assumed to be constant over time. The language-use data are taken from Ortmann and Shin (2011). For the case of low migration, we use migration figures estimated for the US in Templin (2011). For the case of high migration, we double those figures.
Figure 5.1 Development of the linguistic composition in all six scenarios in situation 1 (US example).
linguistic environment in all six scenarios is presented numerically in table 5.1 and graphically in figure 5.1. In the tables and the figures we can see that migration as well as the language planning measure effect the linguistic composition of the society. As one would expect, the more migrants enter the population each year, the faster grows the population. After 50 years, we end up with a total population 362 million for no migration, 401 million for low migration and 440 million for high migration. Our starting date (t = 0) is the year 2010. Further, we are only considering individuals claiming English or Spanish as language(s) spoken at home. In addition, Puerto Rico is excluded. Hence, the numbers are not exactly in agreement with the total recorded population of the United States of America.

In the case of no migration, no new speakers of the minority language enter the population. Many of the monolingual speakers of $L$ learn the majority language, and become bilinguals. As a consequence, the fraction of $L$-monolinguals drops, and – at least in the short run – the fraction of bilinguals increases. It can be seen in table 5.1, that a policy increasing the status can slow down the decrease of $L$. Without the policy (low status), the fraction of $L$ monolinguals drops from 6.1% to 0.8% within 50 years. With the policy (high status), the fraction only drops down to 2.7%. Hence, after 50 years the policy has tripled the fraction of $L$ monolinguals. This effect can be explained by the incentive structure of individuals and families. The lower the status $S$, the higher is the incentive for $L$ monolinguals to acquire the majority language $H$ and hence to become bilingual. Moreover, the higher the status of $L$, the higher is the incentive of $L$-speaking parents to transmit the minority language to their children. The language planning leads to comparable effects for the cases of low and high migration. In those two cases, due to a steady inflow of newcomers, the fractions of $L$ monolinguals increase or show only a small decline over time. For low migration, this fraction decreases by 23% (with 1.4 percentage points, from 6.1% to 4.7% of the population) in 50 years without the policy (low status) or increases by 46% (with 2.8 percentage points, from 6.1% to 8.9% of the population) if the policy is in place. For high migration, we even end up with an increase of 38% (with 2.3 percentage points, from 6.1% to 8.4% of the population) without the policy and by a factor of 2.28 with the policy (high status).

On the fractions of bilinguals the policy has the opposite effect. With no migration, the number of bilinguals first increase and then start to decrease both with and without the policy. This is the typical picture of a language shift. The fraction of speakers of the majority language steadily increases, whereas the speakers using the minority language decreases. In the beginning the number of monolinguals decreases and the number of bilinguals increases, but after some time, also the fraction of bilingual speakers declines and the minority language will at the end not be used. Bilingualism is only a period in history. The policy slows down this process but does not stop it. In the two cases with migration, the fraction of bilinguals increases over time, and the policy slows down this increase. For high migration, for example, the fraction of bilinguals increases from 7.3% to 14.1%, i.e. almost doubles, without the policy. With the policy in place, it only increases by 48% (with 3.5 percentage points, from 7.3% to 10.8% of the population). This negative effect of the policy on the fraction of bilinguals can also be explained – at least partially – by the incentive structures. Increasing the status of the minority language lowers the incentive for $L$ monolinguals, who are mainly first generation migrants, to learn the majority language. Hence, fewer of them become bilingual. Conversely, an increase

22 For a discussion of this case and of the cases when the status of the minority language is high enough to lead to permanent societal bilingualism without migration, see WICKSTRÖM (2005).
of the status yields higher incentives for parents to transmit \(L\) to their children. But in the empirical example studied in Situation 1, the lower incentive for adult newcomers to learn \(L\) outweighs the higher incentive for parents to transmit \(L\). Another reason for relatively low number of bilinguals, compared to \(L\) monolinguals, is the dominance of the majority language in the education system. Many bilingual children become primarily English speakers, and do not transmit the Spanish language to their children. A policy aiming at promoting inclusion in the long term, therefore, would not increase the status of Spanish. Of course, this conclusion is based on a context-specific definition of inclusion according to which speakers of the minority language are required to become bilingual, whereas nothing is expected from the members of the majority-language community.\(^{23}\)

The recommendation derived from a cost-effectiveness analysis is, hence, clear. If the status-increasing policy is costly and the goal of the policy maker is to maximize the sum of the number of monolinguals in \(H\) and the number of bilinguals, the analysis tells us that doing nothing is the cost-efficient policy. Of course, this policy is not necessarily in the interest of the speakers of the minority language, and a cost-benefit analysis including the preferences of the members of the minority could come to a very different conclusion.

\(^{23}\) Such a suggestion for Canada can be found in CARR (1985).

| Situation 2 with low and high migration. Population size \(N\) increases independently of the acquisition policy. For the status quo, as well as for both education-policy options, the evolution of the linguistic composition is given for a time span of 50 years starting in year 2010. |

<table>
<thead>
<tr>
<th>Population</th>
<th>(N)</th>
<th>(t=0)</th>
<th>(t=10)</th>
<th>(t=25)</th>
<th>(t=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low migration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status quo</td>
<td>(N)</td>
<td>2,169,038</td>
<td>2,196,271</td>
<td>2,237,222</td>
<td>2,305,747</td>
</tr>
<tr>
<td>(X_H)</td>
<td>0.680</td>
<td>0.648</td>
<td>0.605</td>
<td>0.547</td>
<td></td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.352</td>
<td>0.395</td>
<td>0.453</td>
<td></td>
</tr>
<tr>
<td>Policy I</td>
<td>(X_H)</td>
<td>0.680</td>
<td>0.642</td>
<td>0.592</td>
<td>0.525</td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.358</td>
<td>0.408</td>
<td>0.475</td>
<td></td>
</tr>
<tr>
<td>Policy II</td>
<td>(X_H)</td>
<td>0.680</td>
<td>0.647</td>
<td>0.603</td>
<td>0.543</td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.353</td>
<td>0.397</td>
<td>0.457</td>
<td></td>
</tr>
<tr>
<td>High migration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status quo</td>
<td>(N)</td>
<td>2,169,038</td>
<td>2,219,161</td>
<td>2,294,534</td>
<td>2,420,659</td>
</tr>
<tr>
<td>(X_H)</td>
<td>0.680</td>
<td>0.651</td>
<td>0.613</td>
<td>0.562</td>
<td></td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.349</td>
<td>0.387</td>
<td>0.438</td>
<td></td>
</tr>
<tr>
<td>Policy I</td>
<td>(X_H)</td>
<td>0.680</td>
<td>0.645</td>
<td>0.600</td>
<td>0.540</td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.355</td>
<td>0.400</td>
<td>0.460</td>
<td></td>
</tr>
<tr>
<td>Policy II</td>
<td>(X_H)</td>
<td>0.680</td>
<td>0.650</td>
<td>0.611</td>
<td>0.558</td>
</tr>
<tr>
<td>(X_B)</td>
<td>0.320</td>
<td>0.350</td>
<td>0.389</td>
<td>0.442</td>
<td></td>
</tr>
</tbody>
</table>
Policy and dynamics

(a) *status quo*, high migration

(b) education policy I, low migration

**FIGURE 5.2** Development of the linguistic composition in the two extreme cases of Situation 2.

### 5.2 SITUATION 2: ACQUISITION PLANNING

In Situation 2, we are dealing with a traditional minority language almost only spoken in the region under consideration. The local majority language is also the dominant majority language of the wider state (Spain). Therefore, only a small fraction of newcomers speak the minority language. We investigate the effects of two different education policies. In Templin (2020), we estimated that 20% of all *H*-monolingual students acquire *L* through education, and that 24% of all bilingual children who enter school as bilinguals lose their ability to speak *L* fluently during their time at school. This is our *status quo* example. The first language education policy (*education policy I*) is a strengthening of the teaching of the minority language to *H*-monolingual children. We assume that *education policy I* increases the learning of the minority language *L* by *H* monolingual children from 20% to 30%. The second policy (*education policy II*) we want to investigate, decreases *L*-language loss for bilingual children from 24% to 14%. For the *status quo* and both policy options we consider a case of low and a case of high migration figures, and apply the model to derive projections for the development of the linguistic composition in Situation 2 for a 50 years time span. Again, the starting year (*t* = 0) is the year 2010 and the initial data come from Eusko Jaurlaritzaren Argitalpen Zerbitzu Nagusia / Servicio Central de Publicaciones del Gobierno Vasco (2013). This is presented in table 5.2 and in figure 5.2. In the figure, we have only pictured the most extreme cases, since the dynamics of all cases is qualitatively very similar.

It can be seen in table 5.2 that in both migration scenarios the fraction of bilinguals increases over time. Within 50 years, this fraction increases by between 37 (with 11.8 percentage points, from 32% to 43.8% in *status quo* with high migration) and 48% (with 15.5 percentage points, from 32% to 47.5% with policy I and low migration). This is due to the language education policy and other language policies in favor of *L* already in place (*status quo*). As one would

---

24 For the low migration case, we use the migration figures for the BAC estimated in Templin (2020). According to these estimates, about 2,300 newcomers move to the BAC every year. For the high migration case, we double this figure.
expect, the increase of the fraction of bilinguals is lower for the higher migration case, since in this case more $H$-monolingual newcomers enter the population every year. The effects of both language policies are comparable for the low and the high migration case. Compared to the status quo, in both migration scenarios education policy I increases the fraction of bilinguals by 2.2 percentage points in 50 years, about 51 000 and 53 000 people, respectively. Education policy II is not as effective in increasing the number of bilinguals. It only increases the fraction of bilinguals by 0.4 percentage points over status quo in 50 years, about 9 500 people. This difference in effectiveness of the two policies can be explained by higher numbers of $H$-monolingual children compared to bilingual children entering school. We can conclude that the negative effect of higher mobility, i.e. less bilinguals in the case of higher migration, can be somewhat eased by language policies strengthening the minority language in education. A policy aiming at promoting inclusion in the long run, therefore, would aim at strengthening Basque in the educational system. This conclusion is based on a context-specific definition of inclusion according to which speakers of the majority language become bilingual, just like the members of the minority-language community.

The cost-effectiveness of the two policies, of course, depends on the size of the costs of the two policies. If both policies cause equal costs, clearly policy I is preferable. Only if policy II is considerably less costly than policy I, it would be sensible to promote policy II, since policy I is almost five and a half times as effective as policy II in increasing the number of bilinguals. Given that the fraction of the bilinguals at least in later years, approaches 50% it is likely that the costs of the two policies are comparable. In this case, policy I is to be preferred by the policy maker. Since the costs of the policies can be assumed to depend on the number of monolinguals and bilinguals, respectively, we cannot exclude that policy II is optimal in early years and that policy I becomes optimal after the number of bilinguals have reached a certain level. In that case, the optimal policy changes as time goes by.

6 CONCLUDING REMARKS

The medium and long run development of the linguistic repertoires of individuals in a society emerges as the result of several processes. A crucial rôle is played by the family and schooling. The first language(s) is (are) determined in the earliest childhood in the family and stabilized by elementary schooling. Especially bilingual families are important for transmitting languages to the next generation. Here, the status of the language is a prime source of pride for the parents and their offspring. This, together with the practical usefulness of the idiom influences their language choice.

The policy maker can influence both the status and practical usefulness of a minority language through various policy measures. Some planning measures, like using the language in some symbolic functions, for instance on money bills, primarily influence its status. Providing public education in the language will influence both the status of the language and lower the learning costs for the individual, thereby contributing to the stabilization of the language skills of the speaker. Using the language in the public administration or supporting cultural activities in the language, will contribute both to the status of the language and its usefulness as a means.

---

25 It is important to note that we are talking about language knowledge and not language use. In social interaction the majority language tends to be overpropotionally used.
of communication.\footnote{Compare to this point also the analysis in \textcite{grin2022}.}

The function of the policy maker is here similar to that of Ulysses sailing the straight of Messina. On the one hand, he wants to use the policy measures that have the strongest effect on the policy goal; on the other hand, he wants to keep the budget as low as possible and still achieve a certain effect, and both the size and the structure of the costs of the various measures vary widely. As if that were not enough, the demographic makeup and the habitation patterns of the language groups to be influenced also vary considerably in the real world. Assume that two different planning measures have the same effect on the goal fulfillment of the policy maker. The implementation costs of one measure might vary strongly with the size of the territory (street signs), whereas by the other they might strongly depend on the numerical size of the relevant group (the real possibility to address the government service institutions in your language). If the budget is limited, the policy maker should be more inclined to use the first measure for a concentrated minority and the second one for a spread-out one, assuming that the magnitude of the costs are comparable. If one measure generally has lower costs, of course, this measure would be used for all types of language groups. \textit{In nuce}, the policy maker is facing trade-offs between the effects of different measures and their implementation cost that are different for different target groups.\footnote{For a more detailed discussion, see \textcite{wickstrom2021}.}

In this essay, we have provided an illustration of how language dynamics can be analyzed in general models with feedback mechanisms. In real situations, however, many factors that we have ignored in our simple examples are important, and our streamlined transparent models will have to be made much more complex. That is, these models open up for an analysis of a very wide spectrum of problems of practical relevance. Our goal was to present some stylized situations. To include the high number of relevant factors needed for a more detailed analysis is not a matter of principle, but of computing.

\textbf{REFERENCES}


