

Online Appendix to Malthusian Migrations (Blanc and Wacziarg, 2026)

APPENDIX 1— SUPPLEMENTARY TABLES

Table A1: Timing of the fertility transition and Post-Columbian population flows, by continent

	log Same-country descendants				
	(1) Africa	(2) Asia	(3) Europe	(4) Old world	(5) New world
Year onset fertility transition / 100	-0.52 (0.60)	-0.03 (0.03)	-0.40** (0.15)	-0.34*** (0.12)	-0.12 (0.08)
Observations	40	33	20	93	22
R^2	-0.00	-0.01	0.15	0.54	0.03

Note: This table displays the results of the OLS regression of the log of the share of same-country descendants on the year of onset (divided by 100) of the fertility transition across countries, as estimated in column 1 of Table 1, for all continents. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Timing of fertility transition and post-1500 population flows (immigration)

	log Same-country ancestors			
	(1)	(2)	(3)	(4)
Year onset fertility transition / 100	0.07*** (0.02)	0.06*** (0.02)	0.07*** (0.02)	0.07*** (0.02)
Continent FEs	Yes	Yes	Yes	Yes
Transatlantic slave trade		Yes	Yes	Yes
Agricultural suitability			Yes	Yes
Pre-industrial development				Yes
Observations	93	93	89	89
Adjusted R^2	0.28	0.28	0.30	0.30

Note: This table displays the results of the OLS regression of the log of the share of same-country ancestors on the year of onset (divided by 100) of the fertility transition across countries. The share of same-country ancestors is defined as the proportion of the ancestors of a country's population in 2000 who resided in that country in 1500. The sample consists of countries in the Old World. Observations are weighed by population in 1500. The following set of controls are included: continent fixed effects, transatlantic slave trade (slave exports per capita between 1400 and 1900), agricultural suitability (land suitability for agriculture, percentage of arable land), and pre-industrial development (population density in 1500). Sources: Putterman and Weil (2010) for the share of same-country ancestors, Delventhal, Fernández-Villaverde and Guner (2024) for the year of onset of fertility transition, Nunn (2008) for the transatlantic slave trade, Ashraf and Galor (2013) for agricultural suitability, McEvedy and Jones (1978) for pre-industrial development. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Determinants of emigration to the US and Canada, in a panel of countries, across different full-count censuses and countries of destination

	log Emigrants per 100,000 inhabitants					
	(1) 1900 US	(2) 1910 US	(3) 1911 CA	(4) 1910 US + 1911 CA	(5) 1920 US	(6) 1930 US
log Marital fertility I_g	8.39** (3.33)	7.54** (2.84)	3.82*** (1.13)	7.64** (2.83)	7.53*** (1.71)	6.90*** (1.40)
_____ $\times$ After transition	-0.48 (1.28)	-0.47 (1.05)	-3.46*** (1.05)	-0.61 (1.05)	-1.45 (1.53)	-1.78* (0.99)
Year of migration FEs	Yes	Yes	Yes	Yes	Yes	Yes
Economic development	Yes	Yes	Yes	Yes	Yes	Yes
Country of origin FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	505	675	692	675	827	977
Clusters (countries)	17	17	17	17	17	17
Adjusted R^2	0.95	0.95	0.71	0.95	0.92	0.92

Note: This table displays the results of the OLS panel regression of the log number of emigrants in various country-census year, relative to the population of sending countries, on the log marital fertility index of sending countries, across countries and time, between 1850 and the year of the census. We consider the 1900, 1910, 1920, and 1930 US censuses, the 1911 Canadian census, as well as the 1910 US census and 1911 Canadian census stacked together, and display the results for the last column of Table 2. Further details are provided in Table 2. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Individual-level determinants of emigration to the New World (OLS), robustness to using restricted sample

	Dummy = 100 if died in New World					
	(1)	(2)	(3)	(4)	(5)	(6)
log Parental fertility	3.79*** (0.27)	3.68*** (0.27)	2.71*** (0.29)	2.62*** (0.27)	2.47*** (0.27)	2.43*** (0.25)
Year of birth FEs	Yes	Yes	Yes	Yes	Yes	Yes
Caloric suitability and urbanization		Yes	Yes	Yes	Yes	Yes
Country of birth FEs			Yes	Yes	Yes	Yes
Country of birth $\times$ year of birth FEs				Yes		Yes
Region of birth FEs					Yes	Yes
Region of birth $\times$ year of birth FEs						Yes
Observations	162,789	153,149	153,149	152,992	153,145	149,090
Adjusted R^2	0.04	0.04	0.10	0.15	0.14	0.28

Note: This table displays the results of the OLS regression of a dummy = 100 if an individual died in the New World on log parental fertility, as in Table 3 but using the sample of individuals born between 1775 and 1875. Further details are provided in Table 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Timing of the fertility transition and Post-Columbian population flows, across Old World and European countries, instrumental variable estimation

log Same-country descendants				log Same-country descendants			
(1) OLS (2) OLS (3) 2SLS				(1) OLS (2) OLS (3) 2SLS			
Panel A: Second stage				Panel A: Second stage			
Year onset fertility transition / 100	-0.41*** (0.13)	-0.43*** (0.14)	-0.35*** (0.12)	Year onset fertility transition / 100	-0.40** (0.15)	-0.42** (0.16)	-0.32*** (0.12)
Panel B: First stage				Panel B: First stage			
asinh Linguistic distance French			0.388*** (0.020)	asinh Linguistic distance French			0.390*** (0.017)
Kleibergen-Paap F-stat			366.9	Kleibergen-Paap F-stat			496.3
Full set of controls and continent FEs	Yes	Yes	Yes				
Observations	89	80	80	Observations	20	19	19
R ²	0.58	0.58		R ²	0.15	0.16	

(Panel A) Old World

(Panel B) Europe

Note: This table displays the results of the OLS regression of the log of the share of same-country descendants on the log timing of the fertility transition across Old World (Panel A) and European (Panel B) countries. Further details are provided in Table 1. Column 1 reports the baseline OLS coefficient from that table. Column 2 restricts the sample to observations with non-missing linguistic distance from French. Column 3 instruments the (log) timing of the fertility transition with the (inverse hyperbolic sine) linguistic distance from French. Sources: Spolaore and Wacziarg (2018) for linguistic distance from French. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Timing of the fertility transition and Post-Columbian population flows, robustness to asinh transformation and controlling for linguistic distance from other colonizers

log Same-country descendants				
	(1)	(2)	(3)	(4)
Panel A: Second stage				
Year onset fertility transition / 100	-0.35*** (0.12)	-0.25* (0.14)	-0.24*** (0.08)	-0.35*** (0.06)
Panel B: First stage				
asinh Linguistic distance French	0.388*** (0.020)		0.386*** (0.026)	
Linguistic distance French		0.093*** (0.010)		0.099*** (0.008)
Kleibergen-Paap F-stat	366.9	87.8	228.8	151.8
Full set of controls	Yes	Yes	Yes	Yes
asinh Linguistic distance other colonizers			Yes	
Linguistic distance other colonizers				Yes
Observations	80	80	80	80

Note: This table demonstrates the robustness of the 2SLS coefficient for the effect of the timing of the fertility transition on the log of the share of same-country descendants, as estimated in Table 1. The robustness is tested by using linguistic distance from French (without inverse hyperbolic sine transformation) as an instrument and by controlling for linguistic distance from other colonizers (England and Spain). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Individual-level determinants of emigration to the New World (IV), with and without reweighing

	Dummy = 100 if died in New World							
	re-weighting obs				no re-weighting			
	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) 2SLS	(7) 2SLS	(8) 2SLS
log Parental fertility	3.67 (0.27)*** [0.35]*** (0.38)***	16.87 (1.52)*** [3.13]*** (4.03)***	16.84 (6.16)*** [5.89]*** (5.45)***	16.71 (1.50)*** [2.85]*** (3.60)***	2.92 (0.13)*** [0.18]*** (0.48)***	8.55 (1.31)*** [2.19]*** (3.83)**	9.07 (3.45)*** [3.47]*** (4.35)**	8.19 (1.54)*** [1.90]*** (3.13)***
Instrument:								
asinh Linguistic distance French		Yes		Yes		Yes		Yes
Dummy = 1 if parents had twins			Yes	Yes			Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	153,060	145,543	153,049	145,532	153,060	145,543	153,049	145,532

Note: This table displays the results of the OLS and IV regressions of a dummy = 100 if an individual died in the New World on log parental fertility, with (Panel A) and without (Panel B) reweighing, using as an instrument the (inverse hyperbolic sine) linguistic distance from French, a dummy that equals one if the individual's parents had (different-sex) twins, and both variables together. Columns 1-4 show the baseline coefficients from the odd columns of Table 4. In columns 5-8, we do not reweigh observations. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Further details are provided in Table 4. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Individual-level determinants of emigration to the New World (IV), robustness to asinh transformation and controlling for linguistic distance from other colonizers

	Dummy = 100 if died in New World			
	(1)	(2)	(3)	(4)
Panel A: Second stage				
log Parental fertility	16.87 (1.52)*** [3.13]*** ⟨4.03⟩***	17.20 (1.66)*** [3.54]*** ⟨4.84⟩***	10.61 (3.12)*** [5.34]** ⟨5.02⟩**	13.12 (4.23)*** [6.79]* ⟨6.86⟩*
Panel B: First stage				
asinh Linguistic distance French	0.15 (0.01)*** [0.01]*** ⟨0.01⟩***		0.10 (0.01)*** [0.02]*** ⟨0.01⟩***	
linguistic distance French		0.04 (0.00)*** [0.00]*** ⟨0.01⟩***		0.04 (0.01)*** [0.01]*** ⟨0.01⟩***
Kleibergen-Paap F statistic				
Parents level	384.9	390.6	73.0	46.5
Municipality level	142.9	139.9	33.1	22.2
Language level	118.9	62.2	54.0	21.6
Baseline controls	Yes	Yes	Yes	Yes
asinh Linguistic distance other colonizers			Yes	
Linguistic distance other colonizers				Yes
Observations	145,543	145,543	145,543	145,543

Note: This table displays the results of the IV regressions of a dummy = 100 if an individual died in the New World on log parental fertility, using as an instrument the (inverse hyperbolic sine) linguistic distance from French in odd columns, and the (non-transformed) linguistic distance from French in even columns. Columns 3-4 further control for linguistic distance from other colonizers (England and Spain). Columns 1 shows the baseline coefficient from column 3 of Table 4. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Further details are provided in Table 4. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A9: Individual-level determinants of emigration to the New World (IV), robustness to using same-sex twins

	Dummy = 100 if died in New World	
	(1)	(2)
Panel A: Second stage		
log Parental fertility	16.84*** (6.16)	5.58*** (1.93)
Panel B: First stage		
Dummy = 1 if parents had twins (different sex)	0.51*** (0.04)	
Dummy = 1 if parents had twins (all)		0.60*** (0.02)
Kleibergen-Paap F statistic	153.7	671.1
Baseline controls	Yes	Yes
Observations	153,049	152,996

Note: This table displays the results of the IV regressions of a dummy = 100 if an individual died in the New World on log parental fertility, using as an instrument a dummy that equals one if the individual's parents had (different-sex) twins in column 1, or any type of twins in column 2. Columns 1 shows the baseline coefficient from column 5 of Table 4. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Further details are provided in Table 4. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

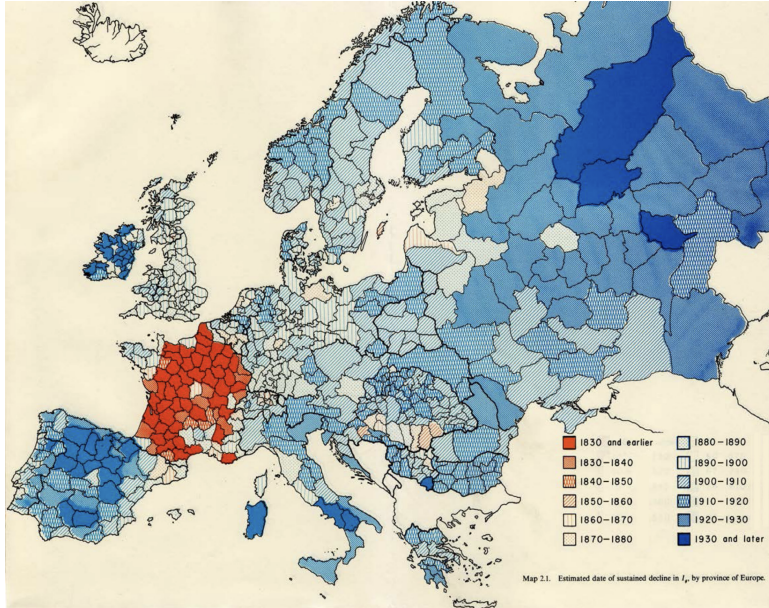
Table A10: Individual-level determinants of emigration to the New World (IV), New World vs USA/Canada

	Dummy = 100 if died in New World				US or CA			
	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) OLS	(6) 2SLS	(7) 2SLS	(8) 2SLS
log Parental fertility	3.67 (0.27)*** [0.35]*** (0.38)***	16.87 (1.52)*** [3.13]*** (4.03)***	16.84 (6.16)*** [5.89]*** (5.45)***	16.71 (1.50)*** [2.85]*** (3.60)***	3.68 (0.26)*** [0.34]*** (0.35)***	17.43 (1.50)*** [3.05]*** (3.86)***	14.41 (6.20)** [5.82]** (6.09)**	17.08 (1.48)*** [2.78]*** (3.44)***
Instrument:								
asinh Linguistic distance French		Yes		Yes		Yes		Yes
Dummy = 1 if parents had twins			Yes	Yes			Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	153,060	145,543	153,049	145,532	153,060	145,543	153,049	145,532

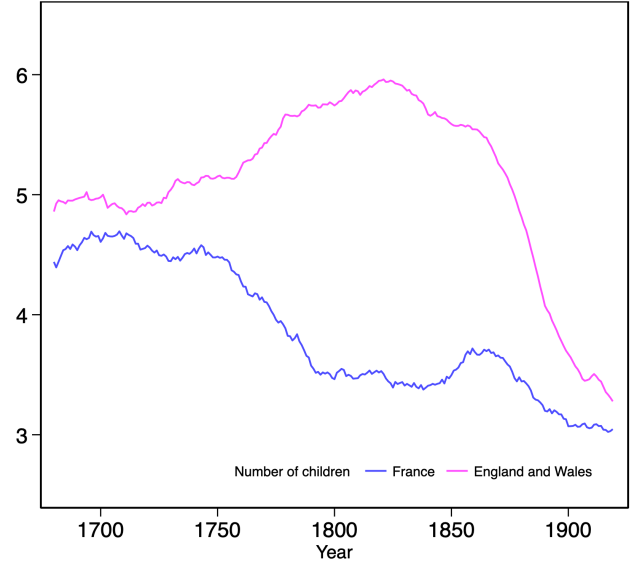
Note: This table displays the results of the OLS and IV regressions of a dummy = 100 if an individual died in the New World (Panel A) or in US and Canada (Panel B) on log parental fertility, using as an instrument the (inverse hyperbolic sine) linguistic distance from French, a dummy that equals one if the individual's parents had (different-sex) twins, and both variables together. Columns 1-4 show the baseline coefficients from the odd columns of Table 4. In columns 5-8, we redefine the dependent variable as a dummy = 100 if an individual died in the US or Canada. Standard errors are clustered at the parents, municipality, and Ethnologue language levels. Further details are provided in Table 4. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX 2— SUPPLEMENTARY FIGURES

Figure A1: The early French fertility transition



(Panel A) Coale and Watkins (1986)



(Panel B) Blanc (2024a)

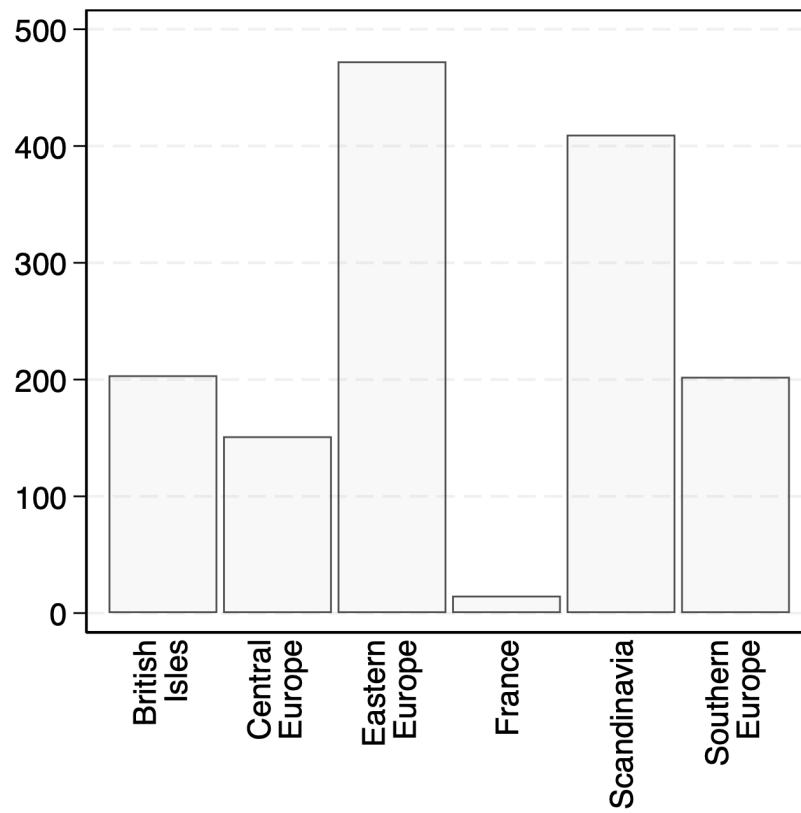
Note: This figure displays, in Panel A, the estimated dates of the first sustained decline in marital fertility across European regions, using census data available in the second half of the 19th century from Coale and Watkins (1986). Panel B shows the rates of gross fertility (total number of children per woman) in England and France over time, using crowdsourced genealogical data from Blanc (2024a).

Figure A2: New France, 1719



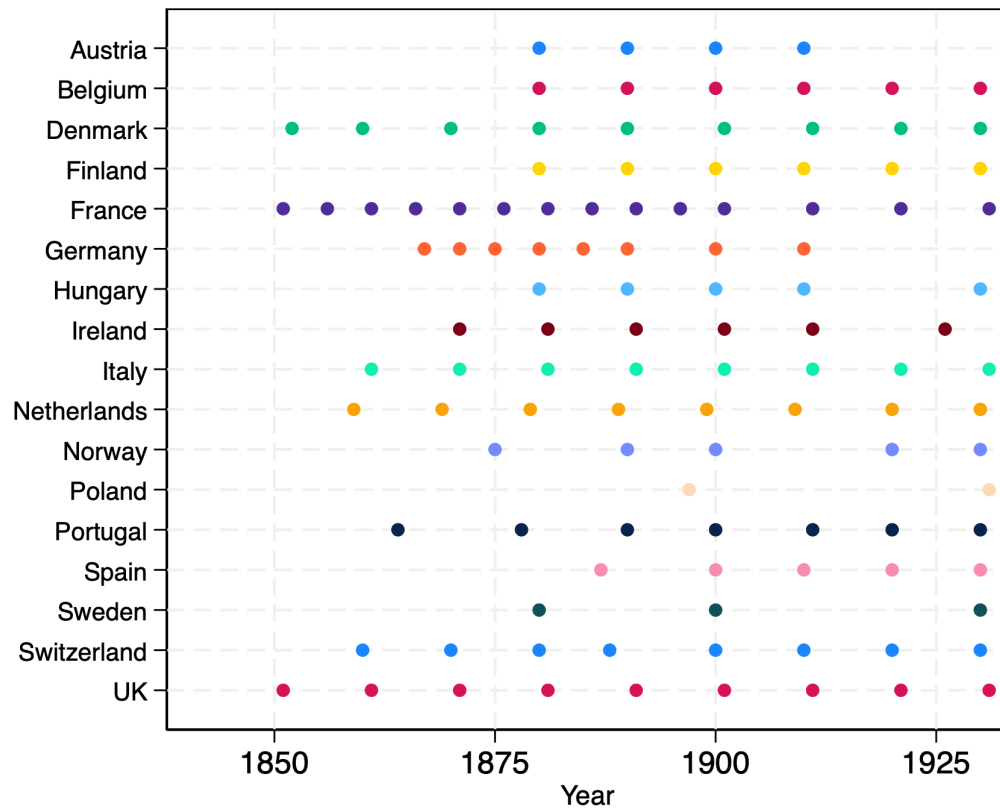
Note: This figure displays a map of New France in 1719. Source: Henri Chatelain's map of the inhabited parts of North America, based upon Nicholas De Fer's map published in 1718.

Figure A3: Emigration flows (per capita) to the US during the Age of Mass Migration



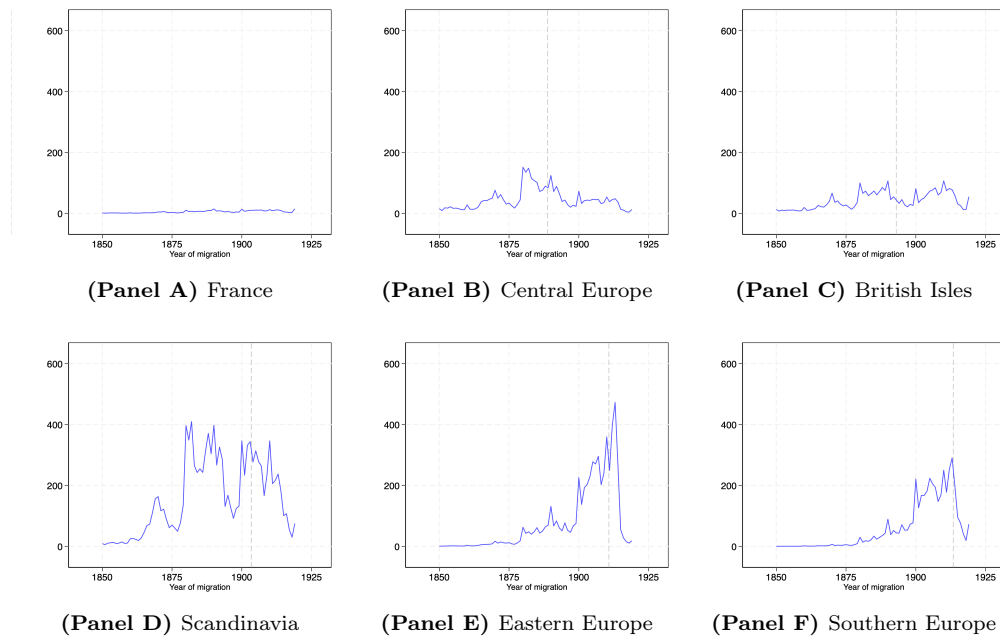
Note: This figure displays the total number of emigrants to the US from France and Europe, relative to the population, between 1850 and 1920, as recorded in the 1920 US full-count census. The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. Source: Ruggles et al. (2023) for migrations, Maddison Project Database (2020) for population.

Figure A4: Years of data availability for marital fertility index



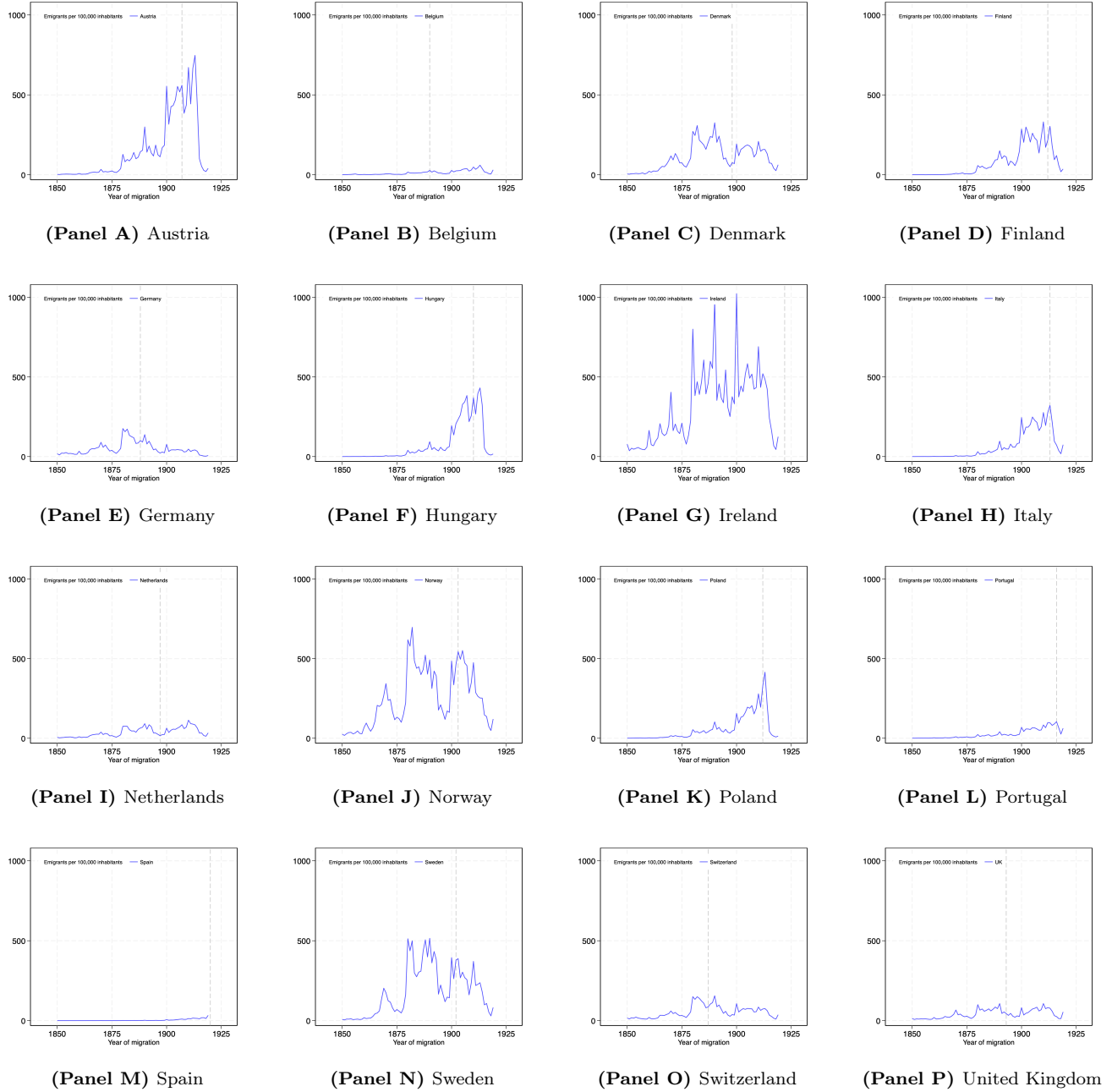
Note: This figure displays the availability of the marital fertility index data across time and space, for the countries in the sample. The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. Note that France has data in the 1830s, but that data does not include Paris, therefore we do not include it in our sample. Source: Coale and Watkins (1986).

Figure A5: Emigration to the US across European regions, 1850-1920



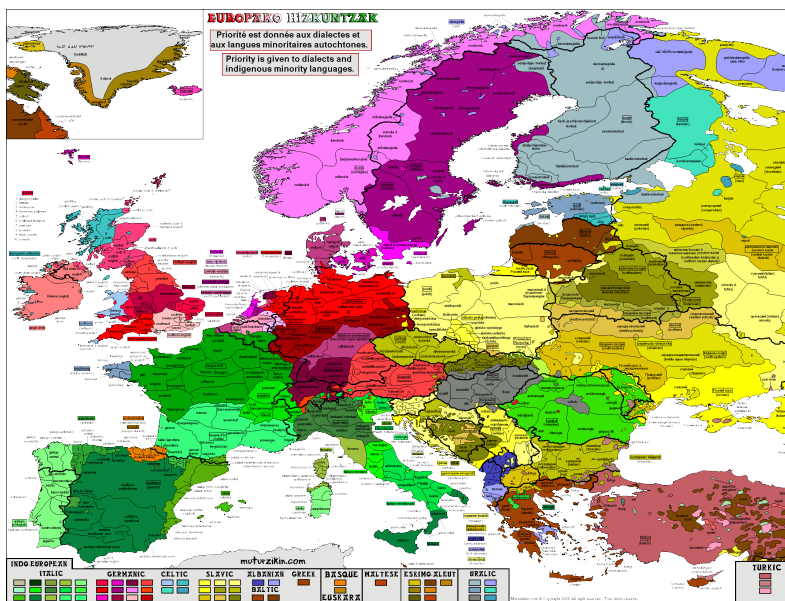
Note: This figure displays the total number of emigrants to the US from regions of Europe, relative to the population, between 1850 and 1920, as recorded in the 1920 US full-count census. We also plot (in vertical lines) the year of the onset of the fertility transition for these regions, as estimated by Coale and Watkins (1986). The sample includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the UK. Countries are grouped into six different regions, as in Figure 3, Panel B. Source: Ruggles et al. (2023) for emigration, Maddison Project Database (2020) for population.

Figure A6: Emigration to the US across European countries, 1850-1920



Note: This figure displays the total number of emigrants to the US from all countries of Europe in our sample (excluding France), relative to the population, between 1850 and 1920, as recorded in the 1920 US full-count census. We also plot (in vertical lines) the year of the onset of the fertility transition for these countries, as estimated by Coale and Watkins (1986). Source: Ruggles et al. (2023) for emigration, Maddison Project Database (2020) for population.

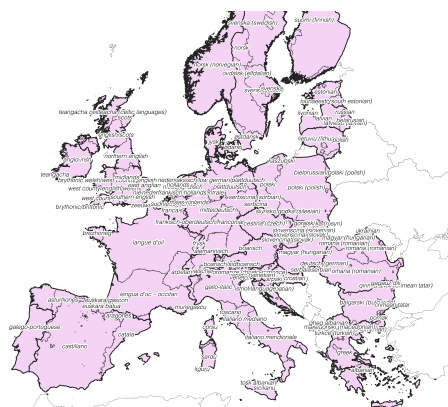
Figure A7: Dialects and languages of Europe



(Panel A) Muturzkin



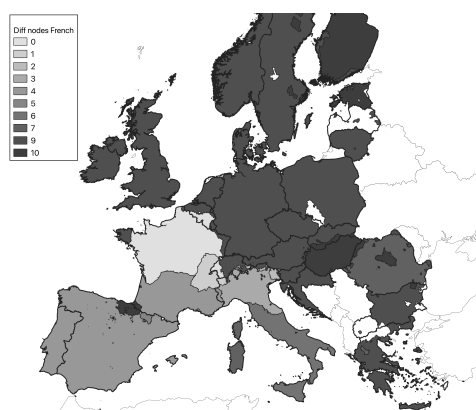
(Panel B) Dialects



(Panel C) Languages



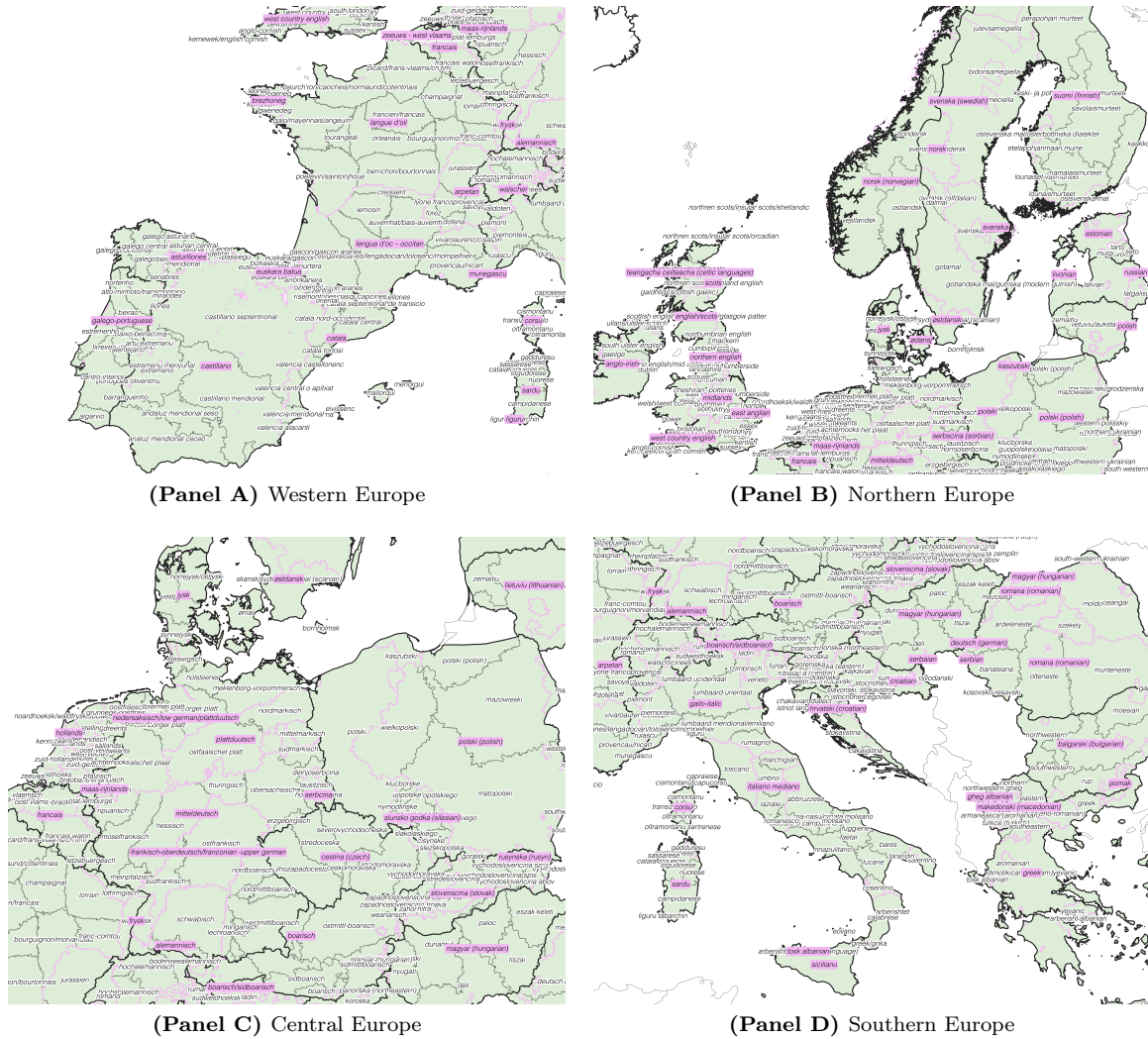
(Panel D) Ethnologue languages



(Panel E) Linguistic distance

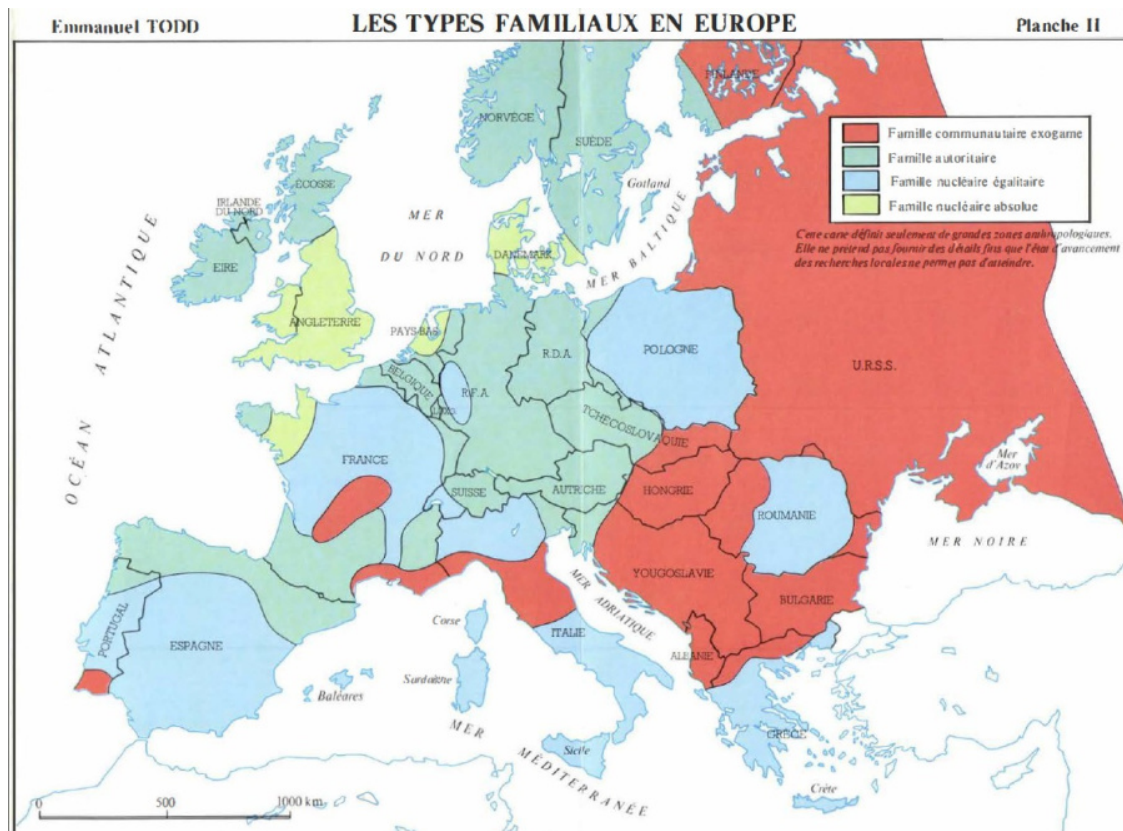
Note: This figure shows the historical linguistic map from [MutturZikin](#) (Panel A); from its digitization and geocoding, the boundaries of dialects (Panel B) and languages (Panel C); from matching the data to the Ethnologue, the boundaries of Ethnologue languages (Panel D); and, finally, linguistic distance from French (Panel E). Further details on the computation of linguistic distance are provided in the text.

Figure A8: Dialects (zoomed-in)



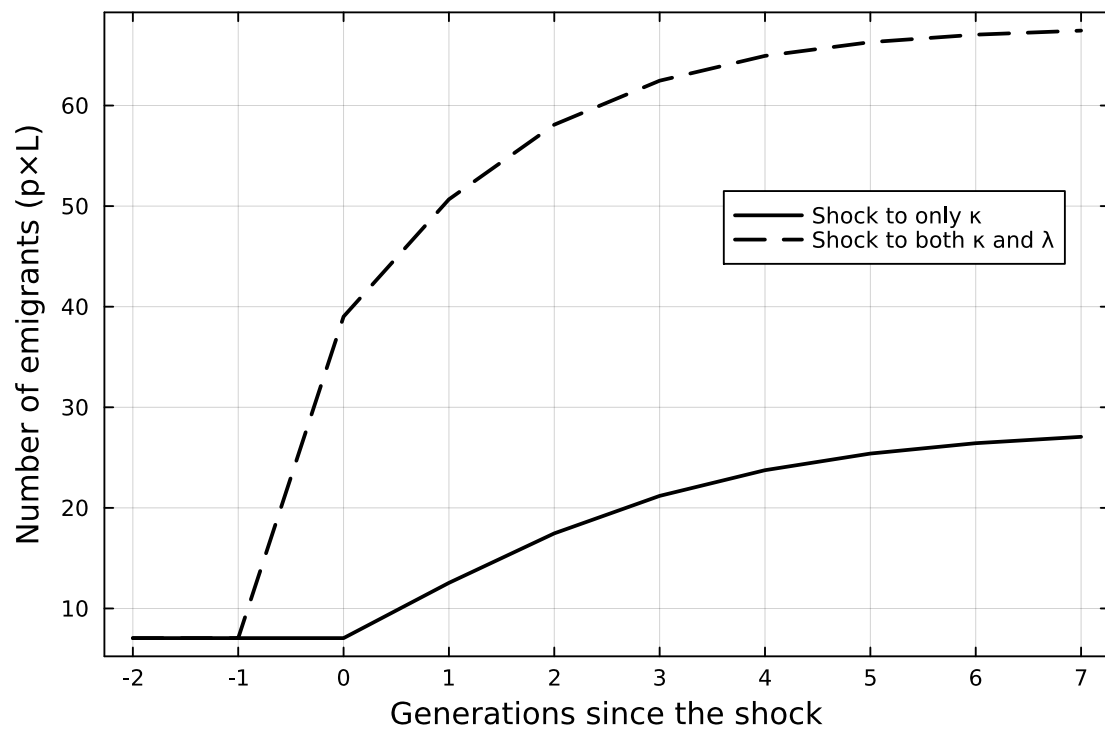
Note: This figure shows the zoomed-in map of dialects in Panel B of Appendix Figure A7.

Figure A9: Todd



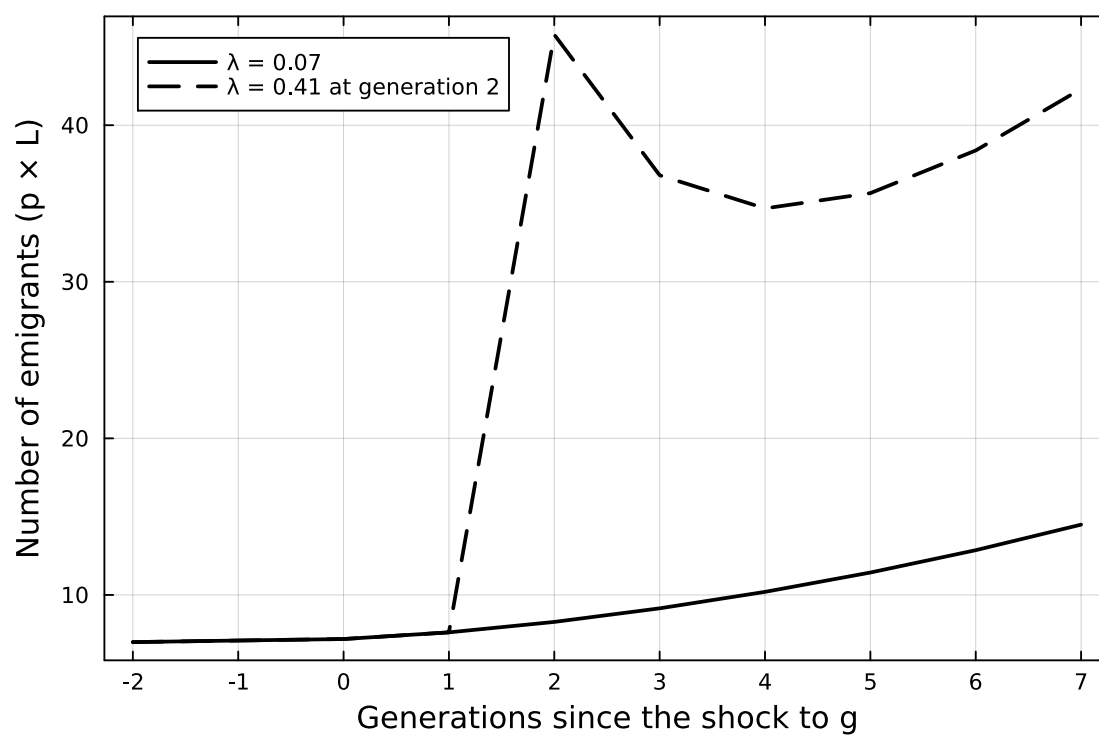
Note: Source: Todd (1985, 1990).

Figure A10: Effect of an increase in intrinsic fertility on emigration



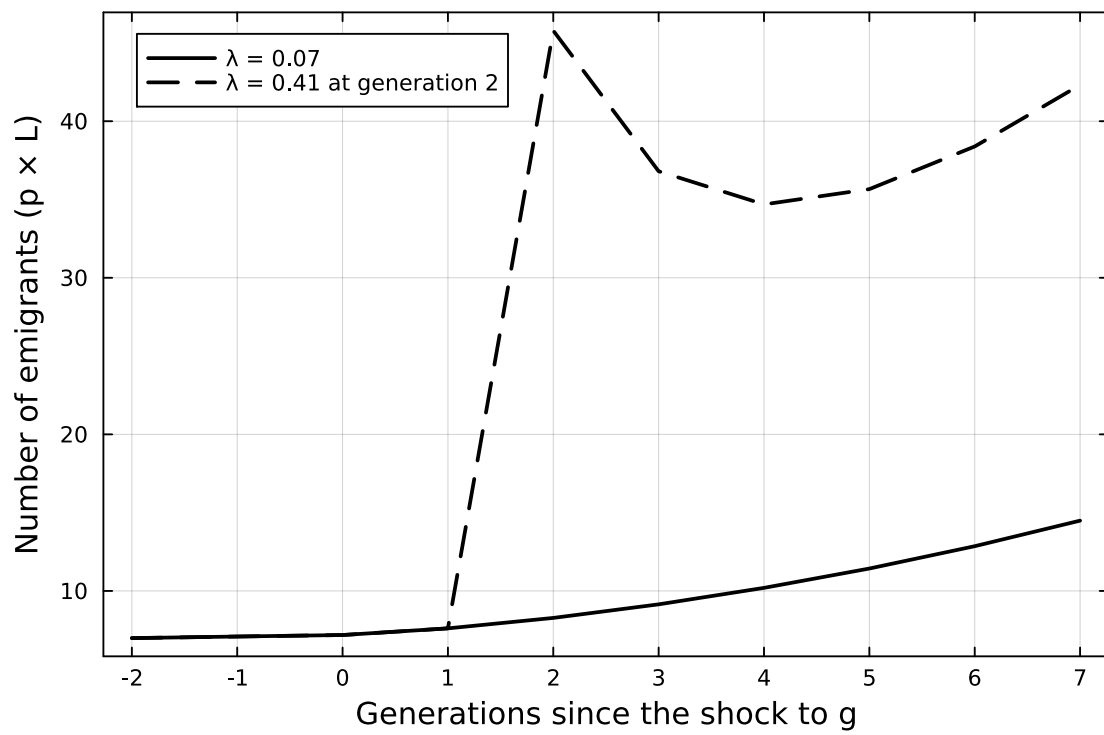
Note: This figure displays the impact of an increase in intrinsic fertility κ on the total number of migrants $p \times L$, with and without a shock to ease of migration λ , as in Figure 13. See Figure 13 for more details.

Figure A11: Effect of an increase in productivity on emigration



Note: This figure displays the impact of a one-time increase in technology A on the total number of migrants $p \times L$, with and without a shock to ease of migration λ at generation 2, as in Figure 14. See Figure 14 for more details.

Figure A12: Effect of an increase in productivity growth on emigration



Note: This figure displays the impact of an increase in the rate of productivity growth (growth of A) on the total number of migrants $p \times L$, with and without a shock to ease of migration λ at generation 2, as in Figure 15. See Figure 15 for more details.

APPENDIX 3— THEORETICAL APPENDIX

A3.1 Comparative statics

Using Equation (10), we can define function F such that:

$$F(\bar{y}, \kappa, \lambda, \bar{y}) = \bar{y}(1 - \lambda m(\bar{y}/y^*)) - \kappa^{-1} = 0$$

Applying the implicit function theorem, we get that, since $\partial F/\partial \bar{y}$ is always positive (as $m'(\bar{y}/y^*) < 0$):

$$\begin{aligned} \frac{\partial \bar{y}}{\partial \kappa} &= -\frac{\partial F/\partial \kappa}{\partial F/\partial \bar{y}} = -\frac{\kappa^{-2}}{(1 - \lambda m(\bar{y}/y^*)) - \lambda(\bar{y}/y^*)m'(\bar{y}/y^*)} < 0 \\ \frac{\partial \bar{y}}{\partial \lambda} &= -\frac{\partial F/\partial \lambda}{\partial F/\partial \bar{y}} = \frac{\bar{y}m(\bar{y}/y^*)}{(1 - \lambda m(\bar{y}/y^*)) - \lambda(\bar{y}/y^*)m'(\bar{y}/y^*)} > 0 \\ \frac{\partial \bar{y}}{\partial y^*} &= -\frac{\partial F/\partial y^*}{\partial F/\partial \bar{y}} = -\frac{\lambda(\bar{y}/y^*)^2 m'(\bar{y}/y^*)}{(1 - \lambda m(\bar{y}/y^*)) - \lambda(\bar{y}/y^*)m'(\bar{y}/y^*)} > 0 \end{aligned}$$

Therefore,

$$\frac{\partial \bar{y}}{\partial A} = \frac{\partial \bar{y}}{\partial X} = 0, \frac{\partial \bar{y}}{\partial \kappa} < 0, \frac{\partial \bar{y}}{\partial \lambda} > 0, \frac{\partial \bar{y}}{\partial y^*} > 0$$

For $\bar{L}$, using the fact that $y_t = (AX/L_t)^\alpha$, we obtain that:

$$\frac{\partial \bar{L}}{\partial A} = \frac{\partial \bar{L}}{\partial X} > 0, \frac{\partial \bar{L}}{\partial \kappa} > 0, \frac{\partial \bar{L}}{\partial \lambda} < 0, \frac{\partial \bar{L}}{\partial y^*} < 0$$

A3.2 A specific functional form

Proposition 1. *If $m(y_t/y^*) = 1 - y_t/y^*$, the unique steady-state is:*

$$\bar{y} = y^* \times \frac{\sqrt{(1 - \lambda)^2 + (4\lambda/\kappa y^*)} - (1 - \lambda)}{2\lambda}$$

Proof. Combining Equation (10) with the functional form for m , we get that the steady-state level of income per capita satisfies the following quadratic equation:

$$\bar{y}(1 - \lambda(1 - \bar{y}/y^*)) = \kappa^{-1} \iff (\lambda/y^*)\bar{y}^2 + (1 - \lambda)\bar{y} - \kappa^{-1} = 0$$

This equation has a unique positive solution,

$$\bar{y} = y^* \times \frac{\sqrt{(1 - \lambda)^2 + (4\lambda/\kappa y^*)} - (1 - \lambda)}{2\lambda}$$

A3.3 Introducing productivity growth g

In that case, it is easy to show that Equation (10) rewrites:

$$(3A) \quad \begin{cases} L_{t+1} = \phi(L_t; A_t, X, \alpha, \kappa, \lambda, y^*) \\ y_{t+1} = (1 + g)^\alpha \psi(y_t; \alpha, \kappa, \lambda, y^*) \end{cases}$$

Proposition 2. *When technology grows at a constant rate g , the new steady-state level of income per capita, $\bar{y}'$, is positively related to the rate of productivity growth.*

Proof. This follows directly from Equation (3A), which can be rewritten as $\bar{y}(1 - \lambda m(\bar{y}/y^*)) = (1+g)\kappa^{-1}$, together with the following properties of m : (i) $m(\cdot) \in [0, 1]$ is continuously differentiable, and (ii) $m'(\cdot) < 0$.

Proposition 3. *When technology grows at a constant rate g , population grows at rate g in the steady state.*

Proof. First, it is straightforward to show, by contradiction, that in the steady state population grows at some constant rate g_L . Second, we rewrite the law of motion for population in Equation (3A), using this result together with the steady-state condition for income per capita. This yields $1 + g_L = \kappa \bar{y}'(1 - \lambda m(\bar{y}'/y^*))$, which implies $g_L = g$.

APPENDIX 4— APPENDIX REFERENCES

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