Online supplementary material for Growing up and moving out: Migration and the demographic transition in low- and middle-income nations. T.J. Bollyky, N. Graetz, J. Dieleman, M.K. Miller-Petrie, D. Schoder, S. Joyce, M. Guillot, S.I. Hay. Population Studies. 2022.

Section 1. GATHER checklist

| Item # | Checklist item                                                                                                                                                                                                 | Reported in                                                      |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|        | **Objectives and funding**                                                                                                                                                                                  |                                                                  |
| 1      | Define the indicator(s), populations (including age, sex, and geographic entities), and time period(s) for which estimates were made.                                                                   | Main text: Impact of population growth on migration, Main text: Methods |
| 2      | List the funding sources for the work.                                                                                                                                                                      | Main text: Acknowledgements                                      |
|        | **Data Inputs**                                                                                                                                                                                               |                                                                  |
|        | *For all data inputs from multiple sources that are synthesized as part of the study:*                                                                                                                                 |                                                                  |
| 3      | Describe how the data were identified and how the data were accessed.                                                                                                                                          | Main text: Methods (Analysis)                                    |
| 4      | Specify the inclusion and exclusion criteria. Identify all ad-hoc exclusions.                                                                                                                                | Main text: Methods                                               |
| 5      | Provide information on all included data sources and their main characteristics. For each data source used, report reference information or contact name/institution, population represented, data collection method, year(s) of data collection, sex and age range, diagnostic criteria or measurement method, and sample size, as relevant. | Main Text: Methods                                              |
| 6      | Identify and describe any categories of input data that have potentially important biases (e.g., based on characteristics listed in item 5).                                                               | Main text: Methods                                               |
|        | *For data inputs that contribute to the analysis but were not synthesized as part of the study:*                                                                                                                                 |                                                                  |
| 7      | Describe and give sources for any other data inputs.                                                                                                                                                         | Main Text: Methods                                              |
|        | *For all data inputs:*                                                                                                                                                                                        |                                                                  |
| 8      | Provide all data inputs in a file format from which data can be efficiently extracted (e.g., a spreadsheet rather than a PDF), including all relevant meta-data listed in item 5. For any data inputs that cannot be shared because of ethical or legal reasons, | Main Text: Code availability                                    |
| Item # | Checklist item                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Reported in                                                                 |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|        | such as third-party ownership, provide a contact name or the name of the institution that retains the right to the data.                                                                                                                                                                                                                                                                                                                                                   |                                                                             |
| Data analysis                                                                                                               | Main text: Methods (Analysis)                                                                                                                                  |
| 9      | Provide a conceptual overview of the data analysis method. A diagram may be helpful.                                                                                                                                                                                                                                                                                                                                                                                        | Main text: Methods (Analysis)                                                                                                                                  |
| 10     | Provide a detailed description of all steps of the analysis, including mathematical formulae. This description should cover, as relevant, data cleaning, data pre-processing, data adjustments and weighting of data sources, and mathematical or statistical model(s).                                                                                                                                                | Main text: Methods (Analysis)                                                                                                                                  |
| 11     | Describe how candidate models were evaluated and how the final model(s) were selected.                                                                                                                                                                                                                                                                                                                                                                                     | Main text: Methods (Analysis)                                                                                                                                  |
| 12     | Provide the results of an evaluation of model performance, if done, as well as the results of any relevant sensitivity analysis.                                                                                                                                                                                                                                                                                                                                           | Main text: Methods (Analysis)                                                                                                                                  |
| 13     | Describe methods for calculating uncertainty of the estimates. State which sources of uncertainty were, and were not, accounted for in the uncertainty analysis.                                                                                                                                                                                                                                            | Main text: Methods (Analysis)                                                                                                                                  |
| 14     | State how analytic or statistical source code used to generate estimates can be accessed.                                                                                                                                                                                                                                                                                                                                                                               | Available at https://github.com/ngraeetz/stalled_transition                                                                                                      |
| Results and Discussion                                                                                                         | Will be posted at https://github.com/ngraetz/stalled_transition                                                                                                  |
| 15     | Provide published estimates in a file format from which data can be efficiently extracted.                                                                                                                                                                                                                                                                                                                                                                               | Main text: Results (Analysis)                                                                                                                                    |
| 16     | Report a quantitative measure of the uncertainty of the estimates (e.g. uncertainty intervals).                                                                                                                                                                                                                                                                                                                                                                           | Main text: Results (Analysis)                                                                                                                                    |
| 17     | Interpret results in light of existing evidence. If updating a previous set of estimates, describe the reasons for changes in estimates.                                                                                                                                                                                                                                                                                                                              | Main text: Discussion (Analysis)                                                                                                                                  |
| 18     | Discuss limitations of the estimates. Include a discussion of any modelling assumptions or data limitations that affect interpretation of the estimates.                                                                                                                                                                                                                                                                                                                   | Main Text: Methods (Limitations)                                                                                                                                  |

*Section 2. Robustness checks for bilateral migration data*

Abel and Cohen (2019) compare six proposed methods for estimating bilateral migrant flows:

1. Stock differencing, drop negatives.
2. Stock differencing, reverse negatives.

3. Demographic accounting, minimization (open).

4. Demographic accounting, minimization (closed).

5. Demographic accounting, pseudo-Bayesian (closed).

6. Migration rates approach.

By comparing to known migrant flow data produced by select countries with robust population tracking systems, Abel and Cohen (2019) suggest that closed demographic accounting approaches are the preferred estimation method for bilateral migrant flows globally based on incomplete stock data. For our main analysis, we use the “demographic accounting, pseudo-Bayesian (closed),” which is the method most well supported in Abel and Cohen (2019) and most like the method previously introduced by Azose and Raftery (2019).

Still, though Abel and Cohen discuss the theoretical benefits of the closed demographic accounting approaches, their empirical validation exercises are ultimately based only on data from high-income countries. It is possible that the other methods may perform better over periods and regions with sparse migrant stock data, which include most of the countries in our study.

We replicate our Figure 3 below (the estimated relationship between lagged growth rates in the young adult population and total out-migrants five years later for all low- and middle-income country-years, 1990–2015) including point estimates from models based on the five other methods reviewed by Abel and Cohen (2019). We observe broad agreement across five out of the six methods with our substantive conclusion that increased population growth in the young adult population is associated with out-migration in the following years, though there is
some significant variation. Results are consistent using both the closed demographic accounting approaches, but much different with the simpler “stock differencing, drop negatives” reviewed in Abel and Cohen (2019). We have included this figure in our Appendix.

**Supplementary Information Figure S1.** Estimated relationship between lagged growth rates in the young adult population (ages 15–24) and total out-migrants five years later for all low- and lower-middle-income country-years, 1990–2015, using estimates from Abel and Cohen (2019). The y-axis represents the multiplicative increase in total out-migrants associated with a 1% increase in the lagged young adult population growth rate. The GDP per capita is represented in terms of global 1990–2015 standard deviations on the x-axis.
Section 3. Further discussion on migration databases and previous bilateral analyses

Until recently, international data on bilateral migration flows were drawn from national agency estimates, largely from Europe and other high-income nations. Accordingly, assessments of the demographic determinants of international migration have generally focused on in-migration to a small subset of wealthy Organization for Economic Co-operation and Development (OECD) countries, ignored South-to-South migration, and used indirect estimates of net-migration to examine relationships in a broader set of poorer countries (Hanson and McIntosh 2016; Mayda 2010). Further, population models previously used to estimate net-migration at the national level have been calculated indirectly from the residual population change remaining after accounting for the empirical data on mortality and fertility. These residual-based formal population models did not allow for the calculation of in- and out-migration flows. More recently, Abel and Cohen (2019) used data from sequential stock tables published by the United Nations (UN) to directly estimate internally consistent bilateral out-migration rates by using place-of-birth responses in censuses, refugee surveillance programs, and other demographic registers comparing six different estimation techniques, ultimately producing estimates of the total number of out-migrants from each country to every other country within 5-year periods between 1990 and 2015 (Abel and Cohen 2019).

Section 4. Motivation for the lagged annualized growth rate

In the figure below we present the population age structure for Kenya in 1980 and 1990. We first calculate the annualized rate of population growth in the 15–24 age group between these two periods. This provides a comparable, relative measure of how quickly the absolute population size in this age group is growing. It is also based on previous rates of births and deaths for that cohort, which helps to address some issues of the additive relationship between contemporaneous population size and migration. According to
traditional Demographic Transition theory, countries in the midst of transition (characterized by high fertility and rapidly declining child mortality) will be growing most rapidly. We posit that a high value for this growth rate measure is most closely related to increased strain on the labor market, as a more rapidly expanding population of young adults needs to be absorbed. In a strong economy (proxied by high GDP per capita) with high opportunity for employment this may be the case, whereas in a weaker economy (proxied by low GDP per capita) this relative growth may push young adults to migrate as they reach prime migrating ages.

In our gravity model for migration flows, we lag this growth rate measure by five years so that we are predicting migration from Country A to Country B in 1995 using the population growth rate of young adults ages 15–24 calculated below over the period 1980–1990 in Country A. In this way, we are capturing the point at which an unusually large cohort would be about to age into peak migrating ages 20–29 (dotted lines below). Most importantly, we are avoiding potentially missing the connection between the size of the young adult population and out-migration that might come with regressing migration on population in the same period (where given the population balancing equation, there is a direct dependence).
**Supplementary Information Figure S2.** Population age distributions in Kenya, 1980 and 1990. Blue bars represent the age groups 15–19 and 20–24. The lagged annualized growth rate between these periods is used to proxy the relative size of cohorts about to age into prime migrating ages, 20–29 (dotted lines).

**Section 5. Alternative model specifications**

| Origin country factors                          | GNI Interaction (Poisson) | GNI Interaction (zero-inflated Poisson) |
|------------------------------------------------|---------------------------|----------------------------------------|
| Growth rate                                    | 1.01                      | 1.01***                                |
| GDP/pc                                          | 2.1***                    | 1.93***                                |
| Growth rate * GDP/pc                            | 0.97**                    | 0.97***                                |
| GDP gap with destination                        | 2.14***                   | 1.96***                                |
| Employee-population ratio                       | 0.97                      | 0.97***                                |
| Polity2 Index                                   | 0.99**                    | 0.99***                                |
| Proportion urban                                | 1.00                      | 1.00***                                |
| Mortality, war/conflict                         | 1.30***                   | 1.29***                                |
| Mortality, natural disaster                      | 0.88***                   | 0.88***                                |

| Destination country factors                     |                           |                                        |
|------------------------------------------------|---------------------------|----------------------------------------|
| Employee-population ratio                       | 1.01***                   | 1.01***                                |
| Polity2 Index                                   | 1.00                      | 0.99***                                |
| Proportion urban                                | 1.00***                   | 1.01***                                |
| Mortality, war/conflict                         | 1.05***                   | 1.06***                                |
| Mortality, natural disaster                      | 1.00                      | 1.01***                                |
### Supplementary Information Table S1

Full countries Poisson model compared to alternative zero-inflated Poisson model.

| Gravity model intercepts                          | GNI Interaction (Poisson) | GNI Interaction (zero-inflated Poisson) |
|---------------------------------------------------|---------------------------|----------------------------------------|
| Origin population                                 | 1.09                      | 1.19***                                |
| Destination population                            | 4.53***                   | 4.34***                                |
| Distance from origin to dest.                     | 0.19***                   | 0.22***                                |
| R²                                                | 0.61                      | 0.60                                   |
| R² (adjusted)                                     | 0.61                      | 0.60                                   |
| N (bilateral country-year dyads)                  | 54,563                    | 54,563                                 |

### Section 6. Sensitivity tests of the functional form of GDP relationship

![Graph](image)

**Supplementary Information Figure S3.** Results of sensitivity analysis interacting Gross Domestic Product per capita (GDP/pc) *quartiles* with the population growth rate (ages 15–24) rather than continuous GDP/pc.
Section 7. Comparisons to other total migrant counterfactuals

| Level                        | Growth 15–24 (0) | GDP origin (1990 value) | War Natural disasters (0) |
|------------------------------|-------------------|-------------------------|---------------------------|
| Global                       | 20,418,551        | 17,782,377              | 29,747,618                |
| World Bank Low Income        | 8,662,556         | 0                       | 7,855,802                 |
| World Bank Lower Middle Income | 11,142,877     | 9,986                   | 15,228,008                |
| World Bank Upper Middle Income | 613,117         | 17,772,391              | 6,663,809                 |
| Andean Latin America         | 254,899           | 360,266                 | 670,958                   |
| Caribbean                    | 293,258           | 395,252                 | 359,788                   |
| Central Latin America        | 424,835           | 9,756,059               | 2,596,059                 |
| Tropical Latin America       | 47,755            | 1,007,542               | 93,530                    |
| North Africa and Middle East | 2,225,130         | 3,974,375               | 7,266,445                 |
| Central Sub-Saharan Africa   | 999,895           | 201,531                 | 1,273,032                 |
| Eastern Sub-Saharan Africa   | 4,221,776         | 0                       | 3,712,713                 |
| Southern Sub-Saharan Africa  | 489,899           | 405,046                 | 574,746                   |
| Western Sub-Saharan Africa   | 3,815,609         | 0                       | 3,589,261                 |
| South Asia                   | 5,259,745         | 0                       | 4,524,056                 |
| Southeast Asia               | 2,385,749         | 1,682,304               | 5,087,030                 |

Supplementary Information Table S2. Comparison of growth counterfactual (observed migrants – expected migrants given a lagged population growth rate of 0 in all countries) to other counterfactual scenarios (e.g., observed migrants – expected migrants given all origin countries fixed at the global average mortality from war during 1990–2015).
Section 8. Alternate drivers of out-migration

To anticipate the potential impact of adult population growth on out-migration in fragile states with greater exposure to the effects of climate change, we controlled for the role of mortality shocks from conflicts and natural disasters on out-migration in low- and middle-income countries between 1990 and 2015. Mortality shocks were associated with more out-migration in sub-Saharan Africa (189% increase in total migrants associated with a one standard deviation increase in mortality rates related to war/conflict). Mortality from natural disasters was typically associated with less out-migration. The contrasting direction of these associations is consistent with research that has shown some types of mortality shocks, such as natural disasters, tend to suppress out-migration, while others, such as state violence and civil war, are likely to increase the movement of migrants internationally.

Section 9. Models stratified by region

|                  | NAME | Sub-Saharan Africa | Latin America | Asia |
|------------------|------|--------------------|---------------|------|
| **Origin country factors** |      |                    |               |      |
| Growth rate      | 1.08 | 1.13***            | 1.05          | 1.07 |
| GDP/pc           | 2.56*** | 1.52***            | 0.63**        | 1.63**|
| GDP gap with destination | 1.59*** | 1.47***            | 2.3***        | 2.88***|
| Employee-population ratio | 0.85  | 1.15*              | 2.03***       | 0.6** |
| Polity2 Index    | 1.01 | 0.98***            | 0.95***       | 1.02* |
| Proportion urban | 1.05** | 1.01              | 1.03*         | 0.98  |
| Mortality, war/conflict | 3.62*** | 1.62***            | 0.98          | 1.09  |
| Mortality, natural disaster | 0.98  | 0.96*              | 0.56***       | 1.12  |
| **Destination country factors** |      |                    |               |      |
| Employee-population ratio | 1.02*** | 1**                | 0.98***       | 1.01***|
| Polity2 Index    | 0.98** | 0.98***            | 1.09***       | 1    |
| Proportion urban | 0.99*  | 1.02***            | 1.02***       | 1.01***|
| Mortality, war/conflict | 1.03*  | 1.04***            | 1.03***       | 1.1***|
| Mortality, natural disaster | 1.01  | 0.99*              | 1.01          | 1.03***|
| **Gravity model intercepts** |      |                    |               |      |
| Origin population | 0.2*  | 0.96               | 4.91**        | 1.21  |
| Destination population | 5.07*** | 5.11***            | 5.8***        | 3.26***|
| Distance from origin to dest. | NAME  | Sub-Saharan Africa | Latin America | Asia  |
|-------------------------------|-------|--------------------|---------------|-------|
|                               | 0.27*** | 0.19*** | 0.13*** | 0.25*** |
| $R^2$                         | 0.55  | 0.20   | 0.44   | 0.84  |
| $R^2$ (adjusted)              | 0.55  | 0.20   | 0.44   | 0.84  |
| N (bilateral country-year dyads) | 9,184 | 31,399 | 9,864  | 15,618 |
### Section 10. Additional tables

| Region | Country                  | Migrants | Migrants* | Growth | GDP   | EPR | Polity | Urban | GDP gap   | War | Disasters |
|--------|--------------------------|----------|-----------|--------|-------|-----|--------|-------|-----------|-----|-----------|
| LIC-Asia | Nepal                    | 5,431    | 783       | 2.2    | 605   | 77  | 3      | 4     | -12,940   | 2   | 1         |
| LIC-Latin | Haiti                  | 1,485    | 199       | 2.4    | 886   | 28  | 3      | 20    | -12,658   | 0   | 585       |
| LIC-SSA   | Benin                    | 860      | 164       | 3.3    | 852   | 54  | 6      | 18    | -12,819   | 0   | 0         |
| LIC-SSA   | Burkina Faso Central African Republic | 2,537 | 499 | 2.9 | 586 | 67 | -2 | 12 | -13,069 | 0 | 0 |
| LIC-SSA   | Chad                     | 361      | 71        | 3.4    | 875   | 56  | -3     | 8     | -12,844   | 5   | 0         |
| LIC-SSA   | DR Congo                 | 3,171    | 731       | 3.0    | 440   | 41  | 1      | 26    | -13,227   | 10  | 0         |
| LIC-SSA   | Eritrea                  | 668      | 144       | 2.9    | 677   | 64  | -7     | 14    | -13,241   | 34  | 0         |
| LIC-SSA   | Ethiopia                 | 1,475    | 409       | 3.4    | 259   | 72  | -2     | 5     | -13,404   | 7   | 0         |
| LIC-SSA   | Gambia                   | 394      | 102       | 3.8    | 590   | 36  | -4     | 25    | -13,091   | 0   | 0         |
| LIC-SSA   | Guinea                   | 2,366    | 433       | 2.6    | 589   | 45  | -1     | 14    | -13,012   | 1   | 0         |
| LIC-SSA   | Guinea-Bissau            | 208      | 33        | 2.6    | 746   | 52  | 4      | 23    | -12,845   | 3   | 0         |
| LIC-SSA   | Liberia                  | 706      | 137       | 2.8    | 421   | 31  | 3      | 32    | -13,308   | 28  | 0         |
| LIC-SSA   | Madagascar               | 136      | 29        | 3.0    | 582   | 70  | 4      | 11    | -13,087   | 0   | 0         |
| LIC-SSA   | Malawi                   | 1,623    | 375       | 3.1    | 473   | 51  | 4      | 9     | -13,132   | 0   | 0         |
| LIC-SSA   | Mali                     | 2,163    | 347       | 2.6    | 728   | 54  | 5      | 12    | -12,932   | 9   | 0         |
| LIC-SSA   | Mozambique               | 1,112    | 223       | 2.5    | 397   | 66  | 3      | 15    | -13,260   | 1   | 0         |
| LIC-SSA   | Niger                    | 631      | 160       | 3.3    | 422   | 67  | 4      | 7     | -13,304   | 0   | 0         |
| LIC-SSA   | Rwanda                   | 2,504    | 477       | 2.6    | 488   | 75  | -5     | 6     | -13,134   | 347 | 0         |
| LIC-SSA   | Senegal                  | 1,611    | 265       | 3.3    | 1,119 | 36  | 5      | 23    | -12,506   | 1   | 0         |
| Region      | Country          | Migrants | Migrants* | Growth | GDP   | EPR | Polity | Urban | GDP gap | War | Disasters |
|------------|------------------|----------|-----------|--------|-------|-----|--------|-------|---------|-----|-----------|
| LIC-SSA    | Sierra Leone     | 896      | 174       | 2.3    | 462   | 37  | 1      | 14    | -13,142 | 19  | 0         |
| LIC-SSA    | Somalia          | 2,348    | 725       | 2.3    | 107   | 24  | -1     | 24    | -13,549 | 16  | 1         |
| LIC-SSA    | South Sudan      | 1,755    | 304       | 3.9    | 1,902 | 51  | -2     | 2     | -13,240 | 9   | 0         |
| LIC-SSA    | Tanzania         | 2,531    | 508       | 3.1    | 640   | 74  | -2     | 11    | -13,003 | 0   | 0         |
| LIC-SSA    | Togo             | 787      | 154       | 3.4    | 664   | 65  | -3     | 21    | -12,977 | 0   | 0         |
| LIC-SSA    | Uganda           | 2,335    | 557       | 3.3    | 508   | 53  | -3     | 5     | -13,169 | 4   | 0         |
| LIC-SSA    | Zimbabwe         | 3,660    | 474       | 2.9    | 1,079 | 67  | -3     | 19    | -12,378 | 0   | 0         |
| LIC-SSA    | Bangladesh       | 15,549   | 2,588     | 2.8    | 651   | 43  | 4      | 13    | -12,900 | 0   | 5         |
| LMIC-Asia  | Cambodia         | 1,089    | 188       | 2.9    | 639   | 72  | 2      | 9     | -12,953 | 1   | 0         |
| LMIC-Asia  | Indonesia        | 5,565    | 270       | 1.7    | 3,006 | 42  | 2      | 16    | -10,508 | 0   | 4         |
| LMIC-Asia  | Laos             | 1,234    | 174       | 2.6    | 1,014 | 67  | -7     | 8     | -12,540 | 0   | 0         |
| LMIC-Asia  | Myanmar          | 6,207    | 639       | 1.6    | 664   | 73  | -7     | 10    | -12,812 | 1   | 13        |
| LMIC-Asia  | Pakistan         | 11,448   | 1,888     | 3.3    | 1,178 | 41  | 2      | 22    | -12,446 | 2   | 3         |
| LMIC-Asia  | Philippines      | 7,983    | 603       | 2.2    | 2,145 | 40  | 8      | 26    | -11,433 | 1   | 1         |
| LMIC-Asia  | Sri Lanka        | 3,321    | 75        | 0.6    | 2,304 | 31  | 5      | 3     | -11,146 | 24  | 8         |
| LMIC-Asia  | Vietnam          | 4,244    | 368       | 1.7    | 1,062 | 62  | -7     | 12    | -12,433 | 0   | 1         |
| LMIC-Latin | Bolivia          | 970      | 73        | 2.1    | 2,183 | 50  | 8      | 40    | -11,379 | 0   | 0         |
| LMIC-Latin | El Salvador      | 2,313    | 74        | 1.1    | 3,421 | 42  | 7      | 18    | -10,029 | 1   | 2         |
| LMIC-Latin | Guatemala        | 1,832    | 124       | 2.6    | 3,179 | 53  | 6      | 17    | -10,421 | 1   | 0         |
| LMIC-Latin | Honduras         | 708      | 77        | 3.0    | 2,124 | 52  | 7      | 19    | -11,504 | 0   | 11        |
| LMIC-Latin | Nicaragua        | 1,198    | 117       | 2.5    | 1,562 | 44  | 8      | 18    | -11,972 | 0   | 1         |
| LMIC-NAME  | Egypt            | 3,323    | 260       | 2.7    | 2,510 | 24  | -5     | 30    | -11,054 | 0   | 0         |
| LMIC-NAME  | Jordan           | 1,600    | 121       | 3.8    | 3,857 | 19  | -3     | 40    | -9,823  | 0   | 0         |
| LMIC-NAME  | Morocco          | 4,471    | 235       | 1.7    | 2,539 | 32  | -6     | 32    | -10,963 | 0   | 0         |
| Region         | Country       | Migrants | Migrants* | Growth | GDP  | EPR | Polity | Urban | GDP gap | War | Disasters |
|----------------|---------------|----------|-----------|--------|------|-----|--------|-------|---------|-----|-----------|
| LMIC-NAME      | Sudan         | 1,973    | 197       | 2.6    | 2,060| 22  | -3     | 19    | -12,911 | 5   | 0         |
| LMIC-NAME      | Syria         | 9,733    | 929       | 3.4    | 2,637| 32  | -8     | 44    | -10,995 | 0   | 0         |
| LMIC-NAME      | Tunisia       | 853      | 32        | 1.9    | 3,736| 25  | -4     | 24    | -9,754  | 0   | 0         |
| LMIC-NAME      | Yemen         | 1,329    | 280       | 4.4    | 1,553| 27  | -2     | 17    | -12,131 | 1   | 0         |
| LMIC-SSA       | Angola        | 502      | 44        | 3.6    | 3,509| 34  | -3     | 31    | -10,195 | 13  | 0         |
| LMIC-SSA       | Cameroon      | 1,062    | 159       | 3.5    | 1,479| 60  | -5     | 25    | -12,160 | 0   | 0         |
| LMIC-SSA       | Congo         | 599      | 40        | 3.1    | 3,551| 27  | -3     | 50    | -10,114 | 19  | 0         |
| LMIC-SSA       | Djibouti      | 154      | 25        | 4.0    | 1,433| 44  | -1     | 56    | -12,128 | 4   | 1         |
| LMIC-SSA       | Ghana         | 1,313    | 178       | 2.7    | 1,290| 44  | 3      | 18    | -12,334 | 0   | 0         |
| LMIC-SSA       | Ivory Coast   | 3,599    | 571       | 3.9    | 1,559| 43  | -1     | 21    | -12,071 | 1   | 0         |
| LMIC-SSA       | Kenya         | 1,682    | 315       | 3.8    | 1,017| 37  | 2      | 12    | -12,633 | 1   | 0         |
| LMIC-SSA       | Mauritania    | 355      | 49        | 2.9    | 1,401| 32  | -5     | 22    | -12,240 | 0   | 0         |
| LMIC-SSA       | Nigeria       | 3,148    | 320       | 2.9    | 2,056| 31  | 1      | 24    | -11,569 | 0   | 0         |
| LMIC-SSA       | Zambia        | 907      | 132       | 3.2    | 1,390| 49  | 3      | 18    | -12,244 | 0   | 0         |
| UMIC-Asia      | Malaysia      | 3,480    | 9         | 2.2    | 9,017| 39  | 4      | 32    | -4,575  | 0   | 0         |
| UMIC-Asia      | Thailand      | 3,937    | 60        | 0.4    | 4,683| 53  | 7      | 24    | -8,780  | 0   | 1         |
| UMIC-Latin     | Brazil        | 2,102    | 0         | 1.5    | 11,965| 51  | 8      | 46    | -1,544  | 0   | 0         |
| UMIC-Latin     | Colombia      | 3,217    | 27        | 1.3    | 6,408| 42  | 7      | 46    | -7,120  | 3   | 1         |
| UMIC-Latin     | Costa Rica    | 482      | 2         | 1.9    | 8,092| 43  | 10     | 34    | -5,467  | 0   | 1         |
| UMIC-Latin     | Cuba          | 1,556    | 27        | -0.7   | 4,860| 34  | -7     | 26    | -8,546  | 0   | 0         |
| UMIC-Latin     | Dominican Republic | 2,059 | 56   | 1.5    | 4,789| 37  | 7      | 29    | -8,735  | 0   | 1         |
| UMIC-Latin     | Ecuador       | 1,433    | 40        | 2.0    | 4,843| 45  | 7      | 31    | -8,718  | 0   | 0         |
| UMIC-Latin     | Jamaica       | 970      | 10        | 0.6    | 5,784| 30  | 9      | 22    | -7,666  | 0   | 0         |
| Region     | Country   | Migrants | Migrants* | Growth | GDP      | EPR | Polity | Urban | GDP gap | War | Disasters |
|------------|-----------|----------|-----------|--------|----------|-----|--------|-------|---------|-----|-----------|
| UMIC-Latin | Mexico    | 15,608   | 0         | 1.7    | 10,332   | 48  | 6      | 54    | -3,191  | 0   | 0         |
| UMIC-Latin | Panama    | 277      | 4         | 1.7    | 7,115    | 45  | 9      | 39    | -6,451  | 0   | 0         |
| UMIC-Latin | Paraguay  | 983      | 48        | 2.6    | 3,785    | 53  | 7      | 38    | -9,780  | 0   | 0         |
| UMIC-Latin | Peru      | 4,299    | 142       | 1.9    | 4,531    | 52  | 6      | 42    | -8,976  | 1   | 0         |
| UMIC-Latin | Venezuela | 5,842    | 0         | 2.0    | 11,074   | 38  | 5      | 46    | -2,481  | 0   | 5         |
| UMIC-NAME  | Algeria   | 1,989    | 61        | 2.8    | 5,270    | 21  | -1     | 15    | -8,260  | 4   | 1         |
| UMIC-NAME  | Iran      | 4,698    | 51        | 3.5    | 6,916    | 26  | -4     | 35    | -6,588  | 0   | 5         |
| UMIC-NAME  | Iraq      | 1,324    | 56        | 3.2    | 5,012    | 28  | -5     | 49    | -8,284  | 13  | 0         |
| UMIC-NAME  | Libya     | 1,172    | 1         | 3.4    | 14,959   | 18  | -7     | 35    | 1,425   | 2   | 0         |
| UMIC-NAME  | Turkey    | 5,249    | 4         | 1.7    | 9,453    | 37  | 7      | 41    | -4,067  | 2   | 1         |
| UMIC-SSA   | Gabon     | 422      | 0         | 3.5    | 13,157   | 13  | -2     | 40    | -476    | 0   | 0         |
| UMIC-SSA   | Namibia   | 294      | 11        | 3.0    | 5,099    | 19  | 6      | 12    | -8,460  | 1   | 0         |

**Supplementary Information Table S3.** Summary characteristics for all countries (all statistics are averaged over 1990–2015). LIC = low-income country, LMIC = lower-middle-income country, UMIC = upper-middle-income country. Migrants* = expected migrants due to observed growth rates compared to if there had been no growth 1990–2015. NAME = North Africa and Middle East, SSA = sub-Saharan Africa, Latin = Latin America and Caribbean. Migrants, Migrants*, GDP, and GDP gap are in thousands. War/natural disaster mortality rates are per 100,000.
**Supplementary Information Figure S4.** Estimated relationship between lagged growth rates in the young adult population (ages 15-24) and total out-migrants five years later for all low- and lower-middle-income country-years, 1990–2010. The y-axis represents the multiplicative increase in total out-migrants associated with a 1% increase in the lagged young adult population growth rate. The gross domestic product *per capita* (GDP/pc) is represented in terms of global 1990–2015 standard deviations on the x-axis, and all country-years are jittered along this axis to visualize clustering of income levels by region.
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