Demography (2017) 54:603–630
DOI 10.1007/s13524-017-0559-1

The Gravity of High-Skilled Migration Policies

Mathias Czaika[1] · **Christopher R. Parsons**[2]

Published online: 13 March 2017

Abstract Combining unique, annual, bilateral data on labor flows of highly skilled immigrants for 10 OECD destinations between 2000 and 2012, with new databases comprising both unilateral and bilateral policy instruments, we present the first judicious cross-country assessment of policies aimed to attract and select high-skilled workers. Points-based systems are much more effective in attracting and selecting high-skilled migrants than requiring a job offer, labor market tests, and shortage lists. Offers of permanent residency, while attracting the highly skilled, overall reduce the human capital content of labor flows because they prove more attractive to non-high-skilled workers. Bilateral recognition of diploma and social security agreements foster greater flows of high-skilled workers and improve the skill selectivity of immigrant flows. Conversely, double taxation agreements deter high-skilled migrants, although they do not alter overall skill selectivity. Our results are robust to a variety of empirical specifications that account for destination-specific amenities, multilateral resistance to migration, and the endogeneity of immigration policies.

Keywords High-skilled immigration · Human capital · Immigration policy

✉ Christopher R. Parsons
christopher.parsons@uwa.edu.au

Mathias Czaika
mathias.czaika@qeh.ox.ac.uk

[1] Department for International Development, International Migration Institute, Oxford University, Oxford, UK

[2] Economics Discipline, UWA Business School, The University of Western Australia, Perth, Australia

Introduction

> *If Europe really wants to have a knowledge based economy, if it wants to play a leading role in innovation and research, if it wants to be competitive in the global economy, it needs to do much more to attract the smartest and the brightest.*
>
> Cecilia Malmström, European Union Commissioner (2012)[1]

Policymakers worldwide, cognizant of the pivotal role that human capital plays in the economic development of receiving nations, increasingly vie to attract "the best and brightest" (Kapur and McHale 2005) in the "global competition to attract high-skilled migrants" (Boeri et al. 2012). At the center of this contest are the countries of the Organisation for Economic Co-operation and Development (OECD), which have historically attracted the largest proportion of high-skilled migrants (Artuç et al. 2014), arguably in part because of the domestic supply of skills falling short of domestic demand (Papademetriou and Sumption 2013). Because high-skilled migrants are motivated to move internationally by myriad factors, however, the efficacy of nation states' policies regarding high-skilled migrants remains highly contested. The lack of existing evidence is largely due to the paucity of adequate data. To the best of our knowledge, this article provides the first test of the efficacy of policies targeting high-skilled migrants in a comparative cross-country setting.

As shown in Fig. 1, ever more countries are engaging in the intense global competition to attract internationally mobile human capital. By 2015, approximately 44 % of the 172 United Nations member states declared an explicit interest in increasing their numbers of high-skilled migrants. Highly developed destinations are at the vanguard of this global trend, with two-thirds of OECD nations having implemented, or being in the process of implementing, policies specifically aiming to attract high-skilled migrants. The desirability of high-skilled immigrant workers, and thus the reason for the proliferation of policies aimed at attracting the highly skilled, has been well documented. Examples include spurring technological progress (Kerr and Lincoln 2010), raising productivity (Peri et al. 2015), and fostering economic growth (Boubtane et al. 2014). These changing policy objectives have been accompanied by a large rise in high-skilled migration. Between the last two census rounds, in 2000/2001 and 2010/2011, OECD countries witnessed an unprecedented 70 % rise in the number of tertiary-educated migrants to 35 million (Arslan et al. 2014).

Despite the concurrent rise in the number of high-skilled immigrants worldwide and the proliferation of policies targeting high-skilled immigrants, the effectiveness of such policies remains contested (Bhagwati and Hanson 2009). Doomernik et al. (2009) argued that attracting high-skilled migrants will likely depend on broader economic and social factors. Papadimitriou et al. (2008) coined the term "immigration package" to describe the overall basket of factors that high-skilled migrants' consider when deciding where to move.

This study examines the effectiveness of skill-selective migration policies in increasing the inflow and selection of high-skilled-labor immigrants, having accounted

[1] http://europa.eu/rapid/press-release_SPEECH-12-312_en.htm?locale=fr

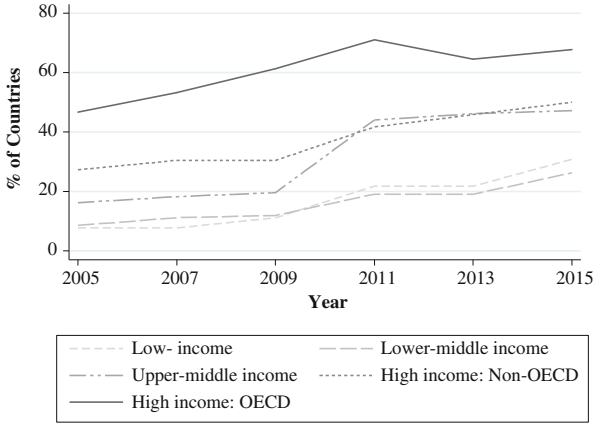

Fig. 1 Government policy objectives on high-skilled migration (% of countries aiming to *raise* high-skilled immigration). *Source:* Data from UN World Population Policies 2015 (http://esa.un.org/PopPolicy)

for a raft of economic and noneconomic factors. The empirical (pseudo-gravity) model is derived from, and consistent with, an underlying micro-founded random utility model (RUM) and is arguably the richest to date in terms of the model being well specified. It also accounts for recent innovations in the empirical literature: namely, a high proportion of zeroes in the dependent variable and multilateral resistance to migration.

The current study contributes to the literature on the determinants of international migration by being the first to examine the efficacy of policies targeting high-skilled migrants in a comparative cross-country setting. Prior cross-country studies have evaluated the effects of entire immigration regimes on *aggregate* bilateral migration flows (Czaika and de Haas 2016; Mayda 2010; Ortega and Peri 2013) or have focused on particular migration categories, such as asylum seekers (Hatton 2005, 2009; Holzer et al. 2000; Thielemann 2006; Vogler and Rotte 2000) or irregular migrants (Czaika and Hobolth 2016).

Our analysis combines three new data collections: (1) a unique data set of bilateral migration flows harmonized by skill level, (2) a novel database of unilateral policies targeting high-skilled immigrants, and (3) a third data set pertaining to other elements of the "immigration package" that includes bilateral migration policies.

The key result of this study is that supply-side policies—for example, points-based systems (PBS)—are much more effective in attracting and selecting high-skilled migrants than are demand-led policies, including job offer systems, labor market tests, and shortage lists. The provision of post-entry rights, as captured in the model by the offer of permanent residency, is effective in attracting high-skilled migrants, but overall, it reduces the human capital content of labor flows.

Theoretical Framework

Sjaastad's (1962) canonical paper laid the foundation for the modern approach to theorize migration in economics, casting potential migrants as rational maximizers of human capital investments who assess the attractiveness of potential destinations by

comparing their associated costs and benefits. The micro-founded pseudo-gravity model of international migration has since become the theoretical workhorse for understanding migrants' location decisions. The theoretical foundations of this article, derived from a RUM, are therefore largely "off the shelf" and have been detailed elsewhere (see Beine and Parsons 2015; Beine and Salomone 2013; Beine et al. 2011, 2013, 2014; Bertoli and Moraga 2013, 2015; Bertoli et al. 2013; Boeri et al. 2012; Grogger and Hanson 2011; Ortega and Peri 2013). In particular, the analysis denotes scale and selection equations (see, e.g., Beine et al. 2011; Boeri et al. 2012; Grogger and Hanson 2011; Ortega and Peri 2013).

Our *scale* equation is used to estimate *total* flows of high-skilled migrants:

$$\ln n_{odt}^{HIGH} = \beta_1\left(\ln W_{dt}^{HIGH}\right) + \beta_2(\ln A_{dt}) - \beta_3(\ln E_{dt}) - \beta_4(P_{dt}) - \beta_5(X_{od}) - \beta_6(\ln M_{odt}) - \beta_7(P_{odt}) + \delta_{ot} + \varepsilon_{odt}^{HIGH}. \quad (1)$$

Our *selection* equation, the *share* highly skilled in total migration, is rather the following:

$$\ln\left(n_{odt}^{HIGH} / \textstyle\sum_z n_{odt}^{z}\right) = \beta_1\left(\ln W_{dt}^{HIGH} - \ln W_{dt}^{AVERAGE}\right) + \beta_2(\ln A_{dt}) - \beta_3(\ln E_{dt}) - \beta_4(P_{dt}) - \beta_5(X_{od}) - \beta_6(\ln M_{odt}) - \beta_7(P_{odt}) + \delta_{ot} + \varepsilon_{odt}, \quad (2)$$

where z refers to skilled migrants (z = high (H), low (L)). The subscripts o, d, and t refer to origins, destinations, and time, respectively. W signifies wages, and A refers to countries' amenities. Migration costs are broadly conceived as comprising time-varying economic factors at destination E_{dt}, which include the prevailing unemployment rate and the total population; time-varying destination-specific migration policies P_{dt}; time-invariant bilateral factors X_{od} that include geographical factors, physical distance between origins and destinations, and whether country pairs share a common border, as well as cultural factors, common languages, or a colonial heritage; and time-varying migrant networks M_{odt}. Time-varying bilateral and multilateral policies are represented by P_{odt}. ∂ is the error term, and origin-time fixed effects, δ_{ot}, are included to control for wages and other time-variant factors at origin in addition to the proportion of natives that remain at home, all of which are unobservable in the data.

Empirical Considerations

Empirical research has operationalized migration policies in two ways. The first approach constructs policy indices that measure the restrictiveness of immigration systems (Boeri et al. 2012; Mayda 2010; Ortega and Peri 2013). Typically, a value of 0 is assigned to the index for a particular country in period 0. This value is increased or decreased by 1 should a policy in a particular year be deemed to be more or less restrictive. This approach can be used to assess how within variation in the intensity of migration policies affects migration to a specific country—what may be termed the *intensive margin*.[2]

The second approach, which we adopt in this article, is to use a binary variable that equals unity should a particular policy be in force in a specific year, or 0 if the policy is

[2] We thank an anonymous referee for this suggestion.

absent. This approach is advantageous in that variations both within and across countries can potentially be exploited, while policies can also be examined in combination. We therefore measure the average effect of a policy being in place (or not)—what may be termed the *extensive margin*.

Given that policies can be implemented to varying degrees (along the intensive margin), we code countries as having a particular policy in place (or not) based on the same criteria, in each case coded for the high-skilled migration channel that is most relevant in terms of the volume of high-skilled migrants the country admits. Given our research design, our approach necessarily glosses over some details in countries' policies, which is the inevitable trade-off between sacrificing some specificity and external validity.[3]

Although in theory we can exploit both the between and within variation in our data, we rely most heavily on the between variation given that we observe few policy changes in our data over the period, thereby precluding a more detailed examination of the intensive margin. In terms of statistical identification, we assume that migration policies targeting high-skilled migrants are essentially random, given that we have controlled for a panoply of other potential determinants as suggested by the existing literature, in addition to batteries of fixed effects along a number of dimensions. We believe that the existence of any remaining omitted variables is unlikely. This approach is inevitable given the cross-country nature of the study because no instruments will likely be available as in single-country cases. Nor is it feasible to exploit quasi-experimental designs (see, e.g., Kato and Sparber 2013; Shih 2016). To this end, we pay particular attention to obtaining data of the highest quality for our analysis while going to the greatest lengths possible to ensure that the data are comparable across countries and over time, and this approach constitutes a particular strength of the current work.

Given our empirical approach, the estimation of Eq. (1) evokes a number of empirical considerations. In their seminal paper, Santos Silva and Tenreyro (2006) showed that in log-linear models, the variance of the error term is a function of the independent variables such that the expected value of the error term will also depend on the value of the regressors. We follow Santos Silva and Tenreyro (2006), who proposed the use of the pseudo-Poisson maximum likelihood (PPML) estimator that instead results in consistent and unbiased estimates in the presence of heteroskedasticity. Additionally, the use of this estimator allows for the inclusion of zeroes in the dependent variable, which is important because our data set contains 8,168 zero-migration observations of a maximum of 23,920 observations.

Bertoli and Moraga (2015) argued that the derivation of Eq. (1) is dependent on two assumptions: (1) the utility derived from each destination varies neither across origins *nor* across individuals, and (2) the stochastic component of utility is independent and identically distributed (i.i.d.) and conforms to an extreme value type I (EVT-1) distribution. Two key implications result. First, the scale of migration from country o to country d crucially depends on the utility associated with all other possible destinations. Bertoli and Moraga (2013) coined the term *multilateral resistance to migration* (MRM). A failure to account for MRM constitutes an omitted variable bias. A number of alternatives have been proposed to deal with this potential omission (Anderson and

[3] An important ongoing innovation in this regard is the IMPALA project (Beine et al. 2015), which uses lawyers—experts on the texts of migration legislation—to code dummy variables for destination countries.

van Wincoop 2003; Bertoli and Moraga 2013; Feenstra 2004; Head et al. 2010). We adopt an alternative approach as suggested by Baier and Bergstrand (2009) to approximate the MRM terms, as first applied to the migration literature by Gröschl (2012).[4]

Second, for the model to be consistent with the underlying RUM—one that does not violate the independence of irrelevant alternatives (IIA) assumption—a set of origin-time dummy variables must be used to control for the population at origin; this requirement in turn implies that the expected value of the gross migration flow conditional on the independent variables (as well as the dummy variables) is independent across all individuals in the data set. It is important to note that the imposition of these fixed effects also controls for credit constraints, the omission of which will likely lead to alternative results (Belot and Hatton 2012).

Data

A comparison of policies targeting high-skilled migrants across countries requires new data on bilateral migration flows disaggregated by skill as well as measures of migration policies specifically targeting high-skilled migrants. Given the contested nature of the efficacy of these policies, a full battery of other potential determinants must also be considered.

Migration Flows of the Highly Skilled

Migration flow data disaggregated by skill level are some of the most seldom-recorded and most difficult to collate of any migration statistics on a comparable cross-country basis.[5] Given the heterogeneity in destination countries' recording mechanisms, the migration flow data disaggregated by skill are derived from a variety of sources, including administrative data files (Australia, Canada, Israel, New Zealand, and the United States), work or residence permits (Switzerland and the United Kingdom), population and employment registers (Norway and Sweden), and employment visas (the Republic of Korea). Given our focus on comparing migration policies across countries, significant efforts were required to collate data at the greatest level of detail possible and subsequently to harmonize the data to the greatest extent possible in order to facilitate meaningful comparisons across countries and over time. We record immigration flows by occupation pertaining to incoming economic migrants

[4] Following Gröschl (2012), the MRM terms are calculated as follows:

$$MRDIST_{odt} = \left[\left(\sum_{k=1}^{C}\theta_{kt}\ln Dist_{ok}\right) + \left(\sum_{m=1}^{C}\theta_{mt}\ln Dist_{md}\right) - \left(\sum_{k=1}^{C}\sum_{m=1}^{C}\theta_{kt}\theta_{mt}\ln Dist_{km}\right)\right]$$

$$MRADJ_{odt} = \left[\left(\sum_{k=1}^{C}\theta_{kt}Adj_{ok}\right) + \left(\sum_{m=1}^{C}\theta_{mt}Adj_{md}\right) - \left(\sum_{k=1}^{C}\sum_{m=1}^{C}\theta_{kt}\theta_{mt}Adj_{km}\right)\right].$$

θ refers to a country's share of population as a fraction of the world population: N_{kt} / N and N_{mt} / N. *Dist* stands for our measure of bilateral distances; *Adj* is a binary variable equal to 1 if two countries in a pair border each other.

[5] The data collection underpinning the current analysis took more than two years to complete and proved particularly expensive. For the sake of brevity, interested readers are referred to Czaika and Parsons (2016) for a more complete overview of the data collection.

entering destination-country labor markets. Any unemployed individuals are dropped. High-skilled migrants' dependents will not be captured in our data unless they, too, are recorded as entering destination countries' labor markets.[6] This focus on migrants entering destination countries for employment purposes is important because these are the individuals whom the relevant policies are attempting to attract.

The raw data obtained were harmonized to the greatest degree possible so that comparable cross-country estimates could be obtained. First, the flow data pertain to labor migrants arriving from abroad as opposed to those individuals that change their status in the destination country. Second, with the exception of Israel,[7] all the data refer to immigrants' nationality as opposed to their country of birth or country of last previous residence; this distinction is important because migration costs are determined (at least in part) by nationality (Beine et al. 2014). Third, the data refer to long-term or permanent migrants—that is, those staying for 12 months or more.[8] Finally, because countries use differing nomenclatures when recording individuals' occupations (Parsons et al. 2014), these data were collected at the lowest possible level of disaggregation to ensure that they could be suitably harmonized to a broad notion of human capital.[9]

Importantly, we adopt two measures of skill. The first, which we refer to as *high-skilled*, includes all those in the first three major groups of the International Standard Classification of Occupations (ISCO) 2008: (1) managers, senior officials, and legislators; (2) professionals; and (3) technicians and associate professionals. The second includes those of all other skill levels—which for the sake of simplicity, we refer to as *low-skilled*—and comprises those in all other ISCO 2008 categories. Students, entrepreneurs, and investors are dropped from the data set because our focus is on destination-country labor markets. In addition, business visitors are omitted from the data set because the period of stay and precise occupations of those individuals remain unclear. Given the great variation in detail in the data obtained, meaningfully aggregating the raw data into alternative skill classifications was not possible (see Czaika and Parsons 2016). Our data capture, on average, more than 700,000 skilled migrants per year from 185 origins who reside in 10 OECD destinations (see Table 4 in the appendix), according to our harmonized definition; the greatest number migrated in 2007, when more than 830,000 were recorded in total.[10]

Migration Policies Targeting the Highly Skilled

Labor immigration systems may be broadly termed as demand- or supply-driven (Chaloff and Lemaitre 2009). *Demand-driven systems* address rather short-term fluctuations

[6] This, of course, means that for family members who enter countries' labor markets through family reunification channels, at which point their occupations are not recorded, our estimates will represent lower bounds.

[7] The majority of immigrants arriving in Israel during the period (74 %) comprised individuals from the countries of the former Soviet Union, which is recorded as a single entity in the data set. This no doubt reduces any discrepancies between the two series.

[8] The single exception to this is our inclusion of H1-B visa data for the United States.

[9] Therefore, our estimates for countries adopting immigration policies that admit greater numbers of high-skilled migrants through on-shore channels will represent lower bounds.

[10] Although this number is somewhat artificially inflated because of the inclusion of H1-B visa data for the United States, which are based on I-94 admissions data (Czaika and Parsons 2016), the results remain robust to their inclusion and exclusion.

on labor markets and aim for immediate employability of incoming migrant labor. They often require labor migrants to have obtained a job offer before gaining entry to the domestic labor market, and employers typically take a leading role in the recruitment process. Most European systems as well as the U.S. labor immigration system are at least partly employer driven. The job offer requirement is, in effect, a general test about a foreign worker's employability in the domestic labor market. Such requirements are effective in selecting migrant workers who are immediately employable, but skilled migrants that do not fill an immediate shortage in the domestic labor market might be deterred.

Supply-driven systems are designed to address more structural and prospective labor market imbalances by fostering human capital accumulation. In these systems, highly qualified migrants can typically apply for work permits in the absence of job offers, although a job offer may still grant preferential access. Qualifications, age, work experience, language skills, and previous wages are usually assessed on an individual basis through a PBS, whereby applicants are selected independently of prevailing labor market conditions. Canada and Australia pioneered these skill-selective immigration systems, which aim to attract high-skilled migrants in large numbers. Despite any potential downside regarding the immediate employability of workers admitted through a PBS, supply-driven systems are often seen as relatively effective in attracting high-skilled migrants (Facchini and Lodigiani 2014). In fact, Boeri et al. (2012) argued that it is *only* such supply-driven systems that can meaningfully attract and capitalize on human capital over the longer term.[11]

Whether a country has implemented an employer-driven (demand) system, an immigrant-driven (supply) system, or a mixture of the two depends on policymakers' priorities when addressing long-term deficiencies in human capital compared with short-term labor market shortages (Papademetriou and Sumption 2013). In practice, despite countries leaning toward a demand- or supply-side orientation, immigration policies tend to comprise a mixture of elements, both demand and supply (Parsons et al. 2014), termed "hybrid systems" (Papademetriou et al. 2008). For example, Australia and Canada have recently begun to combine their PBS with shortage lists that constitute demand elements (Koslowski 2014).

To capture immigration policy *systems*, we choose nine policy elements that collectively capture many of the key differences between destination countries' policy stances. These instruments reflect three broader policy categories comprising skill-selective admission policies (shortage lists, job offer requirements, labor market tests, PBS), post-entry policy instruments (permanency rights, financial incentive schemes), and bilateral labor agreements specifying double taxation, diploma recognition, and social security, including pension portability.[12] It is unlikely that a single policy instrument makes a particular destination country more or less attractive for high-skilled migrants, but rather combinations of immigration policies that establish cross-country variation of immigration systems (Cerna 2009).

Besides a job offer requirement, most European immigration systems require work permit requests to be approved after a labor market test, which is a case-by-case assessment of whether equivalent domestic workers are currently available to fill advertised

[11] For a fuller discussion as to how countries conceptualize the time horizon of their migration policies, interested readers are directed to Parsons et al. (2014).

[12] See Czaika and Parsons (2016) for a more detailed description on the evolution and diffusion of these policy instruments across Western immigration destinations since 2000.

positions. Labor market tests avoid the recruitment of unemployable migrants and those who might reduce the employability of native workers. To lower the bureaucratic burden of labor market tests—particularly if it is obvious that entire occupations cannot be filled locally—countries have developed shortage lists of occupations that are exempt from labor market tests. Shortage lists encapsulate assessments of labor market shortages on an occupation-by-occupation basis, in contrast with the individual approach of a labor market test. Depending on the number and types of shortage-listed occupations, such lists can facilitate the entire recruitment process but only for those occupations for which shortages have been identified.[13]

High-skilled migrants are also hypothesized to be strongly attracted by prospects of permanent residency. Even though many high-skilled migrants begin employment on (renewable) temporary work permits, most OECD destinations currently offer a road to permanency after a migrant lives and works in the country for a number of years. Migrants who are not granted these permanency rights on arrival—those who begin on a temporary visa—are often constrained in changing the employer that originally sponsored their work permit. Financial incentives, including tax exemptions and other economic incentives, also predominantly target high-skilled migrants.[14]

Our analysis also includes bilateral policies and agreements that relate to social security, double taxation (and tax evasion), and the recognition of diplomas, all of which aim to facilitate the admission and transition of high-skilled employees. Social security agreements regulate the equality in treatment between signatories regarding payments abroad, including old age pension, pension portability, disability support, parenting payment for widowed persons, and unemployment benefits. Double-taxation agreements prevent the double taxation of income, capital, and inheritances that are increasingly important for attracting highly mobile skilled workers who may hold multiple residences, including in their home country. These agreements also seek to

[13] The accuracy of the underlying shortage analysis in identifying and assessing labor market needs has often been criticized (e.g., Sumption 2013). Therefore, the effect of a shortage list on the overall number of high-skilled immigrants is rather ambiguous, even more so when shortage lists also include occupations that require lower skill levels.

[14] Given the heterogeneity of high-skilled migration policies across countries, methodologically we adopt a set of statements against which a 0 or 1 can be assigned to ensure consistency when coding our policy variables. Our data are always coded for the most attractive and most relevant HSM policies (in terms of volumes). Thus, while glossing over some detail, we primarily aim to capture the existence of some major policy instruments of skill-selective immigration systems. For example, for a labor market test, the guiding statement is simply, "Is there a mechanism in place to attempt to ensure the position cannot be filled by domestic workers?" The remaining statements can be found in Table 5 in the appendix. Nevertheless, because destination countries typically implement numerous policies that often relate to more than one class of migrant (Czaika and de Haas 2013), we adhere to a series of coding assumptions in order to ensure that the data are comparable both across countries and over time. These assumptions can also be found in Table 5 in the appendix. The aim is thus to imagine how a migrant with full knowledge of policies views the incentives presented within policies at the point of deciding to move. In many instances, such incentives all or predominantly fall under a single visa, which offer an array of specific provisions for high-skilled migrants. In the United States for example, we select the conjunction of H1B and EB visas because few applications for EB visas are made by new arrivals. With a processing and wait time of several years for the EB2/3 categories (and only a very narrow band of applicability within EB1), such policies are unlikely to allow migrants to respond to immediate opportunities. Therefore, the EB visas alone cannot be used to characterize immediately available incentives. They might, however, factor into long-term plans, making them attractive in terms of providing possibilities for permanent residence, spousal work rights, greater scope for family reunification, and so forth. In other words, since visa switching is clearly a strategy used by skilled migrants, looking at the provisions of these two visas in conjunction makes most sense in terms of capturing the incentives available to most skilled migrants.

reduce fiscal evasion. Bilateral agreements that recognize the credentials of migrants' overseas aim to foster migrants' integration into host-country labor markets by ensuring that qualifications of migrants are of equivalence to domestic degree programs. Many countries have implemented procedures for institutionalizing assessments and for recognizing foreign diplomas and credentials.

To isolate the effect of immigration policies, we must control for treaties that facilitate the freedom of movement of people. We construct a single variable that is both bilateral and time-varying, thereby capturing whether the two members of a country pair in a particular year are signatories to a freedom-of-movement agreement. The agreements captured include the Schengen agreement; the freedom of movement afforded to member states of the European Union and the European Free Trade Association; the de facto right of abode between Australia and New Zealand; and the Common Travel Area comprising Ireland, the United Kingdom, the Isle of Man, Jersey, and Guernsey. Each unilateral (bilateral) policy variable is coded as 1 should a particular policy instrument be in place for a particular country (pair) in a given year.

Amenities and "Gravity" Variables

Total unemployment and high-skilled wage data are taken from the OECD.[15,16] High-skilled wages are calculated as average annual wages multiplied by the ratio of the 9th decile to the 5th decile. Total population data are taken from the International Database of the U.S. Census Bureau.[17] Our dyadic control for immigrant networks is taken from the OECD Database on Immigrants in OECD and non-OECD countries (DIOC),[18] which provides statistics for the numbers of immigrants residing in each of the OECD countries in 2000, 2005, and 2010. Flows from 2000 to 2004 are equated with the 2000 migration network, as captured by the bilateral stock of migrants in 2000, flows from 2005 to 2009 with the 2005 stock, and flows from 2010 to 2012 with the 2010 stock. Contiguity, common language, distance, and the sharing of a colonial heritage are all taken from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) database (see Head et al. 2010).

A number of amenity variables are included that aim to capture the relative attractiveness of the 10 OECD destinations. Our *Net-of-tax* measure captures differences in tax rates across countries. This measure is calculated by subjecting a fixed annual salary of $150,000 (in purchasing power parity terms) to the differing tax schedules as provided by the OECD.[19] Ceteris paribus, lower taxes are thought to increase the relative attractiveness of particular destinations for high-income earners.[20] The appeal of global cities, in which high-skilled migrants no doubt agglomerate, is proxied by the prevailing UN salary country multipliers in each year.[21] These multipliers are calculated based on the cost of

[15] OECD Data Unemployment: https://data.oecd.org/unemp/unemployment-rate.htm
[16] OECD Data Earnings and Wages: https://data.oecd.org/earnwage/average-wages.htm
[17] U.S. Census Bureau, International Database: http://www.census.gov/population/international/data/idb/informationGateway.php
[18] OECD Database on Immigrants in OECD and non-OECD Countries: http://www.oecd.org/els/mig/dioc.htm
[19] OECD Tax Database: http://www.oecd.org/tax/tax-policy/tax-database.htm
[20] The results do not change when alternative annual salaries of $150,000, $200,000, and $250,000 are considered.
[21] These were calculated from data available from United Nations International Civil Service Commission, Post Adjustment Reports: http://icsc.un.org/secretariat/cold.asp?include=par

living in major cities in each of the OECD destinations and reflect (among other things) the variety of goods that high-skilled migrants are able to consume as well as the urban amenities available to them. A quality-of-education variable is included by way of the Programme for International Student Assessment (PISA) scores, as provided by the OECD.[22] We hypothesize that high-skilled workers value the provision of education for their children. Finally, the level of technological development that high-skilled migrants are hypothesized to favor is proxied by the density of mobile phone use (Information and Communications Technology (ICT) coverage), measured as the number of mobile or cellular phone subscriptions per 100 inhabitants. These data are taken from the United Nations.[23] Descriptive statistics on all variables are reported in the appendix (Table 6).

Baseline Results

Table 1 reports the baseline results from estimating Eq. (1). Model 1 reports estimates of the economic and standard gravity in addition to the freedom-of-movement dummy variables. Models 2 and 3 additionally consider bilateral and unilateral policies, respectively, while Model 4 estimates all our core variables. All regressions reported in Table 1 include a full set of origin-time fixed effects to ensure the theoretical consistency of the empirical estimates.

Across the first four models, our estimates are remarkably stable. Even though all 10 destination countries are highly developed, an increase in high-skilled wages of 10 % is associated with an increase in high-skilled immigration flows of between 7 % and 11 %. High-skilled migrants include in their calculus prevailing unemployment rates and are deterred from moving to areas with fewer job opportunities. Migration networks foster high-skilled migration flows: a 10 % increase in the size of the bilateral migrant community is associated with an increase in high-skilled flows of more than 1 % along the same migrant corridor. Other migration cost-reducing factors captured by cultural, linguistic, geographical, and political proximity are all statistically significant and in the expected direction. Shared common border, language, colonial heritage, and freedom of movement between origin and destination all have a positive influence on high-skilled flows. Increasing geographical distance, however—a proxy for migration costs—naturally reduces high-skilled worker flows.

Models 2 and 4 include three major types of bilateral agreements that we assume are shaping the dynamic of high-skilled migration. Bilateral agreements aimed at recognizing foreign qualifications are associated with an increase in the number of high-skilled migrants by 30 % to 60 %. Evidence on bilateral agreements that regulate social security concerns are less robust, although we find mild evidence of a positive association in our full model. The net effect of the two countervailing forces underpinning the expected sign of the double taxation agreements variable interestingly is negative, suggesting that high-skilled individuals care more about avoiding tax than they care about being taxed only once as provided for in such agreements.

Turning to our main policy variables of interest, two of the three demand-driven instruments—the need to obtain a job offer, and shortage lists—significantly deter the

[22] OECD, PISA: http://www.oecd.org/pisa/
[23] UN Data: http://data.un.org/Default.aspx

Table 1 Drivers of high-skilled migration flows (scale equation)

	Pseudo-Poisson Maximum Likelihood				
	(1)	(2)	(3)	(4)	(5)
Destination Controls					
High-skilled wages (log)	1.069**	1.066**	0.751**	0.749**	0.657**
	(0.119)	(0.120)	(0.123)	(0.124)	(0.128)
Unemployment (log)	−0.719**	−0.695***	−0.533**	−0.482**	−0.445**
	(0.113)	(0.117)	(0.148)	(0.145)	(0.150)
Population (destination, log)	1.544**	1.519**	1.083**	0.976**	0.912**
	(0.127)	(0.132)	(0.174)	(0.172)	(0.181)
Dyadic Controls					
Network size (log)	0.130**	0.119**	0.141**	0.128**	0.125**
	(0.011)	(0.010)	(0.011)	(0.011)	(0.012)
Contiguity	0.577**	0.648**	0.317**	0.420**	0.456**
	(0.122)	(0.124)	(0.098)	(0.097)	(0.098)
Common language	0.950**	0.953**	0.878**	0.846**	0.850**
	(0.091)	(0.096)	(0.073)	(0.076)	(0.080)
Distance (log)	−0.081	−0.117*	−0.096*	−0.111*	−0.138**
	(0.055)	(0.055)	(0.046)	(0.044)	(0.046)
Colonial heritage	0.324**	0.305**	0.300**	0.216**	0.183*
	(0.057)	(0.062)	(0.061)	(0.064)	(0.080)
Freedom of movement	1.139**	1.017**	0.719**	0.552**	0.494**
	(0.135)	(0.136)	(0.120)	(0.115)	(0.116)
Bilateral Agreements					
Diploma recognition		0.305**		0.631**	0.599**
		(0.090)		(0.100)	(0.098)
Social security		−0.037		0.121*	0.117†
		(0.063)		(0.060)	(0.060)
Double taxation		−0.299**		−0.375**	−0.343**
		(0.049)		(0.048)	(0.047)
Unilateral Policies					
Permanency			1.062**	1.075**	1.193**
			(0.156)	(0.152)	(0.159)
Financial incentive			0.080	0.036	−0.192†
			(0.097)	(0.093)	(0.115)
Job offer			−1.854**	−1.896**	−1.893**
			(0.175)	(0.166)	(0.172)
Labor market test			0.169	0.143	0.113
			(0.164)	(0.159)	(0.158)
Shortage list			−0.641**	−0.699**	−0.649**
			(0.078)	(0.081)	(0.098)
Points-based system (PBS)			1.492**	1.382**	
			(0.124)	(0.117)	

Table 1 (continued)

	Pseudo-Poisson Maximum Likelihood				
	(1)	(2)	(3)	(4)	(5)
PBS (United Kingdom)					1.299**
					(0.122)
PBS (Canada)					0.959**
					(0.192)
PBS (Australia)					1.530**
					(0.183)
PBS (New Zealand)					1.507**
					(0.195)
Origin × Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	20,240	20,240	20,240	20,240	20,240
R^2	.961	.962	.969	.971	.971

Notes: Dependent variable is the total number of high-skilled individuals born in origin country *o*, living in destination country *d* at time *t* as given in Eq. (1). Standard errors are shown in parentheses.

$^{\dagger}p < .10$; $*p < .05$; $**p < .01$

absolute inflow of high-skilled migrants. Countries requiring a job offer recruit almost one-half as many high-skilled migrants. Labor market tests, however, have no influence on high-skilled migration flows in the baseline models. Shortage lists, which are even more rigid in preselecting high-skilled migrants, seem to represent an additional barrier for recruiting high-skilled migrants in large numbers.

Our main result is that PBSs appear to represent the most effective policy for attracting high-skilled migrants. Major PBS countries (Australia, Canada, New Zealand, the United Kingdom) attract, on average, 1.5 times the number of high-skilled migrants when compared with countries that adopt alternative policy tools. As opposed to the other policy measures, PBS across the destination countries might well operate differently. To address this concern, Model 5 includes separate dummy variables for PBS country—the results from which suggest that PBSs in Australia and New Zealand are the most effective.

The provision of permanency rights is also an important incentive for high-skilled migrants. Countries providing a road to permanency attract, on average, double the number of high-skilled migrants in comparison with those that do not. Permanency rights—even if permanent settlement is not the prime intention of the migrant at entry—increase the option value of staying longer in the host country and expand future opportunities. Financial incentives, such as tax breaks, are another attempt to attract international talent. The results from our baseline model suggest that such schemes have no effect, however.

Robustness Checks

Table 2 reports a series of robustness tests of the core model specification. Model 1 in Table 2 includes two MRM terms that albeit both significant do not alter the other

estimates significantly; the exception is for financial incentive schemes, which become statistically significant at the 10 % level. The estimates for these terms (negative for the distance measure and positive for the adjacency measure) are omitted for the sake of brevity. Model 2 includes dyad fixed effects to address concerns that an omitted variable—for example, cultural distance—might be driving the results. They adequately control for such an omission because, as shown by the pioneering work of Geert Hofstede (Hofstede 1980; Hofstede et al. 2010), cultural distances change extremely slowly over time. Although the addition of dyad fixed effects improves the goodness of fit, several of the other estimates become smaller in size; the social security variable is no longer significant, and the labor market test variable becomes negative and significant. Nevertheless, the key findings remain intact.

Another particular concern (as shown in Fig. 2 in the appendix) is that the policy variables fail to capture many policy *changes* over the period 2002–2012, meaning that the estimation needs to rely quite heavily on the between variation across countries. We cannot impose a set of destination fixed effects, therefore, which might lead to fears of an omitted (destination country) variable bias. To address such concerns, Model 3 in Table 2 is equivalent to the core model that includes both origin-time and destination-time fixed effects. The difference between the R^2 in Model 3 in Table 2 and the R^2 from the core Model 4 in Table 1 is only 0.1 %, however, which provides confidence that an omitted variable is not responsible for driving the results.

Model 4 in Table 2 extends the core model with the inclusion of five additional variables that proxy for the role of economic and social amenities that have traditionally been viewed as determining the relative attractiveness of potential destinations (Gosnell and Abrams 2011; Tiebout 1956). All the variables are included simultaneously, without causing any significant changes in the other variables of interest. The coefficients on the amenity variables are largely as expected. The ICT coverage variable is used to capture the degree to which a location is culturally and technologically *avant-garde* because it has been argued that a rising creative class is attracted to such places (Florida 2002). A 10 % increase in ICT coverage is associated with a nearly 9 % increase in the inflow of high-skilled workers.

The net-of-tax variable proxies the attractiveness of national tax schemes and is shown, rather unsurprisingly, to significantly attract large numbers of foreign high-skilled workers. Whereas the importance of global cities for attracting international talent is well established (e.g., Sassen 2011), rising living costs—including property prices and rents—are major disincentives to moving to those cities. The coefficient on the global city living-cost variable is insignificant and negative, however, which suggests that the cornucopia of urban amenities and available product varieties compensate for relatively high living costs.

The estimates of the coefficient on the educational sector, as measured by global PISA scores, are significantly negative. In other words, the results suggest that high-skilled workers locate to those destinations that fare relatively poorly in education. This result can be attributed to the fact that Korea, which performs best overall on the PISA, plays host to the fewest high-skilled migrants in the sample; comparatively, the United States, which performs worst overall on the PISA, plays host to the greatest number of migrants. It is also likely that high-skilled migrant workers are able to place their children in private schools, so concerns about average PISA scores across the country might not be taken into consideration when they are deciding where to move.

Table 2 Drivers of high-skilled migration flows: Robustness tests

	Pseudo-Poisson Maximum Likelihood					Generalized Method of Moments
	(1)	(2)	(3)	(4)	(5)	(6)
Destination Controls						
High-skilled wages (log)	0.830**	0.099**		0.639**	3.900**	0.208*
	(0.129)	(0.032)		(0.117)	(0.288)	(0.032)
Unemployment (log)	−0.406**	−0.164*		−0.366*	−0.887**	−0.654*
	(0.155)	(0.064)		(0.159)	(0.206)	(0.071)
Population (destination, log)	0.914**	2.561**		0.941**	1.019**	1.110*
	(0.182)	(0.166)		(0.190)	(0.217)	(0.075)
Dyadic Controls						
Network size (log)	0.142**	0.016**	0.136**	0.127**	0.101**	0.092*
	(0.012)	(0.005)	(0.010)	(0.010)	(0.008)	(0.008)
Contiguity	0.488**		0.157†	0.427**	0.169	−0.735†
	(0.103)		(0.092)	(0.096)	(0.111)	(0.334)
Common language	0.822**		0.606**	0.826**	0.714**	0.387*
	(0.079)		(0.071)	(0.077)	(0.082)	(0.078)
Distance (log)	−0.142**		−0.186**	−0.118**	−0.200**	−0.175*
	(0.045)		(0.043)	(0.046)	(0.054)	(0.064)
Colonial heritage	0.186*		0.251**	0.165*	0.302**	0.074
	(0.073)		(0.094)	(0.079)	(0.084)	(0.195)
Freedom of movement	0.402**	0.413**	0.497**	0.475**	0.380**	−0.142
	(0.119)	(0.125)	(0.117)	(0.119)	(0.139)	(0.190)
Bilateral Agreements						
Diploma recognition	0.619**	0.453**	0.727**	0.667**	0.695**	3.479*
	(0.100)	(0.051)	(0.102)	(0.099)	(0.101)	(0.571)
Social security	0.131*	−0.036	0.194**	0.109†	0.158*	−2.760*
	(0.057)	(0.070)	(0.058)	(0.057)	(0.071)	(0.602)
Double taxation	−0.375**	−0.209**	−0.332**	−0.364**	−0.269**	−0.071
	(0.047)	(0.038)	(0.046)	(0.047)	(0.055)	(0.289)
Unilateral Policies						
Permanency	1.024**	0.297**		1.344**	1.395**	0.485*
	(0.147)	(0.091)		(0.156)	(0.243)	(0.046)
Financial incentive	0.196†	0.248**		0.229**	−0.009	−0.114†
	(0.111)	(0.048)		(0.096)	(0.142)	(0.051)
Job offer	−1.797**	−2.096*		−2.110**	−1.420**	−0.069
	(0.173)	(0.828)		(0.255)	(0.192)	(0.115)
Labor market test	0.169	−0.210**		−0.086	0.172	0.617*
	(0.156)	(0.057)		(0.184)	(0.115)	(0.058)
Shortage list	−0.657**	−0.063†		−0.361**	−0.333**	−0.265*
	(0.080)	(0.033)		(0.079)	(0.086)	(0.054)
Points-based system	1.499**	2.063*		1.977**	1.192**	0.789*
	(0.119)	(0.833)		(0.220)	(0.174)	(0.131)

Table 2 (continued)

	Pseudo-Poisson Maximum Likelihood					Generalized Method of Moments
	(1)	(2)	(3)	(4)	(5)	(6)
Amenities						
ICT coverage				0.886**		
				(0.187)		
Net-of-tax				2.350**		
				(0.492)		
Global city living costs				−0.059		
				(0.045)		
Schooling quality				−7.467**		
				(2.381)		
Life expectancy				−5.710		
				(3.756)		
Multilateral Resistance to Migration Terms	Yes	No	No	No	No	No
Origin × Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Destination × Time Fixed Effects	No	No	Yes	No	No	No
Origin + Time Fixed Effects	No	No	No	No	No	Yes
Dyad Fixed Effects	No	Yes	No	No	No	No
Number of Observations	20,130	20,240	20,240	20,240	11,040	18,400
R^2	.972	.997	.972	.971	.971	.779

Notes: Standard errors are shown in parentheses. System dynamic generalized method of moments Model 6 includes AR(1): 0.170*** (standard error = 0.027). Arellano-Bond test for AR(2) in first differences fails to reject the null of no autocorrelation in errors ($p = .092$).

$^{\dagger}p < .10$; $*p < .05$; $**p < .01$

Finally, a measure of life expectancy is included in the estimation as a proxy for the overall quality of living conditions (including health services provision) in addition to other factors that affect longevity. The coefficient on this measure is insignificant, which might suggest that high-skilled migrants care more about the provision of good health care (for example) privately as opposed to average health outcomes across the country. The imposition of the amenity measures does not alter any of the results that concern economic or policy variables. Moreover, the R^2 of Model 4 in Table 2 is identical to that of the core Model 4 in Table 1, suggesting that in the empirical framework, amenities—that is, noneconomic factors—seem to play little role in determining the destination choices of high-skilled migrants.

Model 5 in Table 2 is estimated to address concerns that the results might be driven at least partly by the fact that the overarching data set is not perfectly balanced. Model 5 is therefore estimated on a reduced, although balanced, panel of dyad-year observations for the period 2003–2008. Again, the main results remain unchanged. Finally, Model 6 in

Table 2 is estimated with an Arrelano-Bond dynamic panel estimator (Roodman 2009) to insulate our results from potentially endogeneity in the policy variables otherwise not accounted for, especially reverse causality. In addition to internal lags and first-difference instruments, unionization in the destination country's labor force is included as another external instrument.[24] Unfortunately, given the large number of variables included in the system–Generalized Method of Moments (GMM) estimation, it is not possible to include a full set of origin-time fixed effects, but separate origin and time fixed effects are included—a modification might drive some of the differences in the results. Nevertheless, the major policy results based on the estimates on permanency, PBS, and shortage lists remain intact, although the coefficients on these variables become significantly smaller.[25]

The Skill Composition of International Migration Flows

Even if particular skill-selecting and skill-attracting policies are associated with larger inflows of high-skilled migrants, the overall effect on the *composition* of total labor migration flows—operationalized as the share of high-skilled in the total labor inflow—remains uncertain.

This overall effect might in part result from our definition of high-skilled migration (ISCO classification categories 1–3). At least some skill-selective policies do not solely target these occupations and may similarly apply and encourage workers of lower skill levels. Shortage lists, for example, often include occupations that are not highly skilled according to this definition. Labor market tests and job offer requirements are policy instruments that may be argued to be a priori skill-neutral, although their application largely depends on underlying labor market demand and labor shortages. Given that such shortages are generally more prevalent in high-skilled occupations, however, we may still expect that even these demand-driven policies somehow have stronger effects on high-skilled labor inflows.

Whether these skill-selective policies are effective in altering the composition of labor inflows in favor of the highly skilled remains an empirical question. Table 3 reports estimates of the proportion of high-skilled migrants in total labor migration flows (see Eq. (2)). Because this share is bounded between 0 and 1, the effects of the explanatory variables tend to be nonlinear, while the variances tend to decrease when the mean approaches the limits. We therefore estimate a zero-one inflated beta-fit model with slightly modified zero-one boundaries (Smithson and Verkuilen 2006).

Model 1 in Table 3 reports the baseline, Model 2 includes the set of bilateral policy variables, and Model 3 adds the unilateral policy variables. Model 4 simultaneously runs seemingly unrelated regressions (SUR) on high-skilled migration (Model 4a) and on non-high-skilled migration (Model 4b) to control for the cross-correlation in the

[24] Trade union density corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. See Trade Union Density - OECD.Stat: https://stats.oecd.org/Index.aspx?DataSetCode=UN_DEN

[25] As a test of reverse causality, we ran additional logit panel regressions of respective policy changes on high-skilled migration flows. Based on these tests (available from the authors on request), we can conclude that we find little to no evidence for a reverse causality of high-skilled migration inflows on the likelihood of a policy change in the expected direction. These results, in combination with the respective GMM result, give confidence that our policy estimates are consistent and do not suffer from endogeneity bias.

Table 3 High-skilled versus non-high-skilled migration flow composition (selection equation)

	Beta (1)	Beta (2)	Beta (3)	Seemingly Unrelated Regressions (4a)	Seemingly Unrelated Regressions (4b)
Destination Controls					
High-skilled wage premium (log)	1.019**	1.003**	0.946**		
	(0.049)	(0.049)	(0.057)		
High-skilled wages (log)				0.617**	
				(0.029)	
Non-high-skilled wages (log)					0.223**
					(0.038)
Unemployment (log)	–0.746**	–0.754**	–0.684**	–0.728**	0.194**
	(0.037)	(0.037)	(0.044)	(0.040)	(0.049)
Population (destination, log)	0.870**	0.879**	0.922**	1.198**	–0.083†
	(0.040)	(0.040)	(0.047)	(0.041)	(0.050)
Dyadic Controls					
Network size (log)	–0.046**	–0.050**	–0.045**	0.153**	0.229**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Contiguity	–0.261**	–0.268**	–0.265**	–0.176*	0.079
	(0.093)	(0.094)	(0.092)	(0.087)	(0.107)
Common language	–0.183**	–0.164**	–0.045†	0.492**	0.530**
	(0.024)	(0.025)	(0.025)	(0.026)	(0.032)
Distance (log)	0.004	0.010	0.074**	–0.143**	–0.187**
	(0.017)	(0.017)	(0.018)	(0.015)	(0.018)
Colonial heritage	1.371**	1.350**	1.321**	–0.097*	–1.545**
	(0.050)	(0.051)	(0.052)	(0.041)	(0.050)
Freedom of movement	–0.027	–0.102†	–0.235**	0.470**	1.180**
	(0.055)	(0.056)	(0.055)	(0.045)	(0.055)
Bilateral Agreements					
Diploma recognition		0.190**	0.204**	1.050**	0.820**
		(0.028)	(0.028)	(0.037)	(0.046)
Social security		0.036	0.082*	–0.097**	–0.111*
		(0.033)	(0.032)	(0.037)	(0.045)
Double taxation		–0.012	–0.009	0.144**	0.287**
		(0.022)	(0.022)	(0.025)	(0.031)
Unilateral Policies					
Permanency			–0.345**	0.860**	1.015**
			(0.040)	(0.029)	(0.037)
Financial incentive			0.575**	–0.114**	–0.550**
			(0.031)	(0.023)	(0.029)
Job offer			0.155*	–0.582**	–0.351**
			(0.069)	(0.046)	(0.056)

Table 3 (continued)

	Beta (1)	Beta (2)	Beta (3)	Seemingly Unrelated Regressions (4a)	Seemingly Unrelated Regressions (4b)
Labor market test			0.239**	0.328**	0.027
			(0.037)	(0.028)	(0.035)
Shortage list			–0.389**	–0.488**	0.078*
			(0.032)	(0.026)	(0.032)
Points-based system			0.238**	0.805**	0.198**
			(0.061)	(0.043)	(0.053)
Origin × Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	14,352	14,352	14,352	20,240	20,240
R^2	.115	.125	.121	.820	.730

Notes: Standard errors are shown in parentheses. R^2 for beta regressions are calculated as the squared correlation coefficient between the actual and fitted values.

$^{\dagger}p < .10$; $*p < .05$; $**p < .01$

error terms between the two groups of workers to ensure that the greatest number of observations are maintained in the data.[26]

A rising skill premium, as captured by the difference between the measure of high-skilled wages and the prevailing median salary in a particular year, significantly alters the composition of labor flows in favor of high-skilled immigrants. Although the wage gap between the 90th percentile and the mean wage was approximately 45 % in 2000, it increased to more than 63 % in 2012 across these 10 OECD destination countries. Thus, a rising skill premium shifts the skill composition of labor inflows toward higher-skilled workers, as predicted by the Roy model (Borjas 1987).

Models 1–3 in Table 3 provide evidence that high-skilled foreign workers are more sensitive to business cycle fluctuations, such that higher unemployment at destination reduces the skill selectivity of incoming migrants. It is interesting, however, that the SUR estimates show that although high-skilled migrants are significantly deterred by high unemployment, migration flows of their lesser-skilled counterparts are negatively correlated with destination unemployment levels. Migrant networks play a more important role in facilitating migration for lower-skilled workers—a result consistent with Beine et al. (2011). This finding is unsurprising given that migrant networks are purported to reduce migration costs that are relatively higher for lower-skilled workers. The existence of migrant networks may therefore alter the selection of migrants over time (see McKenzie and Rapoport 2010).

The beta-fit regressions show that flows between contiguous country pairs tend to encourage fewer high-skilled workers because low-skilled workers are more sensitive to migration costs and may take advantage of migrating to neighboring countries. Country pairs with freedom of movement also encourage larger shares of non-high-skilled workers, thereby leading to a more negative selection on skills. The results from the beta-fit

[26] When calculating the shares of the highly skilled in the total (Models 1–3), regressions cannot be run if the total number highly skilled is equal to 0 because these observations are dropped from the estimation.

regressions also suggest that longer distances between two countries increase the skill selectivity of the migration flow, which again would suggest (as the SUR estimates show) that non-high-skilled workers are more sensitive to increases in migration costs. Somewhat surprisingly, the regressions show that migration between countries that share a colonial heritage tends to be more skill-selective, and the SUR regressions show that this effect might be driven by a large deterrent effect for non-high-skilled workers. Similarly, the estimated coefficient on language in the beta-fit regressions indicates that common language reduces the selection on skills, and the SUR regressions suggest that a common language spurs the movement of non-high-skilled more than their high-skilled counterparts.[27]

With regards to migration policies, PBSs again prove the most effective in improving the incoming distribution of skills at destination. PBSs assess skill profiles and filter labor migrants according to perceived long-term skill requirements and therefore are effective instruments not only for recruiting relatively large numbers of high-skilled migrants but also for shifting the skill composition in favor of the highly skilled.

The beta-fit regression in Model 3 suggests (albeit weakly) that requiring a job offer at entry increases the skill selectivity of incoming workers. The corresponding SUR results, based on the full sample, suggest the opposite: job-offer systems deter both sets of workers—the highly skilled, worst of all—the overall effect of which would be to reduce the incoming selectivity on skills. Labor market tests are shown to increase the share of high-skilled relative to lower-skilled migrants. The SUR regressions suggest this result is due to a positive effect exerted on the high-skilled migrant flow. This finding may indicate that countries implementing labor market tests might be more successful at filling lower-skilled positions domestically, meaning that the overall skill composition of the incoming flow increases. The imposition of shortage lists, however, significantly reduces the overall selection on skills because such lists deter high-skilled migrants more than low-skilled ones. This instrument is therefore not effective in attracting highly qualified migrants because the lists often comprise occupations that are not classified as highly skilled.

The beta-fit regressions show that permanency rights reduce the overall skill selectivity of immigrant flows. The SUR results indicate that although permanency rights provide positive incentives for both high- and otherwise-skilled workers, the effect on the latter is larger, such that the overall effect is negative. Both skill groups somewhat counterintuitively seem to be deterred by financial incentive schemes. Although tax breaks and allowances are expected to be relevant in the decision of high-income earners to migrate, robust empirical support for this presumption is not found. Finally, turning to the measures of bilateral agreements, recognition of diplomas, and social security agreements, both seem to be effective in increasing the skill composition of migrant flows, while no overall effect of international double-taxation agreements is seen.

Conclusion

High-skilled migration policies are *en vogue*, in large part because of increasing demand from various businesses that lobby governments for political support in filling labor market shortages with foreign workers. The phenomenon of business-driven labor migration policies is not new, as demonstrated by the guest worker programs of the

[27] However, the SUR regressions show no significant difference of the effect of common language on skill selectivity.

1950s and 1960s. The main difference, though, is that employers increasingly demand skill sets that often require tertiary education or other highly qualified expertise—skills that cannot be fully met by domestic labor. Governments have decided to respond to these demands by implementing various types of skill-specific and skill-selective immigration regimes that facilitate the international recruitment of desired workers.

Recent policy developments demonstrate, however, an increasing hybridization of skill-selective immigration systems. Demand-driven policies coexist with supply-driven elements in an attempt to balance the conflicting aims of numbers versus employability. The main result of this article is that supply-led systems—that is, points-based systems—increase both the absolute numbers of high-skilled migrants and the skill composition of international labor flows. Conversely, demand-driven systems, which are usually based on the principle of job contingency and are often supplemented by case-by-case (labor market test) or occupation-by-occupation (shortage lists) assessments of labor market needs, are shown to have little effect—and potentially even a negative one. This general conclusion needs to be clarified, however, because the aims of these policy tools differ. Points-based systems, such as those pioneered by Canada and Australia, were initially introduced with the idea that "there can never be enough of a good thing" and implemented as population policies with the aim of achieving the large-scale immigration of skilled workers. Other countries' immigration policies—for example, those largely used across Europe—were founded on the notion of integrating migrants both economically and socially, and prioritize labor market *outcomes* over the *numbers* of migrants actually recruited.

Acknowledgments The research presented in this article is part of the Drivers and Dynamics of High-Skilled Migration (DDHSM) project, which received generous funding from the Alfred P. Sloan Foundation (Grant 2011-10-22) and KNOMAD. The authors would like to thank Laurin Janes, Sebastien Rojon, Farhan Samanani, and Lena Wettach for nothing short of exemplary research assistance. We are grateful to attendees of the DEMIG Conference, Wolfson College, Oxford, September 2014; the Drivers and Dynamics of High-Skilled Migration Workshop, Oxford Martin School, October 2014, in particular Rey Koslowski, Çağlar Özden, and Martin Ruhs; the IRES Research Seminar, Université Catholique de Louvain, February 2015, especially Frédéric Docquier and David de la Croix; and finally to the participants of the 8th International Conference on Migration and Development, World Bank, June 2015. This article also reflects comments by three anonymous reviewers received through the KNOMAD peer review process and benefited from editing by Sherrie Brown as well as two anonymous referees during the Demography peer review process.

Appendix

Table 4 List of countries and economies

Origin (185)

Afghanistan; Albania; Algeria; Andorra; Angola; Anguilla; Antigua and Barbuda; Argentina; Australia; Austria; The Bahamas; Bahrain; Bangladesh; Barbados; Belgium; Belize; Benin; Bermuda; Bhutan; Bolivia; Botswana; Brazil; British Virgin Islands; Brunei Darussalam; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Canada; Cape Verde; Cayman Islands; Central African Republic; Chad; Chile; China; Colombia; Comoros; Republic of Congo; Cook Islands; Costa Rica; Côte d'Ivoire; Cuba; Cyprus; Czechoslovakia; Democratic Republic of Congo; Denmark; Djibouti; Dominica; Dominican Republic; Ecuador; the Arab Republic of Egypt; El Salvador; Equatorial Guinea; Eritrea; Ethiopia; Falkland Islands; Federated States of Micronesia; Fiji; Finland; France; Gabon; The Gambia; Germany; Ghana; Gibraltar; Greece; Grenada; Guatemala; Guinea; Guinea Bissau; Guyana; Haiti; Honduras; Hong Kong SAR, China; Hungary; Iceland; India; Indonesia; the Islamic Republic of Iran; Iraq; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kenya; Kiribati; the Republic of Korea; Kuwait; the Lao People's Democratic Republic; Lebanon; Lesotho; Liberia; Libya; Luxembourg; Macau SAR, China; Madagascar; Malawi; Malaysia; Maldives; Mali; Malta; Marshall

Table 4 (continued)

Islands; Mauritania; Mauritius; Mexico; Mongolia; Montserrat; Morocco; Mozambique; Myanmar; Namibia; Nauru; Nepal; the Netherlands; Netherlands Antilles; New Zealand; Nicaragua; Niger; Nigeria; Niue; the Democratic Republic of Korea; Norway; Oman; Pakistan; Palau; Panama; Papua New Guinea; Paraguay; Peru; the Philippines; Poland; Portugal; Puerto Rico; Qatar; Romania; Rwanda; Saint Helena; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; San Marino; São Tomé and Príncipe; Saudi Arabia; Senegal; Seychelles; Sierra Leone; Singapore; Solomon Islands; Somalia; South Africa; Spain; Sri Lanka; Sudan; Suriname; Swaziland; Sweden; Switzerland; the Syrian Arab Republic; Taiwan, China; Tanzania; Thailand; Timor Leste; Togo; Tonga; Trinidad and Tobago; Tunisia; Turkey; Turks and Caicos Islands; Tuvalu; Uganda; the United Arab Emirates; the United Kingdom; the United States; Uruguay; USSR; Vanuatu; República Bolivariana de Venezuela; Vietnam; the Republic of Yemen; Yugoslavia; Zambia; Zimbabwe
Destination (10)
Australia, Canada, Israel, the Republic of Korea, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, the United States

Table 5 High-skilled migration policy database

Coding Rules and Definitions of Variables

- Labor Market Test: Is there a mechanism in place to attempt to ensure that the position cannot be filled by domestic workers?
- Shortage List: Is there a list of in-demand or otherwise valued occupations that is somehow incorporated into the selection process for high-skilled migrants?
- Points-Based System: Is there a selection system that grants applicants points for particular attributes and allows entry to all those over a particular threshold?
- Job Offer Contingency: Is it possible to enter the country as a high-skilled migrant without first having received a job offer?
- Permanency Rights: Are high-skilled migrants privileged in terms of obtaining permanent residence or citizenship?
- Financial Incentives: Are there special financial arrangements (such as tax exemptions, or allowances) pertaining to high-skilled migrants?

Assumptions Made When Coding

Data will always be coded for the highest level of specificity: The scope of this project was to research policies most relevant to high-skilled migrants rather than the impact of policies in general. Thus, for each indicator, the data and the resulting score are based on the policy that is most relevant to high-skilled migrants. If broader provisions (that is, those applying to a wider pool of migrants) favor high-skilled migrants but specific provisions favor them to a greater extent, the specific provision will be recorded and coded rather than the broader one. If broader provisions have effects that are relevant to high-skilled migrants but apply equally to others, they will not be coded as positive. For example, if the permanency rights of high-skilled migrants are simply through broad permanent resident routes, a policy for high-skilled migrants will not be considered to exist.

Data will always be for the most attractive and relevant (in terms of volume) high-skilled migration policies: As above, if more than one route of entry for high-skilled migrants entails significant numbers, the "most relevant" route will be the one coded for. If this route is eliminated but others remain, the coding will pertain to the next most appealing, and so on. Similarly, if more-appealing routes are newly introduced, coding will prioritize them over the previously existing routes. This means that the coding at any one time may not relate to a single route of entry; instead, the coding may reflect the most appealing route of entry. This assumption is not made if it has been judged to focus on a specific route of entry to fit with the data.

Continuity is assumed on the basis of similar conditions and legal continuity: If the conditions for high-skilled entry at two points in time are similar (and, when possible, if they can be shown to be the artifact of the same law), it will be assumed that the conditions in the intervening period between the times are also the same. Most notably, this risks missing new laws that were introduced and then revoked in the intervening period, as well as some bureaucratic reforms that may more subtly alter the entry regime.

More-detailed sources are privileged: If different sources report conflicting information, and the conflict cannot be resolved by seeking an additional, authoritative source, the source that provides the greatest level of detail will be used.

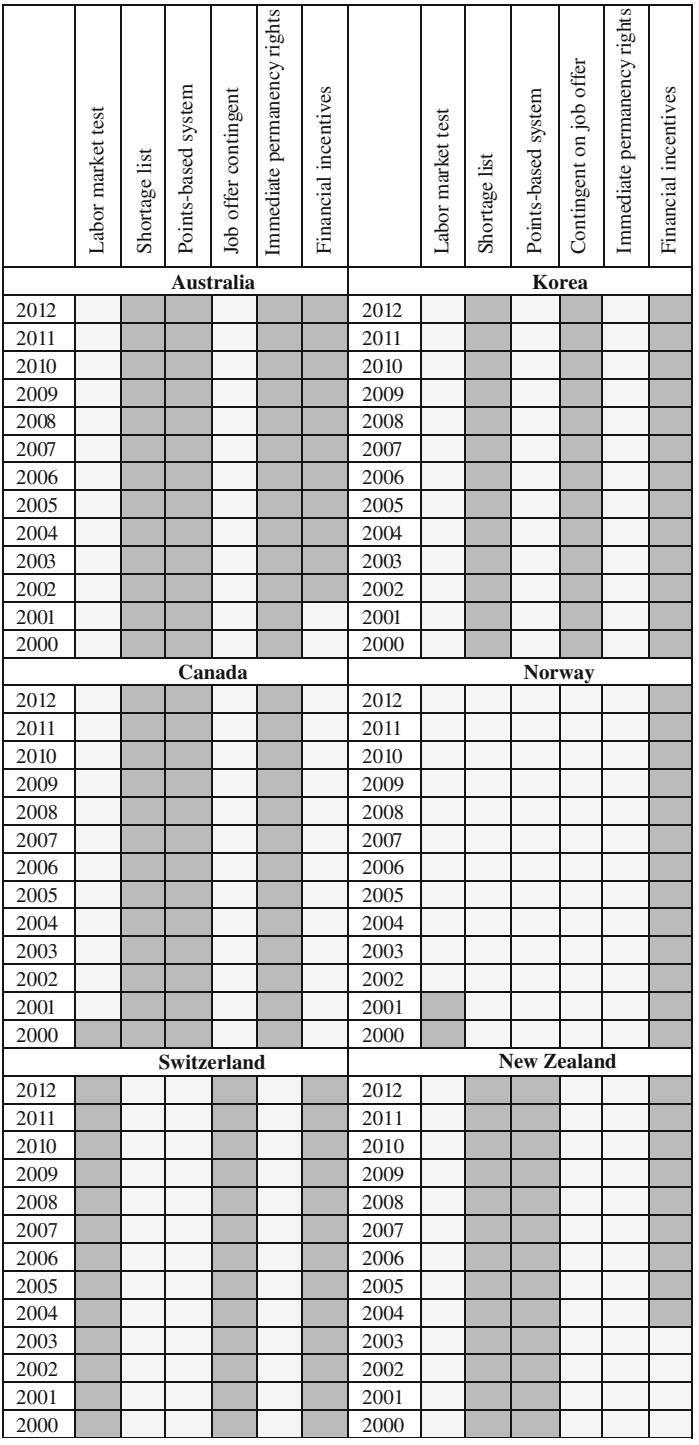

Fig. 2 High-skilled migration policies across 10 Western destinations, 2000–2012. Light gray = policy does not exist; dark gray = policy implemented

	Labor market test	Shortage list	Points-based system	Job offer contingent	Immediate permanency rights	Financial incentives
United Kingdom						
2012	■	■	■	■		
2011	■	■	■	■		
2010	■		■			
2009	■		■			
2008	■		■			
2007	■		■			
2006			■			
2005			■			
2004			■			
2003			■			
2002			■			
2001	■	■		■		
2000	■	■		■		
Israel						
2012	■			■		
2011	■			■		
2010	■			■		
2009	■			■		
2008	■			■		
2007	■			■		
2006	■			■		
2005	■			■		
2004	■			■		
2003	■			■		
2002				■		
2001				■		
2000				■		

	Labor market test	Shortage list	Points-based system	Contingent on job offer	Immediate permanency rights	Financial incentives
Sweden						
2012	■			■	■	■
2011	■			■	■	■
2010	■			■	■	■
2009	■			■	■	■
2008	■			■	■	■
2007	■			■	■	■
2006	■			■	■	■
2005	■			■	■	■
2004	■			■	■	■
2003	■			■	■	■
2002	■			■	■	■
2001	■			■	■	■
2000	■			■	■	■
United States						
2012	■			■	■	
2011	■			■	■	
2010	■			■	■	
2009	■			■	■	
2008	■			■	■	
2007	■			■	■	
2006	■			■	■	
2005	■			■	■	
2004	■			■	■	
2003	■			■	■	
2002	■			■	■	
2001	■			■	■	
2000	■			■	■	

Fig. 2 (continued)

Table 6 Descriptive statistics

Variable	Number of Observations	Mean	SD	Min.	Max.
Bilateral Migration Flows					
High-skilled migrants	21,712	427.499	3,988.527	0	176,722
Non-high-skilled migrants	21,712	347.573	1,898.019	0	43,012
Destination Controls					
High-skilled wages	22,080	82,790.530	65,924.9	46,029	770,581
Unemployment	23,920	1,482.401	2,898.607	58	14,827
Population (destination)	23,920	5.16e+07	8.94e+07	3,164,550	3.14e+08
Dyadic Controls					
Network size	23,920	30,617.620	260,435.8	0	1.19e+07
Distance	23,920	8,869.417	4,482.842	115	19,648
Contiguity	23,920	0.010	0.098	0	1
Common language	23,920	0.261	0.439	0	1
Colonial heritage	23,920	0.053	0.223	0	1
Freedom of movement	23,920	0.063	0.243	0	1
Bilateral Agreements					
Diploma recognition	23,920	0.168	0.374	0	1
Social security	23,920	0.083	0.276	0	1
Double taxation	23,920	0.249	0.432	0	1
Unilateral Policies					
Permanency	23,920	0.846	0.361	0	1
Financial incentive	23,920	0.554	0.497	0	1
Job offer	23,920	0.469	0.499	0	1
Labor market test	23,920	0.462	0.499	0	1
Shortage list	23,920	0.462	0.499	0	1
Points-based system	23,920	0.385	0.487	0	1
Amenities					
ICT coverage	23,920	4.482	0.315	3.383	4.915
Net-of-tax	23,920	11.607	0.119	11.352	11.844
Global city living costs	23,920	3.606	0.962	0	4.698
Schooling quality	23,920	6.229	0.050	6.098	6.297
Life expectancy	22,080	4.393	0.019	4.342	4.456

References

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review, 93,* 170–192.

Arslan, C., Dumont, J.-C., Kone, Z., Moullan, Y., Parsons, Ç., Özden, C., & Xenogiani, X. (2014). *A new profile of migrants in the aftermath of the recent economic crisis* (OECD Social, Employment and Migration Working Paper No. 160). Paris, France: OECD.

Artuç, E., Docquier, F., Özden, C., & Parsons, C. (2014). A global assessment of human capital mobility: The role of non-OECD destinations. *World Development, 65,* 6–26.

Baier, S. L., & Bergstrand, J. H. (2009). Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics, 77,* 77–85.

Beine, M., Bertoli, S., & Moraga, J. F.-H. (2014). *A practitioners' guide to gravity models of international migration* (Working Paper No. 2014–03). Madrid, Spain: FEDEA.

Beine, M., Bricongne, J.-C., & Bourgeon, P. (2013). *Business cycles and international migration among OECD countries* (CESifo Working Paper No. 4379). Munich, Germany: CESifo Group.

Beine, M., Burgoon, B., Crock, M., Gest, J., Hiscox, M., McGovern, P. , . . . Schapers, J. (2015). Comparing immigration policies: An overview from the IMPALA database. *International Migration Review.* Advance online publication. doi:10.1111/imre.12169

Beine, M., Docquier, F., & Özden, Ç. (2011). Diasporas. *Journal of Development Economics, 95,* 30–41.

Beine, M., & Parsons, C. (2015). Climatic factors as determinants of international migration. *Scandinavian Journal of Economics, 117,* 723–767.

Beine, M., & Salomone, S. (2013). Network effect in international migration: Does education matter more than gender? *Scandinavian Journal of Economics, 115,* 354–380.

Belot, M. V. K., & Hatton, T. J. (2012). Immigrant selection in the OECD. *Scandinavian Journal of Economics, 114,* 1105–1128.

Bertoli, S., Brücker, H., & Moraga, J. F.-H. (2013). *The European crisis and migration to Germany: Expectations and the diversion of migration flows* (IZA Discussion Paper No. 7170). Bonn, Germany: Institute for the Study of Labor.

Bertoli, S., & Moraga, J. F.-H. (2013). Multilateral resistance to migration. *Journal of Development Economics, 102*(C), 79–100.

Bertoli, S., & Moraga, J. F.-H. (2015). The size of the cliff at the border. *Regional Science and Urban Economics, 51,* 1–6.

Bhagwati, J., & Hanson, G. (2009). *Skilled immigration today: Prospects, problems, and policies*. Oxford, UK: Oxford University Press.

Boeri, T., Brücker, H., Docquier, F., & Rapoport, H. (Eds.). (2012). *Brain drain and brain gain: The global competition to attract high-skilled migrants*. Oxford, UK: Oxford University Press.

Borjas, G. (1987). Self-selection and the earnings of immigrants. *American Economic Review, 77,* 531–553.

Boubtane, E., Dumont, J.-C., & Rault, C. (2014). *Immigration and economic growth in the OECD countries, 1986–2006* (IZA Discussion Paper No. 8681). Bonn, Germany: Institute for the Study of Labor.

Cerna, L. (2009). The varieties of high-skilled immigration policies: Coalitions and policy outputs in advanced industrial countries. *Journal of European Public Policy, 16,* 144–161.

Chaloff, J., & Lemaitre, G. (2009). *Managing highly-skilled labour migration: A comparative analysis of migration policies and challenges in OECD countries* (OECD Social, Employment and Migration Working Paper DELSA/ELSA/WD/SEM(2009)5). Paris, France: OECD Publishing.

Czaika, M., & de Haas, H. (2013). The effectiveness of immigration policies. *Population and Development Review, 39,* 487–508.

Czaika, M., & de Haas, H. (2016). The effect of visas on migration processes. *International Migration Review.* Advance online publication. doi:10.1111/imre.12261

Czaika, M., & Hobolth, M. (2016). Do restrictive asylum and visa policies increase irregular migration into Europe? *European Union Politics, 17,* 345–365.

Czaika, M., & Parsons, C. R. (2016). *High skilled migration in times of global economic crisis* (IMI Working Paper No.126). Oxford, UK: International Migration Institute, Oxford University.

Doomernik, J., Koslowski, R., & Thränhardt, D. (2009). *The battle for the brains: Why immigration policy is not enough to attract the highly skilled* (Brussels Forum Paper). Washington, DC: German Marshall Fund of the United States.

Facchini, G., & Lodigiani, E. (2014). Attracting skilled immigrants: An overview of recent policy developments in advanced countries. *National Institute Economic Review, 229,* R3–R21.

Feenstra, R. (2004). *Advanced international trade: Theory and evidence*. Princeton, NJ: Princeton University Press.

Florida, R. L. (2002). *The rise of the creative class: And how it's transforming work, leisure, community and everyday life*. New York, NY: Basic Books.

Gosnell, H., & Abrams, J. (2011). Amenity migration: Diverse conceptualizations of drivers, socioeconomic dimensions, and emerging challenges. *GeoJournal, 76,* 303–322.

Grogger, J., & Hanson, G. H. (2011). Income maximization and the selection and sorting of international migrants. *Journal of Development Economics, 95,* 42–57.

Gröschl, J. (2012). Climate change and the relocation of population. *Beiträge zur Jahrestagung des Vereins für Socialpolitik 2012:* Neue Wege und Herausforderungen für den Arbeitsmarkt des 21. Jahrhunderts - Session: Migration II, No. D03-V1.

Hatton, T. J. (2005). European asylum policy. *National Institute Economic Review, 194,* 106–119.

Hatton, T. J. (2009). The rise and fall of asylum: What happened and why? *Economic Journal, 119,* F183–F213.

Head, K., Mayer, T., & Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of International Economics, 81,* 1–14.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Newbury Park, CA: Sage Publications, Inc.

Hofstede, G., Hofstede, J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind* (3rd ed.). New York, NY: McGraw-Hill Professional.

Holzer, T., Schneider, G., & Widmer, T. (2000). The impact of legislative deterrence measures on the number of asylum applications in Switzerland (1986–1995). *International Migration Review, 34,* 1182–1216.

Kapur, D., & McHale, J. (2005). *Give us your best and brightest: The global hunt for talent and its impact on the developing world*. Washington, DC: Center for Global Development.

Kato, T., & Sparber, C. (2013). Quotas and quality: The effect of H1-B visa restrictions on the pool of prospective undergraduate students from abroad. *Review of Economics and Statistics, 95,* 109–126.

Kerr, W. R., & Lincoln, W. F. (2010). The supply side of innovation: H-1B visa reforms and US ethnic invention. *Journal of Labor Economics, 28,* 473–508.

Koslowski, R. (2014). Selective migration policy models and changing realities of implementation. *International Migration, 52,*(3) 26–39.

Mayda, A. M. (2010). International migration: A panel data analysis of the determinants of bilateral flows. *Journal of Population Economics, 23,* 1249–1274.

McKenzie, D., & Rapoport, H. (2010). Self-selection patterns in Mexico-U.S. migration: The role of migration networks. *Review of Economics and Statistics, 92,* 811–821.

Ortega, F., & Peri, G. (2013). The effect of income and immigration policies on international migration. *Migration Studies, 1,* 47–74.

Papademetriou, D. G., Somerville, W., & Tanaka, H. (2008). *Talent in the 21st-century economy* (Transatlantic Council on Migration report). Washington, DC: Migration Policy Institute.

Papademetriou, D. G., & Sumption, M. (2013). *Attracting and selecting from the global talent pool—Policy challenges* (report). Washington, DC: Migration Policy Institute.

Parsons, C., Rojon, S., Samanani, F., & Wettach, L. (2014). *Conceptualising international high-skilled migration* (IMI Working Paper No. 104). Oxford, UK: International Migration Institute, Oxford University.

Peri, G., Shih, K., & Sparber, C. (2015). STEM workers, H1B visas and productivity in US cities. *Journal of Labor Economics, 33,* S225–S255.

Roodman, D. (2009). *How to do xtabond2: An introduction to difference and system GMM in Stata* (Working Paper No. 103). Washington, DC: Center for Global Development.

Santos Silva, J. M. C., & Tenreyro, S. (2006). The log of gravity. *Review of Economics and Statistics, 88,* 641–658.

Sassen, S. (2011). *Cities in a world economy* (4th ed.). Thousand Oaks, CA: Sage Publications.

Shih, K. (2016). Labour market openness, H1-B visa policy, and the scale of international student enrollment in the United States. *Economic Inquiry, 54,* 121–138.

Sjaastad, L. A. (1962). The costs and returns of human migration. *Journal of Political Economy, 70*(5, Part 2), 80–93.

Smithson, M., & Verkuilen, J. (2006). A better lemon squeezer? Maximum likelihood regression with beta-distributed dependent variables. *Psychological Methods, 11,* 54–71.

Sumption, M. (2013). The elusive idea of labor-market "shortages" and the U.S. approach to employment-based immigration policy. In M. Fix, D. G. Papademetriou, & M. Sumption (Eds.), *Immigrants in a changing labor market* (pp. 93–121). Washington, DC: Migration Policy Institute.

Thielemann, E. R. (2006). The effectiveness of governments' attempts to control unwanted migration. In C. Parsons & T. M. Smeeding (Eds.), *Immigration and the transformation of Europe* (pp. 442–472). Cambridge, UK: Cambridge University Press.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy, 64,* 416–424.

Vogler, M., & Rotte, R. (2000). The effects of development on migration: Theoretical issues and new empirical evidence. *Journal of Population Economics, 13,* 485–508.