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Immigration Economics by George J. Borjas: A Review Essay†

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We review Immigration Economics *by George J. Borjas, published in 2014 by Harvard University Press. The book is written as a graduate-level textbook, and summarizes and updates many of Borjas's important contributions to the field over the past thirty years. A key message of the book is that immigration poses significant costs to many members of the host-country labor market. Though the theoretical and econometric approaches presented in the book will be very useful for students and specialists in the field, we argue that the book presents a one-sided view of immigration, with little or no attention to the growing body of work that offers a more nuanced picture of how immigrants fit into the host-country market and affect native workers.* (*JEL* A22, J11, J24, J31, J61, R23)

1. *Introduction*

George Borjas is the leading economic scholar on immigration. Over the past three decades, he has authored or coauthored dozens of papers that have opened up new lines of investigation and helped frame the way that economists think about immigration. He has also written two previous books on the topic—*Friends or Strangers? The Impact of Immigrants on the US Economy* in 1990, and *Heaven's Door: Immigration Policy and the American Economy* in 1999—and contributed important reviews to the *Journal of Economic Literature* and the *Handbook of Labor Economics*.

Borjas's new book, *Immigration Economics* (hereafter, *IE*), summarizes much of his past work, updating the empirical work in some of his seminal papers and addressing concerns that have been raised by other researchers (including us). *IE* is written as a graduate-level textbook, carefully laying out a series of neoclassical models and describing empirical methods in detail. It takes a technical/pedagogical approach, with comprehensive footnotes and appendixes and extended discussions of problems like imputation error and attenuation bias. It very rarely talks about policy implications and never takes a political stand. This is a book for scholars and advanced students of economics, rather than policy makers or the general public. Because of this focus, *IE* has the potential to serve as a reference for those interested in understanding the state of the art in the modeling and statistical analysis of many immigration-related issues.

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The contents of the book's nine chapters, and their relationship to Borjas's previous work, are summarized in table 1. Apart from chapter 3, which is entirely theoretical, each chapter is focused around one or two key substantive questions, typically starting with a simple model, then presenting some basic descriptive evidence, and ultimately discussing detailed tables of econometric estimates.[1] As is clear from table 1, *IE* focuses almost exclusively on the labor market, specifically on understanding the determinants of immigrants' earnings (chapters 1 and 2), their children's earnings (chapter 9), and the impacts of immigrant arrivals on native earnings (chapters 3–8). Each chapter is based on one or two of Borjas's earlier papers. Readers who are familiar with the earlier papers will find that the story has not changed, though the model presentation in *IE* is streamlined (and sometimes generalized), the empirical analysis is often updated, and there is some discussion of the intervening literature.

The main achievement of *IE* is its comprehensive perspective on the labor market aspects of immigration. In the introduction of the book, Borjas describes his central theme as this:

> *. . . immigration has consequences, and these consequences generally imply that some people lose while others benefit. . .* (p. 4).

As a glance at the third column of table 1 suggests, this theme is particularly clear in the core chapters on labor-market impacts, where Borjas's theoretical model (chapter 3), descriptive evidence (chapter 4), baseline simulations (chapter 5), and case studies of high-skilled immigration (chapter 8) all underscore the *costs* of immigration for competing native workers.

Given the central importance that Borjas attaches to the issue of labor-market impacts, in this review we concentrate on these core chapters. The modeling and interpretation of labor-market impacts is an area where economics is most in need of consensus, where simple correlations can help us understand the data, and where the lessons from the analysis of immigration have the strongest spillovers to other fields, including urban economics and productivity analysis. This is also the main area where our own research on immigration has been focused.

2. *Descriptive Correlations*

A significant part of *IE* is taken up with basic descriptive correlations between the presence of immigrants and the labor-market outcomes of natives. Chapter 4 is entirely devoted to documenting these correlations; they also fill a substantial share of chapter 6. These correlations shape Borjas's structural modeling choices and frame his discussion of the literature. Therefore, it is important to understand the specific correlations that he chooses to focus on.

2.1 *What Are the Descriptive Correlations of Interest?*

Although one might hope that analysts could agree on the basic correlations that need to be explained by a successful model of immigrant impacts, this is not the case. Rather, differences in opinion over the descriptive correlations of interest have been central to the ongoing debate in the literature about the wage effects of immigration and the impact of immigrants on native mobility.[2] Since this is the area where we have the most

[1] The models in *IE* are not "structural" in the modern sense of providing a complete specification of the data generating process for the data under consideration. Rather, Borjas specifies a simple model—e.g., an aggregate production function—and then estimates equations that can be interpreted as stochastic approximations of the relations implied by the model.

[2] See Peri and Sparber (2011) for a discussion in the context of mobility responses to immigration. See also Card and DiNardo (2000).

TABLE 1
SUMMARY OF CHAPTER CONTENT: IMMIGRATION ECONOMICS

Chapter and related articles	Main questions	Answers
"Chapter 1: The Selection of Immigrants," Borjas (1987, 2008)	a. Do men who immigrate to the United States have above- or below-average potential earnings, relative to others from the same source country?	a. US immigrants are typically negatively selected—more likely to come from the bottom than the top of the distribution.
	b. How large are implicit costs of migration?	b. Very large.
"Chapter 2: Economic Assimilation," Borjas (1985, 1995a)	a. At arrival to the United States, how much less do immigrant men earn than natives? Is the gap bigger for recent cohorts?	a. New immigrants earn less than natives. Gap is bigger for recent cohorts, mainly because of rising returns to education.
	b. In their first ten years in the United States, how much do average earnings of immigrant men rise? Is the rate of increase smaller for recent cohorts?	b. Immigrant earnings rise relatively slowly. The rate of increase is particularly low for more recent arrival cohorts.
"Chapter 3: Immigration and the Wage Structure: Theory," Borjas (2003)	How does immigration affect wages in the short run (with fixed capital) and in the long run (with a fixed return to capital)?	In the short run, immigration lowers wages. In the long run, it may or may not affect average wages, but it lowers the relative wage of groups with higher inflow rates.
"Chapter 4: The Wage Effects of Immigration: Descriptive Evidence," Borjas (2003)	a. What is the partial correlation between wages and the share of immigrants in a group?	a. Uniformly negative, but varying in magnitude.
	b. How does this correlation vary with the level of aggregation: cities, states, divisions, or the national level?	b. More negative at higher levels of aggregation.
"Chapter 5: The Wage Effects of Immigration: Structural Estimates," Borjas (2003)	a. What are the simulated effects of immigrant arrivals from 1990 to 2010 on the wages of different education groups from a baseline model?	a. Largest effect on high-school dropouts: −6 percent, assuming no capital accumulation; −3 percent, assuming fixed return to capital.
	b. Should the baseline model account for imperfect substitutability between immigrants and natives with similar skills?	b. Possibly.
	c. Should the baseline model allow for perfect substitutability between high-school graduates and dropouts?	c. Possibly.
"Chapter 6: Labor Market Adjustments to Immigration," Borjas, Freeman, and Katz (1996); Borjas (2006)	a. Do natives in a given age/education group move away when there is a higher share if immigrants in their group in the local market?	a. Yes. Native mobility rates across cities and states are relatively sensitive to immigrant shares.
	b. Do firm investments vary with the local immigration rate of low-skilled workers?	b. Yes. Firm investment choices are relatively sensitive to the shares of low-skilled immigrants in their local markets.

Continued

TABLE 1
Summary of Chapter Content: Immigration Economics (*Continued*)

Chapter and related articles	Main questions	Answers
"Chapter 7: The Economic Benefits of Immigration," Borjas (1995b)	What are the net effects of immigration on US income?	Small positive gain (assuming fixed return to capital).
"Chapter 8: High-Skilled Immigration," Borjas (2009); Borjas and Dorn (2012)	Are there positive spillover effects from high-skilled immigration that offset the basic negative impacts?	High-skilled immigrants lower wages and opportunities for high-skilled natives. No evidence of positive spillovers.
"Chapter 9: The Second Generation," Borjas (1992, 1993)	a. Do US-born male children of immigrants earn more than third- and higher-generation natives? Is the gap smaller for recent cohorts?	a. US-born children of immigrants earn more than other natives, but the gap is smaller today than in the past.
	b. How strong is the intergenerational correlation between immigrant fathers and their US-born sons?	b. The intergenerational correlation is high (at least 0.5). This is due, in part, to ethnic capital, which limits intergenerational progress for many subgroups.

Source: Authors' summary of *Immigration Economics*.

reservations about the material presented in *IE*, we begin by describing in some detail our differences of opinion with Borjas.

Most modern empirical studies of immigrant impacts begin by assuming that immigrants and natives can be classified into a relatively small number of skill groups, and proceed to model immigration as a shift in the supply of different types of labor. This is precisely the starting point of the theoretical analysis in chapter 3 of *IE*, where Borjas (equation 3.8) defines the relative shift in the supply of labor of skill group i due to immigration as:

$$(1) \qquad m_i = \frac{dL_i}{L_i},$$

where L_i represents the size of the initial labor force of type i workers and dL_i is the change in this type of workers due to immigration. As Borjas shows in this thorough but concise chapter, with constant returns-to-scale in the aggregate production function, the impacts of immigrant inflows are entirely a function of these relative supply shifts.

In light of this theoretical framework, it seems most natural (to us) to develop descriptive evidence relating native labor-market outcomes to the empirical analogues of these supply shifts.[3] Specifically, if we let M_{it} represent the number of immigrant workers in skill group i in a given labor market in year t, and let N_{it} represent the corresponding number of native workers, the empirical equivalent of (1), measured in discrete time-changes between census years $t-10$ and t, is:

$$(2) \qquad m_{it} = \frac{M_{it} - M_{it-10}}{N_{it-10} + M_{it-10}} = \frac{\Delta M_{it}}{L_{it-10}}.$$

[3] Consistent with this reasoning, in chapter 4 Borjas defines the "relevant wage elasticity" from his descriptive models as the derivative of the log wage of a given skill group with respect to the "immigration-induced percent increase in the labor supply of [the] group" (p. 85).

A straightforward descriptive analysis based on (2) can be conducted by relating the changes in the measured outcomes of natives of a given skill group in a given labor market to their corresponding supply shocks due to immigration:

$$(3)\quad \Delta y_{it} = y_{it} - y_{it-10} = \textit{fixed effects}\,(\textit{time}, \textit{skill group}) + \beta^{m} m_{it} + \eta_{it},$$

where *"fixed effects (time, skill group)"* refers to a series of controls for the time period and skill group under consideration.

In contrast to this approach, throughout the different chapters of *IE,* Borjas relates the outcomes of native workers to the *fraction of immigrants* in their skill group and labor market in year t:

$$(4)\qquad p_{it} = \frac{M_{it}}{N_{it} + M_{it}}.$$

This choice was used in Borjas (2003) and several subsequent papers (Borjas 2006, 2009; Aydemir and Borjas 2007) and by other economists whose work is cited in chapter 4 of *IE*, including Bonin (2005), Bratsberg et al. (2014), and Steinhardt (2011). Rather than relating the changes in labor-market outcomes of natives to the corresponding immigrant-induced supply changes, Borjas fits descriptive models of the form:

$$(5)\ y_{it} = \textit{fixed effects}\,(\textit{market}, \textit{time}, \textit{skill group}) + \beta^{p} p_{it} + \upsilon_{it},$$

where the set of fixed effects is expanded to include controls for the labor market under consideration.

With market-specific fixed effects, estimates based on equation (5) are approximately equivalent to estimating first differenced models in which the key dependent variable is the *change* in the fraction of immigrants in a given skill group and labor market:[4]

$$(6)\quad \Delta y_{it} = \textit{fixed effects}\,(\textit{time}, \textit{skill group}) + \beta^{p} \Delta p_{it} + \Delta \upsilon_{it}.$$

Superficially, this looks a lot like equation (3), and one might be tempted to think that the two specifications are roughly equivalent. Unfortunately, that is not the case, and the difference leads to dramatically different conclusions about the descriptive correlations between immigrant inflows and native labor-market outcomes, as we document below.

To understand the reasons for the difference, consider the first-order approximation to the change in the ratio p_{it}:

$$(7)\ \Delta p_{it} \approx (1 - p_{it-10})\,\frac{\Delta M_{it}}{L_{it-10}} - p_{it-10}\,\frac{\Delta N_{it}}{L_{it-10}}.$$

To first order, the change in the immigrant share is a weighted average of the immigrant-driven supply shock $\left(\frac{\Delta M_{it}}{L_{it-10}}\right)$ and the change in the number of *native workers* in skill group i, divided by the lagged size of the group $\left(\frac{\Delta N_{it}}{L_{it-10}}\right)$.[5] Since native labor-market outcomes are on the left-hand side of equation (6), it is extremely important not to confound these native supply

[4] With only two periods, including market-specific fixed effects or first differencing within, markets are exactly equivalent. With more periods, the first differences specification is somewhat more flexible, but would be expected to yield similar estimates of the key coefficient β^{p}.

[5] Equation (7) is only a first-order approximation. Hence it is more accurate for small changes. For many US labor markets over ten year intervals, like those analyzed in *IE*, large changes occurred, in which case a second-order term (incorporating interactions of the changes in native and immigrant workers) is needed. Omission of this second-order term will lead to additional biases.

changes with the immigrant supply shocks that are the fundamental exogenous variables of interest.

A particularly troublesome source of correlation can arise if changes in the number of native workers in a given skill group are positively correlated with changes in their wages. Such a positive correlation will arise naturally if there are relative-demand shocks in a given market that raise wages and draw in new native workers. It is precisely because of concerns over these types of shocks, which can lead to a *positive bias* in the partial correlation between native wages and immigrant inflows, that researchers have attempted to devise instrumental variables for the relative inflow rate of immigrants to different labor markets (e.g., Altonji and Card 1991; Card 2001). Ironically, by using p_{it} as the measure of immigrant market pressure, this positive bias leads to a negative bias in the descriptive partial correlations presented in chapter 4 of *IE*. This bias will be larger, the larger the initial share of immigrants in the labor market, p_{it-10}.

Even more alarming is the spurious correlation induced by this specification for the native-mobility models presented in chapter 6 of *IE*. In these models (reported in table 6.1), the *dependent variable* is the change in the number of natives in a given skill group, or the component of the change attributable to out-migration or in-migration. Essentially, these models are equivalent to specifications like:

$$(8) \quad \frac{\Delta N_{it}}{L_{it-10}} = \textit{fixed effects} + \beta^p \, \Delta p_{it} + \theta_{it}.$$

In light of equation (7), however, the dependent variable is mechanically negatively correlated with the independent variable. As we show in the next section, the resulting estimates bear little relationship to estimates from the more appropriate specification with the immigrant-driven supply shock m_{it} as the explanatory variable.

The same issue spills over to some of Borjas's structural estimates. Specifically, in chapter 6 of *IE*, he presents a behavioral model of location decisions by native workers. The dependent variable of the main estimating equation (equation 6.5) is the change in the number of native workers in a given skill group, standardized by the initial supply of labor in this skill group. The key independent variable is the cumulated change in the number of immigrants in the same skill group, standardized by the initial supply of labor in the skill group—i.e., m_{it}. Rather than estimating this specification, however, Borjas estimates a version of equation (8). In other words, despite the fact that his theoretical model specifically relates native inflows and outflows to m_{it}, he actually uses Δp_{it}.

2.2 *Estimated Descriptive Correlations*

With this background, we turn to a simple comparison of the descriptive correlations that arise using either the immigrant inflow measure m_{it} or the immigrant skill share p_{it}. This exercise is facilitated by the fact that Borjas has helpfully posted online many of the data sets used in the core chapters of *IE*, as well as the programs that are used to create many of the tables in *IE*.[6]

Table 2 shows how the switch in defining the correlation of interest affects the sign and magnitude of the descriptive correlation between immigrant inflows and native wages. Row 1 of the table reproduces the specifications for male workers reported in tables 4.2 and 4.5 of *IE* corresponding to estimates of equation (5) above. As emphasized by Borjas, there are two salient features of these partial correlations. First, they are all negative and statistically significant, suggesting that regardless of the level of

[6] We are also making available the codes and data (modified from *IE*) used to obtain our results. They can be accessed at the website of the *Journal of Economic Literature.*

TABLE 2
LONGITUDINAL SPATIAL CORRELATIONS BETWEEN IMMIGRATION AND NATIVE-MALE WAGES: REPRODUCTION AND EXTENSION OF TABLES 4.2 AND 4.5 IN *IMMIGRATION ECONOMICS*

	Definition of regional labor market			
Specification and explanatory variable	Metropolitan area	State	Census division	National
1. Borjas's specification: immigrant share in levels (p_{it}) (table 4.2, row 1 and table 4.5, col. 1)	−0.058 (0.018)	−0.186 (0.029)	−0.237 (0.048)	−0.529 (0.102)
2. Change in immigrant share (Δp_{it})	−0.029 (0.011)	−0.058 (0.024)	−0.106 (0.043)	−0.237 (0.118)
3. Immigrant inflow (m_{it})	0.036 (0.010)	0.049 (0.019)	0.022 (0.032)	−0.124 (0.132)
4. Contribution of native inflows to change in immigrant share ($-p_{it-10}\,\Delta N_{it}/L_{it-10}$)	−0.102 (0.024)	−0.123 (0.033)	−0.135 (0.047)	0.078 (0.114)

Notes: See notes to *IE*, tables 4.2 and 4.5. Standard errors, clustered by skill group/region level (columns 1–3) and by skill group (column 4), in parentheses. Metro-area models use data on male workers in five education groups and eight experience groups from 1980, 1990, 2000 Censuses and 2009–11 American Community Survey (42,770 observations). State, division, and national models add data from 1960 and 1970 Censuses (12,215 observations at the state level, 2,160 at the division level, 240 at the national level). Coefficients in row 1 are obtained by regressing the logarithm of native wages on the immigrant share of labor in the skill group controlling for skill-time, area-time, and area-skill fixed effects. Coefficients in row 2 are obtained by regressing the change in the logarithm of native wages on the change of the immigrant share in the skill group and including skill-time and area-time fixed effects. Coefficients in row 3 are obtained by regressing the change in the logarithm of native wages on the inflow of immigrants in the skill group over the past decade (m_{it}) including skill-time and area-time fixed effects. Coefficients in row 4 are obtained regressing the change in the logarithm of native wages on the contribution of native inflows to the change in immigrants share and including skill-time and area-time fixed effects.

aggregation used to define labor markets, a greater immigrant presence is associated with lower native wages. Second, the correlations are more negative at higher levels of aggregation, leading Borjas to argue that ". . . other factors are perhaps diffusing the impact of immigration across local labor markets or that there may be measurement error in the observed immigrant share for smaller geographic units" (p. 86).

Row 2 of table 2 shows what happens when the dependent and the key independent variables are expressed in first differences, as in equation (6) above. The magnitude of the partial correlations is reduced, but the general conclusion remains that native wages are negatively related to immigrant shares, with a larger negative correlation at higher levels of aggregation.

Row 3 of table 2, then, presents the partial correlations from our preferred specification based on equation (3) above, which relates changes in native wages to immigrant inflows, expressed as a fraction of the size of the skill-group-specific labor force in the previous census. In sharp contrast to the estimates of β^p in rows 1 and 2, the estimates of β^m are all relatively small in magnitude and except at the national level, positive. Moreover, the estimates of β^m are very similar as the level of aggregation changes from metropolitan area to state to census division. The point estimate of β^m at the national level is negative, but given the relatively large sampling error for the national estimate, one could easily conclude that the partial correlation between immigrant inflows and native wages is close to zero and invariant to the level of aggregation.

Part of the explanation for the difference between the estimates of the two partial correlations is revealed in row 4, where we relate the change in native wages to the component of the change in Δp_{it} that is attributable to inflows or outflows of native workers (i.e., to the term $-p_{it-10} \times \Delta N_{it}/L_{it-10}$). At the area level, changes in native wages are negatively correlated with this component, presumably because native workers tend to move to areas of the United States where their wages are growing. At the national level, in contrast, the correlation is imprecisely estimated but insignificantly different from zero.

The comparisons across the rows of table 2 may be helpful for nonspecialists who are aware of the debates in the immigration literature regarding the impact of immigration on native wages, and puzzled by the fact that some analysts—including Borjas—believe there is a strong prima facie case of a negative impact, while others—including us—believe there is not. As shown in the table, the strength and even the sign of the basic descriptive correlations depend entirely on what correlations are deemed to be of interest. Although we strongly believe that the elasticities of interest are defined directly by equation (1)—leading us to focus on the partial correlations in row 3 of table 2—we have little reason to expect any convergence of opinion on this issue.

2.3 *Interpreting the "Descriptive Correlations"*

While the estimates in chapter 4 of *IE* are presented as "descriptive correlations," it is important to keep in mind that these are partial regression coefficients obtained from models with a rich set of controls. Consider, for example, the estimated correlations in the fourth column of table 2, which are based on national data for male wages and immigrant inflows (or shares) in forty different education/experience cells. How should one interpret the estimated partial correlation in row 3, which is −0.124?

According to the model laid out in chapter 3, the change in wages measured at period t for workers in a given education (e) and experience cell (x) is determined by a structural equation of the form:

$$(9) \qquad \Delta \log w_{ext} = \delta_t + \left(\frac{1}{\sigma_x} - \frac{1}{\sigma_e}\right) m_{et} + \frac{1}{\sigma_x} m_{ext},$$

where δ_t is a period effect that incorporates the adjustment of the aggregate capital–labor ratio over the relevant period, m_{et} is the proportional increase in the number of workers in education group e, m_{ext} is the relative increase in the supply of workers in the specific education/experience group ex over the relevant period, and σ_e and σ_x are the partial elasticities of substitution between education groups and experience groups, respectively. Given that the models in column 4 include education-group-by-time fixed effects, which will fully absorb m_{et}, the −0.124 estimate can therefore be interpreted as an estimate of the inverse elasticity of substitution between experience groups.[7] Indeed, Borjas's structural estimate of this inverse elasticity, reported in row 1 of table 5.1, is −0.153. Similar estimates of the same parameter are reported in Card and Lemieux (2001), Borjas (2003), and Ottaviano and Peri (2012). Thus, the "descriptive correlations" in table 2, and in chapter 4 of *IE*, are much closer to model-based parameter estimates than simple correlations.

In an extended discussion on pages 127–30 of *IE*, Borjas argues that the descriptive correlations presented in chapter 4 (and summarized in the top row of table 2) capture an average of the own-group and cross-group elasticities of wages with respect to the inflows of immigrants in various skill categories. However, this interpretation is only correct if the partial correlation is estimated in a specification *without* education-group-by-year effects. When these effects are included, as they are in the models used in chapter 4 (and in all the specifications reported in table 2), they absorb all or most of the relevant cross-complementarity effects exerted by changes in the number of workers in other education groups. Indeed, if the nested CES model underlying equation (9) is correct, these fixed effects fully control for all relevant cross-complementarities.

Nevertheless, it is interesting to follow Borjas's intuition and ask what happens to the partial correlation between wages of workers in specific skill groups and the corresponding immigration-induced relative supply shocks when the model is fit *without* controlling for education-time effects. Carrying out this exercise using all skill groups at the national level yields an estimated partial correlation of 0.409 (standard error = 0.092). The argument presented on pages 127–30 suggests that this can be interpreted as an estimate of the net effect of immigrant-driven supply shocks occurring throughout the skill distribution on average wages in the economy. If true, then, the net effect of immigration has been positive. Without education-group-specific time effects in the estimating model, however, the partial correlation between wages and immigrant inflows is likely to pick up skill-biased technological changes and other factors that happen to be correlated with immigrant supply shocks, so we are reluctant to endorse this interpretation.

To summarize: the "descriptive correlations" estimated from a national-level model with education-group- and experience-group-specific time effects are actually interpretable as estimates of the inverse partial elasticity of substitution between narrowly defined skill cells, and have little bearing on the total wage effect of immigration. If one confines attention to national level data, as Borjas argues is appropriate, then a model is needed to simulate the effects of immigration. An alternative approach is to focus on correlations at a lower level of aggregation, like the city or state, and use the trends in other cities or states as a data-driven counterfactual. Assuming that correlations focus on changes in the *net supplies* of different types of labor associated with immigrant inflows, we believe that there is useful information in the area-based correlations. Specifically, assuming that there is a local production function generating the local demand for labor, the theoretical framework developed in chapter 3 of *IE* can be used to understand how immigrant-induced supply shocks affect relative wages of natives at the local level.

2.4 *Descriptive Correlations with Native Migration Flows*

A second set of "descriptive correlations" are presented in chapter 6 of *IE*, relating the inter-area migration flows of natives in specific skill groups to the corresponding immigrant

[7] This is really a reduced-form estimate from a system in which the first stage relates the overall number of workers in the education/experience group in year t to the associated immigrant inflow. In fact, the first stage coefficient is not far from one.

skill shares. As noted above in the discussion of equation (8), we believe these correlations are particularly susceptible to biases arising from the fact that the measure of immigrant presence used by Borjas is mechanically negatively correlated with net native migration.

Table 3 presents a series of estimates that illustrate the issues, following the same format as table 2. Row 1 reproduces the specifications reported in table 6.1 of *IE*. Using the immigrant share p_{it} as a measure of immigration pressure, it appears that native location decisions are extremely sensitive to the presence of immigrants: the −0.664 estimate for net native migration across metro areas in column 1, for example, suggests that the addition of one hundred new immigrants in a given skill group in a city leads to a net reduction of sixty-six in the number of natives in that skill group, arising from a combination of reduced native in-migration (a loss of thirty-nine natives) and increased native out-migration (a loss of twenty-eight natives). These estimates imply that native migration flows undo fully *two thirds* of the supply effect caused by immigrant inflows to specific cities. The effect on states is smaller, but still economically large and highly significant.

In row 2 of table 3, we present specifications in which the key independent variable is expressed in first differences. As in table 2, the magnitude of the partial correlations is reduced, but the estimates still show large negative effects of immigrant inflows on net native migration.

Row 3 of table 3 presents estimates from our preferred specification that directly relates native migration flows to immigrant inflows. At the metropolitan-area level, the estimated responses are reduced in magnitude by 85 percent, and suggest that the migration responses of natives only undo about 10 percent of the effect of immigrant inflows. At the state level, the net native migration effect is even smaller, and statistically insignificant.

In row 4 we relate the native mobility flows to the component of the change in Δp_{it} that is attributable to inflows or outflows of native workers (i.e., to the term $-p_{it-10} \times \Delta N_{it}/L_{it-10}$). As expected, we find a negative correlation with native in-migration and a positive correlation with native out-migration, both particularly strong at the metropolitan-area level, that explain a significant share of the measured migration responses in the specifications in rows 1 and 2.

Overall, we conclude that Borjas's use of immigrant skill shares as the measure of immigrant impact leads to a serious exaggeration of the responsiveness of natives' location decisions to the presence of immigrants. At the city level, our approach—which is directly consistent with the structural model outlined by Borjas in chapter 6—suggests that native migration flows offset only about 10 percent of the effect of immigrant inflows. At the state level, our approach suggests an even smaller offset.

Again, a comparison across the different rows of table 3 may be useful to nonspecialists, who are aware of the sharp difference of opinion between some analysts—like Borjas—who believe that immigration inflows lead to large offsetting movements of natives, and other analysts—like us—who believe these offsetting mobility flows are small. The "evidence" depends entirely on how one chooses to model immigration inflows. In our view, the theoretically appropriate and empirically defensible approach suggests that the offsetting mobility flows of natives are small. Based on past experience, however, we do not expect any convergence of opinion on the nature of the appropriate evidence.[8]

[8] The argument that native mobility rates should be related to immigrant arrival flows (rather than the contemporaneous fraction of immigrants) is made in Wright, Ellis, and Reibel (1997); Card and DiNardo (2000); Card (2001); and Peri and Sparber (2011); but is not acknowledged by Borjas.

TABLE 3
Longitudinal Spatial Correlations between Immigration and Native-Migration Flows
(Based on IE, Table 6.1)

	Native flows between metropolitan areas			Native flows between states		
Specification and explanatory variable	Net native migration	Native in-migration	Native out-migration	Net native migration	Native in-migration	Native out-migration
1. Borjas's specification: immigrant share in levels (p_{it}) (table 6.1)	−0.664 (0.223)	−0.385 (0.198)	0.278 (0.070)	−0.323 (0.099)	−0.159 (0.082)	0.164 (0.049)
2. Change in immigrant share (Δp_{it})	−0.442 (0.073)	−0.248 (0.065)	0.193 (0.025)	−0.179 (0.062)	−0.019 (0.057)	0.160 (0.039)
3. Immigrant inflow (m_{it})	−0.100 (0.035)	−0.048 (0.030)	0.051 (0.012)	−0.071 (0.043)	0.012 (0.037)	0.084 (0.021)
4. Contribution of native inflows to change in immigrant share ($-p_{it-10}\ \Delta N_{it}/L_{it-10}$)	−0.210 (0.060)	−0.084 (0.047)	0.125 (0.026)	−0.071 (0.090)	−0.027 (0.089)	0.044 (0.043)

Notes: See notes to *IE*, table 6.1. Standard errors, clustered by skill group/region level, in parentheses. Metro-area models use data on male workers in five education groups and eight experience groups from 1990 and 2000 Censuses and 2009–11 American Community Survey and have 21,239 observations. State models add data from 1970 and 1980 Censuses and have 8,157 observations. Coefficients in row 1 are obtained by regressing the dependent variable listed at the top of the column on the immigrant share of labor in the skill group controlling for skill-time, area-time, and area-skill fixed effects. Coefficients in row 2 are obtained by regressing the dependent variable listed at the top of the column on the change in the immigrant share in the skill group and including skill-time and area-time fixed effects. Coefficients in row 3 are obtained by regressing the dependent variable listed at the top of the column on the inflow of immigrants in the skill group over the past decade (m_{it}), including skill-time and area-time fixed effects. Coefficients in row 4 are obtained by regressing the dependent variable listed at the top of the column on the contribution of native inflows to the change in immigrant share, including skill-time and area-time fixed effects.

3. *Model-Based (Structural) Analysis of the Impacts of Immigration*

Now we turn to a discussion of what is arguably the central chapter in *IE*. In chapter 5, Borjas presents a set of simulation results that quantify the effects of immigrant arrivals over the period from 1990 to 2010 on the wages of various native groups. The setup follows the template of Borjas's influential 2003 paper in the *Quarterly Journal of Economics*. Aggregate output is produced by a three-level nested function with constant returns to scale:

$$Q_t = f(K_t, L_t; \lambda_t) \tag{10a}$$

$$L_t = g(L_{1t}, L_{2t}, \ldots, L_{Jt}; \theta_t) \tag{10b}$$

$$L_{et} = h(L_{e1t}, L_{e2t}, \ldots, L_{eKt}; \alpha_t), \tag{10c}$$

where K_t represents capital in year t; L_t represents aggregate labor input; $L_{1t}, L_{2t}, \ldots, L_{Jt}$

are the aggregate amounts of labor in each of J education classes; L_{ext} is the amount of labor in education/experience class ex in year t (for $e = 1, \ldots, J$ and $x = 1, \ldots, K$); λ_t represents a two-dimensional vector of technology parameters; θ_t is a J-dimensional vector of education-group-specific technology parameters; and α_t is a JK-dimensional vector of experience-group-specific parameters. For his baseline simulations Borjas assumes f is Cobb–Douglas (with labor's share equal to s), g is a CES function with elasticity of substitution parameter σ_e, and h is a CES function with elasticity of substitution parameter σ_x.

In this model, an increase in labor supply (regardless of skill mix) has no long-run effect on average wages in the economy if the cost of capital is held constant, while in the short run with fixed capital, the elasticity of average wages with respect to aggregate labor supply is $-(1 - s)$, which Borjas sets to -0.3. The skill-group-specific impacts of different labor inflows depend on the two parameters, σ_e and σ_x. Given values of these two elasticities and information on the skill share distributions of immigrant arrivals, it is possible to simulate the effects on skill-group-specific average wages.

Table 4 summarizes the simulation results. The top row shows Borjas's baseline long-run simulated impacts of immigrant inflows over the 1990–2010 period for each of five education groups and all natives. (The corresponding simulated impacts assuming no adjustment of capital—which we believe to be unrealistic for a twenty-year period—are all shifted down by 3.2 percent, reflecting the 11 percent increase in overall labor supply Borjas attributes to immigration over the period.) The baseline simulation assumes that $\sigma_e = 5$ and $\sigma_x = 6.7$. The simulated gains and losses for different education groups are small in magnitude, with the largest negative effect (-3.1 percent) for high-school dropouts, reflecting the relatively large inflow of poorly educated immigrants over the past several decades.

One concern about these baseline simulations is that the presumed structure of substitution between different education groups is incorrect. As noted in Card (2005, 2009) and Ottaviano and Peri (2012), and discussed in some detail in chapter 5 of *IE*, a key issue is the degree of substitutability between dropouts and high-school graduates. If these two groups are perfect substitutes—as we have argued in our earlier work—then the impact of the large inflows of immigrants with less than a high-school education is diffused across a much larger segment of the native workforce. As shown in row 2 of table 4, with this assumption the simulated impacts of immigration for the bottom two education groups are now very small, while the effects for the other education groups are unchanged. Borjas presents a variety of new evidence on the issue and ultimately concludes that

> *. . . the available evidence on the elasticity of substitution between high school dropouts and high school graduates is not robust to assumptions made about the time path of unobserved shocks to relative demand. . . . The sensitivity of the results suggests that the nested CES framework does not provide a particularly useful approach for analyzing the substitutability of labor between these two skill groups* (p. 124).

A similar issue arises with regard to the degree of substitutability between immigrants and natives with the same education and experience. Many analysts have noted that immigrants and natives with the same observed characteristics are treated differently by the labor market.[9] Lewis (2013)

[9] See, e.g., Dustmann, Frattini, and Preston (2013). In fact, the difference in age profiles of earnings for immigrants and natives has been a major concern in the immigration literature, and is taken up in chapter 2 of *IE*. Friedberg (2000) showed that immigrants typically receive no return to their premigration experience.

TABLE 4
Simulated Wage Impacts of US Immigration 1990–2010 on Native Subgroups, Allowing Capital Adjustment

	Education subgroup					
	High-school dropouts	High-school graduates	Some college	Four years college	Post-graduate	All natives
1. Baseline table 5.4, row 4	−3.1	0.4	0.9	−0.1	−0.9	0.0
2. Assume perfect substitution between dropouts and high-school graduates ($\sigma_{HS} = 0$) Table 5.6, row 8	−0.2	−0.2	0.9	−0.1	−0.9	0.0
3. Assume imperfect substitution between immigrants and natives ($\sigma_{NM} = 20$) table 5.4, row 1	−1.7	0.9	1.2	0.5	−0.1	0.6
4. Assume perfect substitution between dropouts and high-school graduates *and* imperfect substitution between natives and immigrants ($\sigma_{HS} = 0$, $\sigma_{NM} = 20$) table 5.6, row 4	1.1	0.2	1.2	0.5	−0.1	0.5

Note: All estimated impacts taken from estimates reported in *IE*, chapter 5.

argues that an important source of imperfect substitutability is language ability.[10] Peri and Sparber (2009) document that immigrants tend to specialize in occupations with lower intensity of language and communication skills. Among younger and less-educated immigrants another factor is legal status: many of these immigrants are undocumented, and are pushed into certain types of jobs where immigration laws can be easily evaded.

Ottaviano and Peri (2012) and Manacorda, Manning, and Wadsworth (2012) introduced the idea of using a four-level nested production function to incorporate imperfect substitution between immigrants and natives, and showed that even a small degree of imperfect substitution can alter the conclusions about the wage impacts of immigration. As shown in row 3 of table 4, assuming that the elasticity of substitution between immigrants and natives (σ_{NM}) is 20 raises the average wage impact on natives to a small positive number, and reduces the size of the simulated losses for native dropouts. Assuming both perfect substitution between dropouts and high-school graduates, and imperfect substitution between immigrants and natives yields the simulation results in row 4 of table 4. In this simulation, all native groups except those with advanced degrees are found to benefit from recent immigrant inflows.

[10] Ferrer, Green, and Riddell (2006) show that immigrants in Canada have lower literacy skills than otherwise similar natives, and argue that this accounts for some of the immigrant wage penalty.

As with the elasticity of substitution between dropouts and high-school graduates, Borjas presents a variety of evidence and ultimately concludes that the likely magnitude of $1/\sigma_{NM}$ is so small as to ". . . not be an important factor in an assessment of the labor market impact of immigration in the United States" (p. 118).

We are less convinced by his analysis, as it includes a large set of nonmodel-based fixed effects that drastically reduce the identifying variation. In fact, estimates of *all* the critical parameters in the aggregate production function (not just $1/\sigma_{NM}$) are highly sensitive to assumptions about unobserved relative productivity trends. As Borjas documents in table 5.1, estimates of $1/\sigma_e$ vary substantially, depending on how one models the trends in the relative factor productivity terms (λ_t) in the upper-level nest. Estimates of $1/\sigma_x$ are similarly sensitive. For example, adding experience-group-by-year trends to equation (5.5) (the basic estimating model for $1/\sigma_x$) along the lines of the robustness checks proposed above for $1/\sigma_{NM}$, causes the estimate of $1/\sigma_x$ to fall from the baseline value of 0.15 (with a standard error of 0.06) to 0.07 (with a standard error of 0.05). Overall, we believe that the bulk of the evidence points toward a small, but non-negligible degree of imperfect competition between native and immigrant workers.

In the end, Borjas concludes that ". . . the nested CES structural approach seems far too sensitive to the imposition of unverifiable (but necessary) assumptions to be of much use in giving a robust and convincing answer" about the impacts of immigrant inflows (p. 127). While we agree that the precise numbers coming from the CES approach are somewhat variable, we take a different lesson from the results in table 4. To us, it seems clear that the simulated effects of immigrant arrivals on native wages are quite small, under a variety of specific assumptions used in the simulation.

4. *Welfare and Productivity Effects of Immigration*

Chapter 7 of *IE* moves from the analysis of native wage outcomes to the overall economic benefits of immigration. The model, however, is decidedly "old school" (Berry and Soligo 1969), and simply calculates the surplus triangles associated with an outward shift in supply of various skill groups, assuming vertical supply curves. Under the assumptions of constant returns to scale, fixed technology, and elastic capital supplies, the calculated surplus is necessarily small, particularly if immigrants are not too different from natives. As Borjas concludes: ". . . it is mathematically impossible to manipulate the canonical model of the competitive labor market so as to yield a large net gain from immigration to the United States" (p. 151).

This is certainly true. The real question is whether one wants to take seriously any of the ideas in modern growth theory, which allow for effects of human-capital externalities (e.g., Romer 1990; Moretti 2004a, 2004b), skill variety (Alesina, Harnoss, and Rapoport 2013), task specialization (Grossman and Rossi-Hansberg 2008), market integration (Rivera-Batiz and Romer 1991), and potential gains from rising numbers of scientists and engineers (Jones 2002). These models allow for potential increasing returns to scale and/or endogenous technological change—factors that arguably dominate the second-order surplus calculations presented in chapter 7, and have been linked in recent work to immigration flows (e.g., Kerr and Lincoln 2010; Lewis 2011; Peri 2012; Peri, Shih, and Sparber (2014); Ottaviano, Peri, and Wright 2013).

At the end of chapter 7, Borjas discusses the welfare costs of immigration when there are *decreasing* returns to scale, building on a model by Hamilton and Whalley (1984). Obviously, any model with decreasing returns to scale will lead to negative spillovers from population growth, as Malthus famously noted. In light of the last few decades of research on economic growth, however, it seems to us that the Malthusian intuition is wrong, and that the only reason one would entertain such a model is for purely rhetorical purposes.

Finally, chapter 8 of *IE* reviews some interesting case studies of high-skilled immigration, focusing on impacts on productivity in innovation (measured by patents) and academia (measured by the numbers of papers published by mathematicians). In the case of patents, foreign skilled workers seem to be highly productive (Hunt and Gauthier Loiselle 2010), with no evidence of a negative spillover on the output of natives (Kerr and Lincoln 2010; summarized in table 8.2 of *IE*). In the case of academic mathematicians, evidence from Borjas and Doran (2012), summarized on pages 183–90 of *IE*, suggests that immigrant arrivals harm the productivity of natives. They find that inflows of mathematicians following the collapse of the Soviet Union led to a reduction in the publications of US mathematicians who had specialized in areas in which the Russian mathematicians were particularly strong, and a displacement of US academics to lower-quality academic jobs and nonacademic positions. Overall, it appears that the production of scholarly papers in mathematics is much closer to a "zero-sum" game than the production of patents, and that mathematicians have a relatively hard time adjusting the focus of their research mid-career. It is hard to argue with either conclusion.

Whether the impacts of immigration on academic mathematics are useful for thinking about the general economic effects of high-skilled immigration is less clear. The number of positions in top academic institutions and the number of papers in top academic journals are relatively rigid, so these are natural places to look for strong displacement effects. We don't think a "fixed slots" paradigm is likely to be as applicable for the broader labor market. Indeed, Peri, Shih, and Sparber (2014) find a strong positive correlation between inflows of foreign STEM (science, technology, engineering, and math) workers and the wages of college-educated natives across US cities.

5. *Conclusions*

George Borjas's new book, *Immigration Economics*, provides a concise overview of many of the important issues surrounding immigration and labor markets. The book is written as a graduate-level textbook, and summarizes and updates many of Borjas's important contributions to the field over the past thirty years. A particular strength of the book is the close attention to integrating simple theoretical models with sophisticated econometric analysis. The chapters on modeling labor demand and using the models to evaluate the effects of immigration on native outcomes are clear and comprehensive, and will surely find their way to graduate reading lists.

In contrast to Borjas's most recent (1999) book *Heaven's Door: Immigration Policy and the American Economy*, *Immigration Economics* is more narrowly focused on economic analysis, with almost no mention of policy issues. Nevertheless, in almost every chapter the book maintains a uniformly dismal view about immigration. This is particularly true in the core chapters on immigrant labor-market impacts, which focus on descriptive correlations (chapters 4 and 6), simulations (chapter 5), and case studies (chapter 8) that emphasize the costs of immigration to native workers. As we have emphasized, Borjas's choice of which descriptive correlation to present, which parameter values to use in the simulations, and which case studies to emphasize all end up reinforcing this dismal view. Thus, although the book is nonpolitical, it has a clear message: immigration is costly to many members of the host country.

After reading *Immigration Economics*, one begins to wonder why countries ever decide to have any immigrants, and why many countries continue to allow relatively large inflows of immigrants. Are immigration policies manipulated by an elite who benefit from these policies at the expense of others? Or is the balance of benefits versus costs—even for native workers who are most directly in competition with immigrants—more positive than one might be led to believe from reading Borjas's latest book? We, and many other economists, come down on the latter side. *Immigration Economics* presents half the story about the economics of immigration. The other half of the story, although a prominent feature of much of the work done by other economists during the past three decades, has no place in this book.

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